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Yogesh K. Dwivedi
Michael R. Wade
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Information Systems Theory

Explaining and Predicting Our Digital Society, Vol. 1

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Information Systems Theory

Explaining and Predicting Our Digital Society, Vol. 1

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To my adorable daughter, Saanvi, on her first birthday, for brightening my each day with her smile and touchingly mischievous playfulness.

Yogesh K. Dwivedi

To Heidi, Christopher, and Benjamin, for your love, patience, and encouragement.

Michael R. Wade

To Cosy and Sunny for daily putting theory into practice, patiently.

Scott L. Schneberger

Foreword

I hesitated when asked to provide a foreword to this two-volume treatise on theories relevant to the information systems field for two reasons. One, I claim no special expertise in the many theoretical frameworks and constructs that have been developed in our field or brought into it from other disciplines that are described in this book. And two, I have not been particularly adept at incorporating these theories into my own research and publications. In fact, some of my more candid colleagues have labeled me as their favorite "a-theoretic author."

This hesitancy is perhaps all the more difficult to understand because the very first paper in Volume One is "DeLone and McLean IS Success Model," a "theory" paper that Bill DeLone, a doctoral student of mine at UCLA, and I published in *Information Systems Research* in 1992; and which, in a recent survey published in the *Communications of the AIS* (2009), was recognized as the most cited IS research paper published in the world in the last 15 years.

The path from first submission to final publication of this paper was one fraught with minefields and critiques, chief among which was the question: "But where is the theory?" John King, the editor-in-chief of *ISR* at that time, although fully aware of the criticism about the apparent lack of theory in the paper, decided to take a chance and publish it anyway. As indicated above, his judgment appears to have been vindicated, if citations are any indication.

But the question of what constitutes good theory and the role that it can – and should – play in information systems research is still, in my view, an essential question this book can help researchers answer. The aforementioned DeLone and McLean Success paper, and their several follow up papers, still suffer from the criticism of a lack of strong theoretical grounding. And they are not alone; there are two more examples.

In the 1970s, Peter Drucker had occasion to relocate from New York to Los Angeles and made inquiries at the business school at UCLA to see if it were possible to obtain a faculty appointment in the school. A vote of the faculty was held and his application was turned down. "He's not a scholar; he's just an 'arm-chair' philosopher." "There is no theory base to any of his writings." "He's just a glorified consultant." So instead, he went to the Claremont Graduate University, where they named the school after him!

Also in the 1970s, Dick Nolan published his famous "Stages of Growth" papers, first in the *Communications of the ACM* (1971) and the following year in the *Harvard Business Review* (1972). They too were soundly criticized as having no theory base; and shortly thereafter, he left the Harvard Business School to form Nolan Norton & Co. which proved wildly successful in providing Stage-Assessment consulting to numerous companies who seemed to exhibit no concern about its lack of a theoretical base.

So what are we to make of the 22 theories presented in Volume One and the 21 theories in Volume Two?

We should study them carefully; and, where they fit the research question that we wish to address, *use them*; and where possible, *refine and extend them*. For readers like myself, these two volumes can serve as a graduate course in the exposition of theories of potential relevance to information systems research. They bring together in an eminently accessible form the theories that form the basis of much – nay, most – of the published IS research in the last 30 years.

Ignore them at your peril – but use them with discretion.

Atlanta, GA

Ephraim R. McLean, Ph.D., FAIS

Preface

To advance our understanding of information systems (IS), it is necessary to conduct relevant and rigorous IS research. IS research, in turn, is built on a foundation of strong and robust theory. Indeed, the IS field has a long and rich tradition of developing and appropriating theories to examine central disciplinary themes, such as the IS life cycle and IS business value, along with a host of social and political factors. The ISWorld wiki "Theories Used in IS Research[1]" (TUISR) lists 87 such theories and models. While this site is a valuable resource for the field, much more could be assembled to aid IS researchers in using theories to explain and predict how information systems can be used within today's digital society.

In our own careers, we have found it to be a major challenge to identify appropriate theories for our work, and even harder to fully understand the theories that we encounter. We would encounter theories we find interesting, but the papers where we found them provide an incomplete account or a superficial explanation of what the theory was about, or how it could be used. It was this problem of theory identification and comprehension that led us to create this book. We wanted to produce a collection of papers about theories that could be used by IS researchers as a starting point for their work. This collection would act like a one-stop-shop for IS theory. We already had the TUISR wiki that provided basic information on theory; but with this book, we wanted to provide more depth and insight into the theories that populated our field.

We believe the lack of a comprehensive source of information on theory poses special problems for researchers. Due to a deficiency of experience within a new area, it may not be easy to fully comprehend and use a new theory in an appropriate manner. Furthermore, it is sometimes difficult for researchers to determine which particular theory, out of the vast number available, may be appropriate in a research context.

We felt a literary and meta-analytic collection of IS theories would not only provide a significant contribution to IS knowledge, but would also be a valuable aid to IS researchers, practitioners and students.

The overall mission of this book is to provide a comprehensive understanding and coverage of the various theories and models used in IS research. Specifically, it aims to focus on the following key objectives:

- To describe the various theories and models applicable to studying IS/IT management issues
- To outline and describe, for each of the various theories and models, independent and dependent constructs, reference discipline/originating area, originating author(s), seminal articles, level of analysis (i.e. firm, individual, industry) and links with other theories
- To provide a critical review/meta-analysis of IS/IT management articles that have used a particular theory/model
- To discuss how a theory can be used to better understand how information systems can be effectively deployed in today's digital world

This book contributes to our understanding of a number of theories and models. The theoretical contribution of this book is that it analyzes and synthesizes the relevant literature in order to enhance knowledge of IS theories and models from various perspectives. To cater to the information needs of a diverse spectrum of readers, this book is structured into two volumes, with each volume further broken down into two sections.

The first section of Volume 1 presents detailed descriptions of a set of theories centred around the IS life cycle, including:

- DeLone and McLean's Success Model
- Technology Acceptance Model
- Unified Theory of Acceptance and Use of Technology
- User Resistance Theories
- Task-Technology Fit Theory
- Process Virtualization Theory
- Theory of Deferred Action

The second section of Volume 1 contains strategic and economic theories, including:

- Resource-Based View
- Theory of Slack Resources
- Portfolio Theory
- Theory of the Lemon Markets
- Technology–Organization–Environment Framework
- Contingency Theory
- Porter's Competitive Forces Model
- Business Value of IT
- Diffusion of Innovations
- Punctuated Equilibrium Theory

- Discrepancy Theory Models
- Institutional Theory
- A Multilevel Social Network Perspective
- Expectation Confirmation Theory
- Stakeholder Theory

The first section of Volume II concerns socio-psychological theories. These include:

- Personal Construct Theory
- Psychological Ownership and the Individual Appropriation of Technology
- Transactive Memory
- Language-Action Approach
- Organizational Information Processing Theory
- Organizational Learning, Absorptive Capacity and the Power of Knowledge
- Actor-Network Theory
- Structuration Theory
- Social Shaping of Technology Theory
- An IT-Innovation Framework
- Yield Shift Theory of Satisfaction
- Theory of Planned Behavior
- An Interpretation of Key IS Theoretical Frameworks Using Social Cognitive Theory

The second section of Volume II deals with methodological theories. These include:

- Critical Realism
- Grounded Theory and Information Systems: Are We Missing the Point?
- Developing Theories in Information Systems Research: The Grounded Theory Method Applied
- Narrative Inquiry
- Mikropolis Model
- Inquiring Systems
- Information Systems Deployment as an Activity System
- Work System Method

Together, these theories provide a rich tapestry of knowledge around the use of theory in IS research. Since most of these theories are from contributing disciplines, they provide a window into the world of external thought leadership.

Considering the breadth and depth of the content, we hope this book will become a trusted resource for readers wishing to learn more about the various theories and models applicable to IS research, as well as those interested in finding out when and how to apply these theories and models to investigate diverse research issues.

We sincerely hope this book will provide a positive contribution to the area of Information Systems. To make further research progress and improvement in the understanding of theories and models, we welcome all feedback and comments about this book from readers. Comments and constructive suggestions can be sent to the Editors care of Springer, USA, at the address provided at the beginning of the book.

Swansea, Wales — Yogesh K. Dwivedi
Lausanne, Switzerland — Michael R. Wade
Elsah, IL — Scott L. Schneberger

Acknowledgments

While our names alone appear on the cover, this book would not have been possible without the material assistance of a great many people. We would like to take this opportunity to convey our thanks to the efforts of those people who helped and supported us at various stages in the completion of this work.

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A book like this would not be possible without the tireless efforts of a legion of volunteer reviewers. The developmental and constructive comments provided by these reviewers dramatically improved the quality of each submission. In addition, we would like to express our gratitude to the chapter authors for contributing interesting and relevant material to this project. We are also highly grateful to *Prof. Ephraim R. McLean* and *Professor Michael D. Myers* for providing the forewords.

Last but not least, we bestow our unbounded gratitude and deepest sense of respect to our families whose blessing, concerted efforts, constant encouragement and wholehearted co-operation enabled us to reach this milestone.

Happy theorizing!

Yogesh, Mike, and Scott

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Chapter 1
The Updated DeLone and McLean Model of Information Systems Success

Nils Urbach and Benjamin Müller

Abstract In order to provide a general and comprehensive definition of information systems (IS) success that covers different evaluation perspectives, DeLone and McLean reviewed the existing definitions of IS success and their corresponding measures, and classified them into six major categories. Thus, they created a multidimensional measuring model with interdependencies between the different success categories (DeLone and McLean 1992). Motivated by DeLone and McLean's call for further development and validation of their model, many researchers have attempted to extend or respecify the original model. Ten years after the publication of their first model and based on the evaluation of the many contributions to it, DeLone and McLean proposed an updated IS Success Model (DeLone and McLean 2003). This chapter gives an overview of the current state of research on the IS Success Model. Thereby, it offers a concise entry point to the theory's background and its application, which might be specifically beneficial for novice readers.

Keywords DeLone & McLean Model • Information Systems Success • IS Success Model

Abbreviations

D&M	DeLone & McLean
ICIS	International Conference on Information Systems
Ind.	Individual
IS	Information systems

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Org.	Organizational
ROI	Return on investment
TAM	Technology acceptance model

1.1 Introduction

During the first International Conference on Information Systems (ICIS), Keen (1980) introduced his perspective on the key challenges of the information systems (IS) discipline. While today, 3 decades later, these questions remain core issues for many IS scholars, the last years have brought about tremendous progress in methodologies and theories. Especially with respect to Keen's second question, the search for the dependent variable in IS research, a lot of progress has been made. Since Keen's paper, work on technology acceptance (e.g. Davis 1989; Davis et al. 1989), IS benefit frameworks (e.g. Kohli and Grover 2008; Müller et al. 2010; Peppard et al. 2007; Shang and Seddon 2002), and the business value of IT (e.g. Sambamurthy and Zmud 1994; Soh and Markus 1995) has been published. One of the most prominent streams of research on the dependent variable of IS research, however, is work connected to the DeLone and McLean IS Success Model (D&M IS Success Model) (1992, 2003).

Since its introduction in 1992, the D&M IS Success Model has created a broad response in the literature. In fact, the 1992 article of DeLone and McLean (1992) was found to be the single-most heavily cited article in the IS literature (Lowry et al. 2007). Through all this work, the model's principal constituents and their relations have been investigated in a broad spectrum of settings (Petter et al. 2008; Urbach et al. 2009b). While the original version of the model, presented in an earlier chapter in this book, was a logical aggregation of research published on IS success, the model has been updated by its original authors to reflect and integrate some of the empirical work investigating the model's propositions as well as to consider the measurement challenges of the growing e-commerce world (DeLone and McLean 2003). A recent meta-study has shown that this updated version of the model has not only received great appreciation in the IS community, too, but that most of its propositions explaining the success of an IS are actually supported (Petter et al. 2008).

Through its popularity, DeLone and McLean's work also managed to address another of Keen's key challenges to the IS discipline: the lack of a cumulative tradition in IS research. Given its high citation counts and the intense investigation of the model's propositions in a broad spectrum of contexts, we believe that the D&M IS Success Model should be part of a comprehensive compendium of IS theories.

To present the updated D&M IS Success Model, we structure this chapter as follows. The next section briefly introduces the updated model (DeLone and McLean 2003), especially highlighting its development after its first introduction (DeLone and McLean 1992). We then present the model's different constructs in more detail and provide an exemplary selection of validated measures that can be reused in future applications. Afterward, we present an analysis of the construct interrelations. Furthermore, we give an overview on existing research that uses the D&M IS Success Model as theoretical basis and/or adapts the model to a specific domain. To conclude, we discuss the significance of the D&M IS Success Model for the IS discipline and link the model to related theories. Finally, we discuss future research opportunities in the field of IS success.

1.2 Development of the D&M IS Success Model

In 1980, Peter Keen referred to the lack of a scientific basis in IS research and raised the question of what the dependent variable in IS research should be. Keen argued that surrogate variables like user satisfaction or hours of usage would continue to mislead researchers and evade the information theory issue (Keen 1980). Motivated by his request for clarification of the dependent variable, many researchers have tried to identify the factors contributing to IS success. Largely, however, different researchers addressed different aspects of IS success, making comparisons difficult. In order to organize the large body of existing literature as well as to integrate the different concepts and findings and to present a comprehensive taxonomy, DeLone and McLean (1992) introduced their (first) IS Success Model.[1]

Building on the three levels of information by Shannon and Weaver (1949), together with Mason's expansion of the effectiveness or influence level (Mason 1978), DeLone and McLean defined six distinct dimensions of IS success: *system quality*, *information quality*, *use*, *user satisfaction*, *individual impact*, and *organizational impact*. Based on this framework, they classified the empirical studies published in seven highly ranked IS journals between January 1981 and January 1988. Their examination supports the presumption that the many success measures fall into the six major interrelated and interdependent categories they present. These authors' IS Success Model was their attempt to integrate these dimensions into a comprehensive framework. Judged by its frequent citations in articles published in leading journals, the D&M IS Success Model has, despite some revealed weaknesses (Hu 2003), quickly become one of the dominant evaluation frameworks in IS research, in part due to its understandability and simplicity (Urbach et al. 2009b).

Motivated by DeLone and McLean's call for further development and validation of their model, many researchers have attempted to extend or re-specify the original model. A number of researchers claim that the D&M IS Success Model is incomplete; they suggest that more dimensions should be included in the model, or present alternative success models (e.g. Ballantine et al. 1996; Seddon 1997; Seddon and Kiew 1994). Other researchers focus on the application and validation of the model (e.g. Rai et al. 2002).

Ten years after the publication of their first model, and based on the evaluation of the many contributions to it, DeLone and McLean (2002, 2003) proposed an updated IS success model.[2]

The primary differences between the original and the updated model are: (1) the addition of *service quality* to reflect the importance of service and support in successful

[1] A graphical representation of this model can be found in DeLone and McLean (1992, p. 87).

[2] A graphical representation of this model can be found in DeLone and McLean (2003, p. 24).

e-commerce systems; (2) the addition of *intention to use* to measure user attitude as an alternative measure of use; and (3) the collapsing of *individual impact* and *organizational impact* into a more parsimonious *net benefits* construct. The updated model consists of six interrelated dimensions of IS success: *information*, *system*, and *service quality*; *(intention to) use*; *user satisfaction*; and *net benefits*. The arrows demonstrate proposed associations between the success dimensions.

Looking at its constructs and their interrelations, the model can be interpreted as follows: a system can be evaluated in terms of information, system, and service quality; these characteristics affect subsequent use or intention to use and user satisfaction. Certain benefits will be achieved by using the system. The net benefits will (positively or negatively) influence user satisfaction and the further use of the IS.

Although DeLone and McLean have refined their first model and presented an updated version, they encourage other researchers to develop the model further and help to continue its evolution. In order to provide a basis for IS scholars to answer this call for future research, the following sections of this chapter will briefly introduce the constructs, measures, and propositions used in research on the IS success model so far.

1.3 Constructs and Measures

Although the D&M IS Success Model is a result of the attempt to provide an integrated view on IS success that enables comparisons between different studies, the operationalization of the model's different success dimensions varies greatly between the several studies which have been published in the past. Especially, the diversity of different types of information systems the model has been adapted to leads to several construct operationalizations. However, with a large amount of publications using the D&M IS Success Model as theoretical basis (Lowry et al. 2007; Urbach et al. 2009b), typical item sets for each of the constructs have emerged which have often been used in several IS success studies.

In the following paragraphs we present the different success dimensions of the D&M IS Success Model in more detail and provide an exemplary selection of validated measures that can be reused for future application of the model. While such a list can certainly not be a comprehensive account of measures, the studies cited should provide a first overview and a good starting point for a more (context-) specific search of the literature.

1.3.1 System Quality

The success dimension *system quality* constitutes the desirable characteristics of an IS and, thus, subsumes measures of the IS itself. These measures typically focus on usability aspects and performance characteristics of the system under examination. A very common measure is *perceived ease of use* caused by the large amount of research related to the Technology Acceptance Model (TAM) (Davis 1989).

Table 1.1 Exemplary measures of system quality

Items	References
Access	Gable et al. (2008), McKinney et al. (2002)
Convenience	Bailey and Pearson (1983), Iivari (2005)
Customization	Gable et al. (2008), Sedera and Gable (2004b)
Data accuracy	Gable et al. (2008)
Data currency	Hamilton and Chervany (1981), Gable et al. (2008)
Ease of learning	Gable et al. (2008), Sedera and Gable (2004b)
Ease of use	Doll and Torkzadeh (1988), Gable et al. (2008), Hamilton and Chervany (1981), McKinney et al. (2002), Sedera and Gable (2004b)
Efficiency	Gable et al. (2008)
Flexibility	Bailey and Pearson (1983), Gable et al. (2008), Hamilton and Chervany (1981), Iivari (2005), Sedera and Gable (2004b)
Integration	Bailey and Pearson (1983), Gable et al. (2008), Iivari (2005), Sedera and Gable (2004b)
Interactivity	McKinney et al. (2002)
Navigation	McKinney et al. (2002)
Reliability	Gable et al. (2008), Hamilton and Chervany (1981)
Response time	Hamilton and Chervany (1981), Iivari (2005)
Sophistication	Gable et al. (2008), Sedera and Gable (2004b)
System accuracy	Doll and Torkzadeh (1988), Hamilton and Chervany (1981), Gable et al. (2008), Sedera and Gable (2004b)
System features	Gable et al. (2008), Sedera and Gable (2004b)
Turnaround time	Hamilton and Chervany (1981)

However, many additional measures have been proposed and used to capture the system quality construct as a whole. Table 1.1 shows a sample of typical items for measuring system quality.

1.3.2 Information Quality

The success dimension *information quality* constitutes the desirable characteristics of an IS's output. An example would be the information an employee can generate using a company's IS, such as up-to-date sales statistics or current prices for quotes. Thus, it subsumes measures focusing on the quality of the information that the system produces and its usefulness for the user. *Information quality* is often seen as a key antecedent of *user satisfaction*. Typical measurement items are presented in Table 1.2.

1.3.3 Service Quality

The success dimension *service quality* represents the quality of the support that the users receive from the IS department and IT support personnel, such as, for example, training, hotline, or helpdesk. This construct is an enhancement of the updated

Table 1.2 Exemplary measures of information quality

Items	References
Accuracy	Bailey and Pearson (1983), Gable et al. (2008), Iivari (2005), Rainer and Watson (1995)
Adequacy	McKinney et al. (2002)
Availability	Gable et al. (2008), Sedera and Gable (2004b)
Completeness	Bailey and Pearson (1983), Iivari (2005)
Conciseness	Gable et al. (2008), Rainer and Watson (1995), Sedera and Gable (2004b)
Consistency	Iivari (2005)
Format	Gable et al. (2008), Iivari (2005), Sedera and Gable (2004b)
Precision	Bailey and Pearson (1983), Iivari (2005)
Relevance	Gable et al. (2008), McKinney et al. (2002), Rainer and Watson (1995), Sedera and Gable (2004b)
Reliability	Bailey and Pearson (1983), McKinney et al. (2002)
Scope	McKinney et al. (2002)
Timeliness	Bailey and Pearson (1983), Gable et al. (2008), Iivari (2005), Doll and Torkzadeh (1988), McKinney et al. (2002), Rainer and Watson (1995)
Understandability	Gable et al. (2008), McKinney et al. (2002), Sedera and Gable (2004b)
Uniqueness	Gable et al. (2008)
Usability	Gable et al. (2008), Sedera and Gable (2004b)
Usefulness	McKinney et al. (2002)

Table 1.3 Exemplary measures of service quality

Items	References
Assurance	Pitt et al. (1995)
Empathy	Pitt et al. (1995)
Flexibility	Chang and King (2005)
Interpersonal quality	Chang and King (2005)
Intrinsic quality	Chang and King (2005)
IS training	Chang and King (2005)
Reliability	Pitt et al. (1995)
Responsiveness	Chang and King (2005), Pitt et al. (1995)
Tangibles	Pitt et al. (1995)

D&M IS Success Model that was not part of the original model. The inclusion of this success dimension is not indisputable, since *system quality* is not seen as an important quality measure of a single system by some authors (e.g. Seddon 1997). A very popular measure for *service quality* in IS is SERVQUAL (Pitt et al. 1995). However, several other measurement items have been proposed. Table 1.3 presents a sample of those.

1.3.4 Intention to Use/Use

The success dimension *(intention to) use* represents the degree and manner in which an IS is utilized by its users. Measuring the usage of an IS is a broad concept that can

Table 1.4 Exemplary measures of (intention to) use

Items	References
Actual use	Davis (1989)
Daily use	Almutairi and Subramanian (2005), Iivari (2005)
Frequency of use	Almutairi and Subramanian (2005), Iivari (2005)
Intention to (re)use	Davis (1989), Wang (2008)
Nature of use	DeLone and McLean (2003)
Navigation patterns	DeLone and McLean (2003)
Number of site visits	DeLone and McLean (2003)
Number of transactions	DeLone and McLean (2003)

be considered from several perspectives. In case of voluntary use, the actual use of an IS may be an appropriate success measure. Previous studies measured use objectively by capturing the connect time, the functions utilized, or the frequency of use. As the amount of time a system is used is apparently not a sufficient success measure, other studies applied subjective measures by questioning users about their perceived use of a system (e.g. DeLone 1988). A more comprehensive approach for explaining the usage of an IS is TAM (Davis 1989). TAM uses the independent variables *perceived ease of use* and *perceived usefulness* contributing to *attitude toward use*, *intention to use*, and *actual use*. Due to difficulties in interpreting the dimension *use*, DeLone and McLean suggest *intention to use* as an alternative measure to *use* for some contexts. Table 1.4 presents some typical measurement items for this success dimension.

1.3.5 User Satisfaction

The success dimension *user satisfaction* constitutes the user's level of satisfaction when utilizing an IS. It is considered as one of the most important measures of IS success. Measuring user satisfaction becomes especially useful, when the use of an IS is mandatory and the amount of use is not an appropriate indicator of systems success. Widely used user satisfaction instruments are the ones by Ives et al. (1983) and Doll et al. (2004). However, these instruments also contain items of system, information, and service quality, rather than only measuring user satisfaction. Accordingly, other items have been developed to exclusively measure user satisfaction with an IS. Table 1.5 presents some examples.

1.3.6 Net Benefits

The success dimension *net benefits*, constitutes the extent to which IS are contributing to the success of the different stakeholders. The construct subsumes the former separate dimensions *individual impact* and *organizational impact* of the original D&M IS Success Model as well as additional IS impact measures from other researchers like work group impacts and societal impacts into one single success dimension. The choice of what impact should be measured depends on the system being

Table 1.5 Exemplary measures of user satisfaction

Items	References
Adequacy	Almutairi and Subramanian (2005), Seddon and Yip (1992), Seddon and Kiew (1994)
Effectiveness	Almutairi and Subramanian (2005), Seddon and Yip (1992), Seddon and Kiew (1994)
Efficiency	Almutairi and Subramanian (2005), Seddon and Yip (1992), Seddon and Kiew (1994)
Enjoyment	Gable et al. (2008)
Information satisfaction	Gable et al. (2008)
Overall satisfaction	Almutairi and Subramanian (2005), Gable et al. (2008), Rai et al. (2002), Seddon and Yip (1992), Seddon and Kiew (1994)
System satisfaction	Gable et al. (2008)

Table 1.6 Exemplary measures of individual impact

Items	References
Awareness/Recall	Gable et al. (2008), Sedera and Gable (2004b)
Decision effectiveness	Gable et al. (2008), Sedera and Gable (2004b)
Individual productivity	Gable et al. (2008), Sedera and Gable (2004b)
Job effectiveness	Davis (1989), Iivari (2005)
Job performance	Davis (1989), Iivari (2005)
Job simplification	Davis (1989), Iivari (2005)
Learning	Sedera and Gable (2004b), Gable et al. (2008)
Productivity	Davis (1989), Iivari (2005), Torkzadeh and Doll (1999)
Task performance	Davis (1989)
Usefulness	Davis (1989), Iivari (2005)
Task innovation	Torkzadeh and Doll (1999)

evaluated, the purpose of the study, and the level of analysis. Although use and user satisfaction are correlated with net benefits, there is still the necessity to measure net benefits directly. Some studies look at the value of technology investments through quantifiable financial measures such as return on investment (ROI), market share, cost, productivity analysis, and profitability. Some researchers argue that benefits in terms of numeric costs are not possible because of intangible system impacts and intervening environmental variables (McGill et al. 2003). Most of the studies applying the D&M IS Success Model measure the benefits of utilizing an IS on the individual and organizational levels. Accordingly, we present exemplary measurement items of individual impact in Table 1.6 and organizational impact in Table 1.7.

1.4 Construct Interrelations

After the introduction of the original D&M IS Success Model (DeLone and McLean 1992), many authors have investigated the model both empirically and theoretically. Beyond the constructs discussed above, also the construct interrelations received

Table 1.7 Exemplary measures of organizational impact

Items	References
Business process change	Gable et al. (2008), Sedera and Gable (2004b)
Competitive advantage	Almutairi and Subramanian (2005), Sabherwal (1999)
Cost reduction	Almutairi and Subramanian (2005), Gable et al. (2008), Sedera and Gable (2004b)
Enhancement of communication and collaboration	Almutairi and Subramanian (2005), Sabherwal (1999)
Enhancement of coordination	Almutairi and Subramanian (2005)
Enhancement of internal operations	Almutairi and Subramanian (2005), Sabherwal (1999)
Enhancement of reputation	Almutairi and Subramanian (2005)
Improved outcomes/outputs	Gable et al. (2008), Sedera and Gable (2004b)
Improved decision making	Almutairi and Subramanian (2005)
Increased capacity	Gable et al. (2008), Sedera and Gable (2004b)
Overall productivity	Gable et al. (2008), Sedera and Gable (2004b)
Overall success	Almutairi and Subramanian (2005), Sabherwal (1999)
Quality improvement	Sabherwal (1999)
Customer satisfaction	Torkzadeh and Doll (1999)
Management control	Torkzadeh and Doll (1999)

manifold attention. In their revised model, DeLone and McLean (2003) have already accounted for and integrated some of these findings. Similarly, Petter et al. (2008) look at the literature on IS success published between 1992 and 2007 and aggregate their findings into an overall assessment of the theoretical and empirical support of the current model. Drawing on their work, we would like to highlight the most important findings for the 15 pair-wise construct interrelations by looking at the dependent variables respectively. Table 1.8 summarizes these relationships at the individual (Ind.) and organizational (Org.) levels. Please note that Table 1.8 does not show the strength or direction of the relations, but highlights how strongly any relation is supported by current studies. For a detailed review of the directions (i.e., positive or negative relations), please see Tables 3 and 4 in Petter et al. (2008).

1.4.1 System Use

At the individual level, the meta-analysis by Petter et al. (2008) shows mixed to moderate support for the explanation of system use. Of the three quality indicators, system quality has received the broadest attention in the literature. However, only mixed support can be found to support the hypothesis that system use can be explained by system quality overall. While a total of nine studies reported a positive association with system use, seven studies reported nonsignificant results for this model path. The same is true for information quality, especially as only a total of six studies reviewed by Petter et al. (2008) did look at this relation to start with. Even fewer data is available for the investigation of service quality, which is why no

Table 1.8 Construct interrelations (as discussed by Petter et al. (2008))

Antecedents	→	Explained constructs	Ind.	Org.
System use				
System quality	→	System use	~	~
Information quality	→	System use	~	o
Service quality	→	System use	o	o
User satisfaction	→	System use	+	o
Net benefits	→	System use	+	o
User satisfaction				
System quality	→	User satisfaction	++	o
Information quality	→	User satisfaction	++	o
Service quality	→	User satisfaction	+	o
System use	→	User satisfaction	+	o
Net benefits	→	User satisfaction	+	o
Net benefits				
System quality	→	Net benefits	+	+
Information quality	→	Net benefits	+	o
Service quality	→	Net benefits	+	o
System use	→	Net benefits	+	+
User satisfaction	→	Net benefits	++	o

++, strong support
+, moderate support
~, mixed support
o, insufficient data

conclusive argument can be drawn for this relation to date. User satisfaction, on the other hand, has been investigated by a high number of studies and was found to be positively linked in most of them. The same is true for the feedback link from net benefits to system use. The literature has shown that both links receive moderate support overall.

The effects on system use at the organizational level are, as of yet, largely uninvestigated. The impact of user satisfaction on system use in an organizational context, for example, has not been covered by a single study. Only the impact of system quality has been covered in a sufficiently high number of studies. The results, however, are somewhat inconclusive as positive, negative, mixed, and nonsignificant relations were found. Especially at the organizational level, a lot of work remains to be done to investigate the IS success model's propositions.

1.4.2 User Satisfaction

In comparison to actual system use, propositions related to user satisfaction received broad and often strong support for positive associations in the literature on the individual level of the D&M IS Success Model. Both system and information quality were found to have strong positive relations with user satisfaction in most studies conducted to date. The results on service quality, on the other hand, only provide mixed support for its ability to explain user satisfaction. While investigated less often, the interrelation between use and user satisfaction shows only moderate support in the literature. However, studies available to date mainly show positive associations (e.g., Chiu et al. 2007; Halawi et al. 2007). Additionally, the feedback effect from net benefits to user satisfaction has shown to be very strong (e.g., Hsieh and Wang 2007; Kulkarni et al. 2007; Rai et al. 2002).

At the organizational level, Petter et al. (2008) highlight the lack of conclusive data on the antecedents of user satisfaction. None of the five constructs interrelations leading to user satisfaction were investigated more than four times. Looking at the quality constructs, the studies conducted so far do, however, indicate a positive relationship. The effects of system use and net benefits, on the other hand, show mixed results. Similarly to the research on system use, the investigation of user satisfaction in an organizational context remains an interesting area for future research into IS success.

1.4.3 Net Benefits

As the D&M IS Success Model's overall dependent variable, net benefits play a significant role in IS success research. Looking at the individual level, current studies have found at least moderate support for all interrelations. System quality has mostly been found to have a positive association with net benefits, even though most of the effect is moderated through system use and user satisfaction. While investigated less often, the same is also true for information and service quality. System use, in turn, also has a moderate positive association with net benefits, even though six studies reviewed by Petter et al. (2008) reported nonsignificant findings. The construct covering user satisfaction was unanimously reported to be positively associated with a system's net benefits by all the studies reviewed. Accordingly, this interrelation was found to be supported strongly by current studies.

On the organizational level, insufficient overall data is a major hurdle for the assessment of the D&M IS Success Model. Three of the five possible antecedents are not covered sufficiently to determine their associations with net benefits in a reliable way. Only the constructs system quality and system use are covered in a sufficient manner to determine a moderate support for their positive association with net benefits. Despite the lack of widespread investigation of net benefits at an organizational level, most of the studies conducted on the other constructs so far do indicate a positive association with net benefits.

1.5 Existing Research on IS Success

During the last years, the D&M IS Success Model in its original and updated version has become a widely used evaluation framework in IS research. Several articles have been published that use the model as the theoretical basis. In a recent literature

Table 1.9 Exemplary collection of IS success studies

Type of information system	Publications
Data warehouse	Nelson et al. (2005), Shin (2003), Wixom and Watson (2001), Wixom and Todd (2005)
Decision support system	Bharati and Chaudhury (2004)
e-Commerce system	DeLone and McLean (2004), Molla and Licker (2001), Wang (2008)
e-Mail system	Mao and Ambroso (2004)
Enterprise system	Gable et al. (2003), Lin et al. (2006), Qian and Bock (2005), Sedera (2006), Sedera and Gable (2004b), Sedera and Gable (2004a), Sedera et al. (2004a, b)
Finance and accounting system	Iivari (2005)
Health information system	Yusof et al. (2006)
Intranet	Hussein et al. (2008), Masrek et al. (2007), Trkman and Trkman (2009)
Knowledge management system	Clay et al. (2005), Halawi et al. (2007), Jennex and Olfman (2003), Kulkarni et al. (2007), Velasquez et al. (2009), Wu and Wang (2006)
Learning system	Lin (2007)
Online communities	Lin and Lee (2006)
Picture archiving and communications system	Pare et al. (2005)
Portal	Urbach et al. (2009a), Urbach et al. (2010), Yang et al. (2005)
Telemedicine system	Hu (2003)
Web-based system	Garrity et al. (2005)
Web sites	Schaupp et al. (2006)

review, Urbach et al. (2009b) explore the current state of IS success research by analyzing and classifying recent empirical articles with regard to their theoretical foundation, research approach, and research design. The results show that the dominant research analyzes the impact that a specific type of IS has by means of users' evaluations obtained from surveys and structural equation modeling. The D&M IS Success Model is the main theoretical basis of the reviewed studies. Several success models for evaluating specific types of IS – like knowledge management systems (Kulkarni et al. 2007) or enterprise systems (Gable et al. 2003) – have been developed from this theory.

In order to give an overview on existing literature on IS success, we present an exemplary collection of research articles in Table 1.9. These are classified in terms of the type of IS being evaluated and should provide a point of departure for context-specific research in these or additional areas.

Taking a closer look at these publications, we see a broad variety of IS types that have been analyzed using the D&M IS Success Model. Thereby, the D&M IS Success Model is used in different ways.

Several authors use the model in its predefined form as a theoretical basis. In these publications, only the operationalizations of the model's success dimensions were adapted to the specific research context. Iivari (2005), for example, evaluates the finance and accounting system of a municipal organization. The empirical data collected is used to validate the D&M IS Success Model in its original form. However, the success dimensions are operationalized with regard to the specific research problem.

Other authors use the model in its predefined form for constructing their research model, but add additional success dimensions that are necessary to fully capture the specifics of the type of IS under investigation. As an example, Urbach et al. (2010) use the D&M IS Success Model as the theoretical basis for investigating the success of employee portals. However, in contrast to other types of IS, employee portals are not only utilized to exchange information, but also to electronically support work processes as well as collaboration between users. Accordingly, the two additional success dimensions, process quality and collaboration quality, were added to the research model.

Finally, in some of the presented publications, the D&M IS Success Model is fully adapted to a specific research problem using newly developed constructs that are similar to those of the original model. Wixom and Watson (2001), for example, develop and validate a model for empirically investigating data warehousing success on the basis of the D&M IS Success Model. Instead of referring to the proposed success dimensions, however, context-specific constructs such as organizational, project, and technical implementation success are utilized.

An additional observation is that many of the published studies only partially analyze the D&M IS Success Model (e.g., Garrity et al. 2005; Kulkarni et al. 2007; Velasquez et al. 2009). Only few studies validate the model in its complete form (e.g., Iivari 2005; Urbach et al. 2010; Wang 2008).

1.6 Conclusion

Despite the high number of studies already conducted in the context of the D&M IS Success Model, there are quite a few further research opportunities. For example, DeLone and McLean (2003) themselves make recommendations for future research. They highlight that the model, especially the interdependent relationships between its constructs, should be continuously tested and challenged. In order to provide a basis for the much needed cumulative tradition of IS research, the authors urge future users of their model to consider using proven measures where possible. Only a significant reduction in the number of measures used can make results comparable beyond the various contexts of IS success studies. Moreover, they emphasize that more field-study research is needed in order to investigate and incorporate net benefit measures into the model.

As especially the summary of the meta-review of Petter et al. (2008) has shown, additional research covering the IS success model from an organizational perspective is required to be able to determine the degree of associations between the constructs.

Looking at current work on the D&M IS Success Model, many studies conducted to date have focused on the measurement and assessment of selected parts of the model. Only few studies use the entire model and, thus, present a holistic approach to measuring IS success. More research using the complete model will help to extend our understanding of the model's overall validity.

Once such additional work has been created, the model could also be used in fieldwork to help IT management teams in the selection, implementation, and assessment of new IS. It would be interesting to see whether the model's propositions can actually help practitioners to better handle their IS in practice. A first step into this direction is the "applicability check" by Rosemann and Vessey (2005, 2008).

As one of the few truly IS-specific pieces of theoretical knowledge created by IS scholars in the last decades, work using the D&M IS Success Model will remain popular in the years to come. Its update provides a powerful argument for the model's accuracy and parsimony and the many studies using the model provide us with a broad basis of empirical support and proven measures. Given the rise of more and more service-oriented IS as well as the increasing use of IS in an interorganizational setting, the D&M IS Success Model is likely to witness a new round of extensions and probably even another update. We hope that this brief introduction will help IS scholars, especially those still new to the profession, to tap into this vibrant and fascinating stream of research and build their own contributions.

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Chapter 2
If We Build It They Will Come? The Technology Acceptance Model

Joseph Bradley

Abstract Global business markets have become more competitive as consumers demand low prices, an increasing variety of goods, and improved product quality. Businesses have turned to information technology to gain performance efficiency in this changing marketplace. Yet, as firms increase their investments in new information technology, they may find employees are reluctant to accept and effectively use the new technologies. The technology acceptance model is the most widely used theory by researchers to explore user acceptance. This chapter explores the development, use, and current status of the technology acceptance model, as well as critiques of the technology acceptance model.

Keywords Technology acceptance model • Theory of reasoned action • User acceptance • Perceived ease of use • Perceived usefulness

Abbreviations

A	Attitude toward behavior
BI	Behavioral intention
CRM	Customer relationship management system
ERP	Enterprise resource planning system
MRP	Materials resource planning
PEOU	Perceived ease of use
PU	Perceived usefulness
SCM	Supply chain management system

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SN	Subjective norm
TAM	Technology acceptance model
TPB	Theory of planned behavior
TRA	Theory of reasoned action
TTF	Task-technology fit model

2.1 Introduction

Global businesses are turning to information technology to compete in a constantly changing marketplace. Customers demand higher-quality products, more choice of products, and lower prices. To meet these customer needs, businesses are adopting more, increasingly complex information systems. Timely and accurate information is a key to gaining performance efficiency. Information technology is widely believed to be a tool to gain the efficiency needed to remain competitive. Complex enterprise resource planning (ERP) systems now manage the internal business processes of firms ranging in size from huge multinationals to small manufacturers. Supply chain management (SCM) systems track moving goods around the world.

Unfortunately, "computer systems cannot improve organizational performance if they aren't used" (Davis et al. 1989, p. 982). Sichel (1997) identifies low usage of installed information systems as a significant factor contributing to the "productivity paradox," which describes low financial returns on information technology investments (Brynojlfsson 1993).

> There is nothing more difficult to plan, more doubtful of success, nor more dangerous to manage than the creation of a new order of things … Whenever his enemies have the ability to attack the innovator, they do so with the passion of partisans, while others defend him sluggishly, so that the innovator and his party alike are vulnerable. (Machiavelli 1513, from Rogers, E. M., Diffusion of Innovations, 2003)

The Machiavelli quote from the sixteenth century demonstrates that resistance to change is not something new or unique to information systems. Human nature seems reluctant to adapt easily to change. Risk is inherent in all information systems projects and user resistance can intensify that risk. Successful implementation of information systems ranging from simple applications, such as word processing and spreadsheets, to more complicated applications requires user acceptance. Information systems, especially integrated systems such as ERP and SCM, often deeply impact organizational processes and the firm's way of doing business. Employees are required to adopt new software, and often at the same time adapt to new and fundamentally different ways of executing business processes. Understanding and predicting user acceptance of new technology is important to developers of information systems and organizations adopting the new technology.

Davis et al. (1989) state that "practitioners and researchers require a better understanding or why people resist using computers in order to devise practical methods for evaluating systems, predicting how users will respond to them, and improving user acceptance by altering the nature of the systems and the processes by which they are implemented (p. 982)." Practitioners who design and implement systems and the academics who study these systems will benefit from a better understanding of the mechanisms of user acceptance. Systems professionals can utilize this knowledge to design systems and implementation methodologies that users are more likely to accept. In 1989, Davis et al. proposed a model of how users deal with the acceptance of new technologies.

Davis et al. (1989) developed the technology acceptance model (TAM) based on expectancy-value theory (Fishbein and Ajzen 1975) and the theory of reasoned action (TRA) (Ajzen and Fishbein 1980). Both these theories are found in psychology literature. The TAM uses two variables, perceived usefulness (PU) and perceived ease of use (PEOU), as determinants of user acceptance. A key element of the TAM is behavioral intent (BI) which leads to the desired action, use of the system.

Although other theories of user acceptance exist, such as the TRA (Ajzen and Fishbein 1980) and the theory of planned behavior (TPB) (Ajzen 1991; Ajzen and Madden 1986), the TRA is the most widely used user acceptance theory in information technology research because of its parsimony and the wealth of empirical studies supporting the model.

This chapter will first look at the theoretical development of the TAM beginning with the expectancy-value theory and the TRA. Then, TAM is introduced and described. A discussion of the impact of TAM on information systems research follows together with the limitations of the model. Extensions of TAM are then discussed. Lastly, a discussion of the future of TAM is presented based on several articles presented in a 2007 special issue of the *Journal of the Association of Information Systems*.

2.2 Literature Review

This section reviews and discusses theories and literature related to TAM. TAM is built on two theories, the expectancy-value model and the TRA. These theories are examined before turning to TAM.

2.2.1 Expectancy-Value Theory

The expectancy-value theory was developed in an attempt to understand the motivation underlying the behavior of individuals (Fishbein and Ajzen 1975). The theory helps to explain why individuals accept or reject information technology. The foundation of this theory is BI, which is posited as the immediate precursor of a particular behavior. The concept of BI is the foundation of TAM. Understanding the elements that influence intention can give researchers the ability to better predict the likelihood of an individual engaging in a particular behavior, such as technology adoption. "Individuals choose behaviors based on the outcomes they expect and the values they ascribe to those expected outcomes" (Borders et al. 2004, p. 539). Expectancy is "the measurement of the likelihood that positive or negative outcomes will be associated with or follow from a particular act" (Mazis et al. 1975, p. 38). The strength of the expectancy and the value attributed to the outcome will determine the strength of

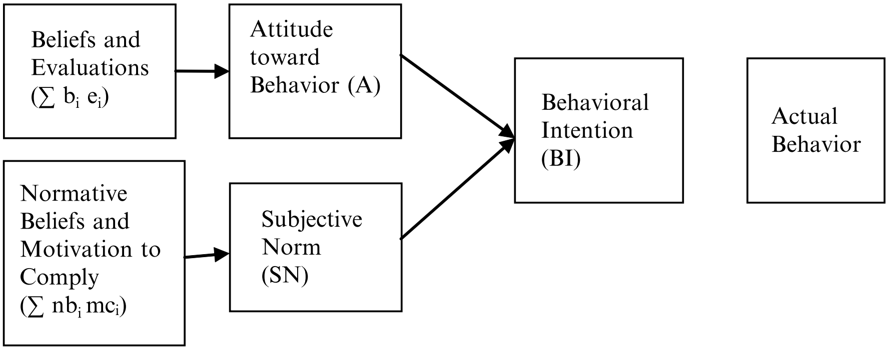

Fig. 2.1 Theory of reasoned action (Adapted from Davis et al. (1989))

the tendency to act (Mazis et al. 1975, p. 38). A simple example demonstrated by Geiger and Cooper (1996) is that college students who valued increasing their grades were more willing to increase their effort in the course.

2.2.2 *Theory of Reasoned Action*

The TRA is found in social psychology literature. TRA improves the predictive and explanatory nature of the expectancy-value theory. The TRA explains the determinants of consciously intended behaviors (Fishbein and Ajzen 1975; Ajzen and Fishbein 1980). TRA is a general model which posits that "a person's performance of a specific behavior is determined by his or her BI to perform the behavior" (Davis et al. 1989). Eveland (1986) observes that "ultimately, technology transfer is a function of what individuals *think* – because what they *do* depends on those thoughts, feelings and interests" (p. 310).

TRA, shown in Fig. 2.1, posits that a person's beliefs and evaluations lead to their attitude (A) toward the behavior, which in turn leads to BI. Normative beliefs and motivation affect the subjective norm (SN) which also influences BI. The SN is defined as the influence others will have on the acceptance decision. Acceptance may be influenced by peers, subordinates, or superiors. Beliefs in the model are defined as "the individual's subjective probability that performing the target behavior will result in consequence *i*" (Davis et al. 1989, p. 984). BI is determined by the person's attitude (A) and SN concerning the behavior in question (Davis et al. 1989). Attitude toward behavior is a function of the individual's "salient beliefs (b_i) about consequences of performing the behavior multiplied by the evaluation (e_i) of those consequences" (p. 984). SN is determined by the user's normative beliefs (nb_i), which are the perceived expectations of specific individuals and groups, and the user's motivation to accept these expectations (mc_i).[1]

[1] Behavioral intention can be shown as BI = A + SN, attitude can be expressed as $A = \Sigma\, b_i\, e_i$, and subjective norm as $SN = \Sigma\, nb_i\, mc_i$.

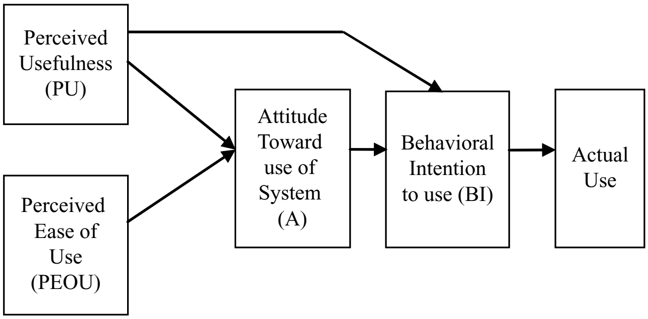

Fig. 2.2 Technology acceptance model (Adapted from Davis et al. (1989))

2.2.3 Technology Acceptance Model

TAM evolved from TRA with the goal "to provide an explanation of the determinates of computer acceptance that is general, capable of explaining user behavior across a broad range of end-user computing technologies and user populations, while at the same time being both parsimonious and theoretically justified" (Davis et al. 1989, p. 985). TAM, however, differs from TRA as it omits the SN element of TRA. Davis states that, "It is difficult to disentangle direct effects of SN on BI from indirect effects via A" (p. 986). Like TRA, TAM postulates that actual technology usage is determined by BI. The model is shown in Fig. 2.2.

The PU variable is based on the observation that "people tend to use or not use the application to the extent they believe it will help them perform their job better" (Davis 1989, p. 320). PU directly influences the attitude toward use of the system and indirectly influences BI to use. Even if an application is perceived as useful, it will only be used if it is perceived as easy to use, that is, benefits of usage outweigh the effort of using the system. PEOU influences attitude toward use of the system. These two determinants, PU and PEOU, directly influence the user's attitude toward using the new information technology, which in turn leads to the user's BI to use. PEOU influences PU. PU also has a direct impact on BI. BI to use leads to actual system use.

The two key variables in TAM are PU and PEOU. PU is defined from the prospective user's point of view. Will the application improve his or her job performance in the organization? PU influenced both attitude (A) toward the use of the system and behavioral intention to use (BI). PEOU is a variable that describes the perception of the user that the system will be easy to use. PEOU influences both PU and attitude toward use (A). Davis (1989) develops and validates a scale for these variables.

Theoretical support for the use of these variables can be found in self-efficacy theory, the cost–benefit paradigm, and adoption of innovation literature. Bandura (1982) defines self-efficacy as "judgments of how well one can execute courses of action required to deal with prospective situations" (p. 122). Davis (1989) describes self-efficacy as similar to PEOU. Self-efficacy beliefs are theorized as determinants of behavior. This theory does not offer a general measure sought by Davis, but is situationally specific. Davis et al. (1989) differentiate TAM from TRA with respect to one's salient beliefs. In TRA these beliefs are "elicited anew for each new context" (p. 988). TAM determines these variables for a population resulting in a more generalized view of systems and users. External effects on the model can be separately traced to each of these variables.

The cost–benefit paradigm from the behavioral decision literature is also relevant to PU and PEOU. The paradigm describes decision-making strategies "in terms of a cognitive trade-off between the effort required to employ the strategy and the quality (accuracy) of the resulting decision" (Davis 1989, p. 321).

Adoption of innovation literature finds that compatibility, relative advantage, and complexity of the innovation are key factors. Rogers and Shoemaker's (1971) definition of complexity is similar to PEOU: "the degree to which an innovation is perceived as relatively difficult to understand and use" (p. 154). Davis (1989) points out the convergence of these and other theories to support the concepts of PU and PEOU.

Gefen and Straub (2000) describe PEOU and PU in terms of intrinsic and extrinsic characteristics. PEOU relates to the "*intrinsic* characteristics of IT, such as the ease of use, ease of learning, flexibility and clarity of its interface" (p. 1). PU results from a user's assessment of IT's "extrinsic, i.e., task-oriented, outcomes: how IT helps users achieve task-related objectives, such as task efficiency and effectiveness" (pp. 1–2). Using MBA students Gefen and Straub demonstrated that PEOU affects intrinsic tasks, that is, using a website for inquiry, but not extrinsic tasks, that is, using a website to make a purchase.

2.2.3.1 TAM Variables

In developing TAM, Davis et al. (1989) describe the development of the questionnaire for this study. Four independent variables were used to operationalize PEOU and another four to operationalize PU.

The four PEOU independent variables are (Davis et al. 1989, p. 991):

- Learning to operate Write One would be easy for me.
- I would find it easy to get Write One to do what I want it to do.
- It would be easy for me to become skillful at using Write One.
- I would find Write One easy to use.

The four independent variables operationalizing PU were (Davis et al. 1989, p. 991):

- Using Write One would increase my performance in the MBA program.
- Using Write One in the MBA program would increase my productivity.
- Using Write would enhance my effectiveness in the MBA program.
- I would find Write One useful in the MBA program.

Usage of the system, the dependent variable, was measured by two variables. The first was a seven-point scale with frequent and infrequent as the end points. The other was a seven-point check-the-box scale describing the responding individual's usage starting at "not at all" and progressing to "more than once a day" (Davis et al. 1989, p. 991).

Future researcher may find it beneficial to review how Davis et al. (1989) operationalized the variables in their work as a guide to future TAM research.

2.2.3.2 Impact of TAM

The IS community has found the TAM to be a powerful model. Lee et al. (2003) found that the first two TAM articles, Davis (1989) and Davis et al. (1989) received 698 journal citations through 2003. Williams et al. (2009) found 345 articles related to diffusion, adoption, or acceptance in the 19 journals they reviewed. A Google Scholar search on the term, "Technology Acceptance Model," in June 2010 produced 14,900 hits. The number of citations in subsequent literature can be used as gauge of the significance of a concept or line of research. As of the end of June 2010, Google Scholar reports that the Davis (1989) article, "Perceived usefulness, perceived ease of use, and user acceptance of information technology," has been cited 7,714 times. The Davis et al. (1989) article, "User acceptance of computer technology: a comparison of two theoretical models," has been cited 4,592 times. The Venkatesh and Davis (2000) article, "A theoretical extension of the technology acceptance mode: Four longitudinal field studies," has been cited 2,465 times.

Lee et al. (2003) examined a number of variables related to TAM research, including types of information systems examined, external variables tested, number of publications by year by journal, most prolific researchers, characteristics of research subjects, relationship between major TAM variables, major limitations, and research methodology.

2.2.3.3 Types of Information Systems Examined

Researchers have applied the TAM model to a wide variety of information systems. In the area of communications systems, Lee et al. (2003) found that, through 2003, TAM has been applied in 25 articles to e-mail, v-mail, fax, and dial-up systems. General-purpose systems were examined in 34 articles, including Windows, PC, the Internet, workstations, computer resource centers, and groupware. Office systems such as word processors, spreadsheets, presentation software, database programs, and groupware were the subject of 33 articles. Specialized business systems such as computerized models, case tools, hospital systems, decision support systems, expert support systems, and MRP were examined in 30 articles.

2.2.3.4 External Variables Tested

Researchers have proposed and examined many external TAM variables. Lee et al. (2003) assembled the following list of external variables in TAM research which is summarized in Table 2.1. See Lee et al. (2003) for definitions, origin, and referred articles.

Table 2.1 TAM variables (Adapted from Lee et al. (2003))

Perceived enjoyment	End-user support	Experience
Accessibility	Anxiety	Attitude
Compatibility	Complexity	Result demonstrability
Facilitating conditions	Image	Job relevance
Managerial support	Playfulness	Personal innovativeness
Relative advantage	Self-efficacy	Social influence, subjective norms, and social pressure
Social presence	Trialability	Usability
Visibility	Voluntariness	

2.2.3.5 TAM Publications

Lee et al. (2003) found 101 studies involving TAM were published in what they defined as major journals and conferences between 1989 and 2003. *MIS Quarterly* led the group with 19 TAM articles; *Information & Management*, 12; *Information Systems Research* and *Journal of Management Information Systems*, 10 each. The peak of interest in TAM was the period from 1999 to 2001 when 41 articles appeared in a 3- year period. Subsequent to 2003 the pace of articles appears to have declined. For example, *MIS Quarterly* ran two articles in 2004, one in 2005, three in 2006, one in 2008, two in 2009, and one in the first half of 2010. However, a *Journal of the Association for Information Systems* special issue in April 2007 included eight articles assessing the current status of technology acceptance research. A discussion of some of these articles can be found below.

Williams et al. (2009) searched 19 peer-reviewed journals published between 1985 and 2007 for the terms adoption, acceptance, and diffusion. Using a longer time frame and a broader definition than Lee et al. Williams et al. (2009) found 345 articles. Approximately 30% of these articles utilized TAM. *Information & Management* published the most articles fitting this category at 76, followed by the *Communications of the ACM* at 34 articles, *Journal of Computer Information Systems* and *MIS Quarterly* each at 24 articles and the *European Journal of Information Systems* at 23.

As shown in Lee et al. (2003) and Williams et al. (2009) studies, a wide variety of journals have published TAM research. Researchers interested in pursuing additional research based on the TAM model or its various elaborations should have multiple outlets in which to publish the results of such research.

2.2.3.6 Characteristics of Research Subjects

Research subjects used in the technology acceptance literature cited by Lee et al. (2003) were composed of students (44 studies) and knowledge workers (60 studies). For example, Davis et al. (1989) used 107 students and word processing technology. Taylor and Todd (1995) used 786 students dealing with the use of a university computing center.

While students provide a convenient sample for researchers, the demographic profile, experience, motivation, and attitudes of a student sample may be very different from the workers expected to adopt a new technology in industry. Future researchers may find it beneficial to use samples drawn from the workplace to provide more relevant results to benefit practitioners and academics.

2.2.3.7 Major Limitations of the Model

Lee et al. (2003) found that the major limitation of the TAM studies included in their examination of TAM research was self-reported usage. The studies did not measure actual usage, but relied on the research subject to indicate usage. A better approach would have been to employ an independent measure actual use. Another limitation was the use of a single IS system in each research project limiting the generalizability of the results to other types of IS systems.

In addition, student samples were heavily employed in TAM research, raising the question of how representative this group is to the real working environment. Other limitations discussed in these papers include single subjects (i.e., one organization, one department, one student group, etc.), one-time cross-sectional studies, measurement problems (e.g., low validity of new measures), single task, low variance scores, and mandatory situations. Future research should design studies to overcome these objections.

TAM was developed to understand user acceptance to voluntary software applications such as word processing and spreadsheets. The model has been widely applied to large integrated systems, such as ERP systems, for which user adoption is clearly not voluntary. Caution should be used by researchers in applying this model to situations that are not voluntary.

Further limitations and strengths of the TAM are discussed below under the caption “Future of the Technology Acceptance Model.”

2.2.3.8 Most Published Authors

Lee et al. (2003) found that 11 authors published four or more papers accounting for 50 of the 101 articles found in major IS journals. The most prolific TAM authors through 2003 include Viswanath Venkatesh (12), Fred D. Davis (9), Detmar W. Straub (8), Elena Karahanna (6), David Gefen (6), and Patrick Y. K. Chau (6). In the broader study by Williams et al. (2009), the most prolific researchers in the area of adoption, acceptance, and diffusion in the 345 journal articles from 19 journals which they examined were Chau (9), Tam (7), and Venkatesh (7).

2.2.3.9 Recent TAM Research

Although the appearance of TAM articles in major journals appears to be on a downturn, TAM research continues to appear in the literature. More recent research extends the TAM to ERP implementation (Amoako-Gyampah and Salam 2004; Bradley and Lee 2007; Hwang 2005), cross-cultural implementation studies (McCoy et al. 2005, 2007), e-commerce participation among older consumers (McCloskey 2006), and biometric devices (James et al. 2006). Pijpers and van Montfort (2006) investigated senior executives' acceptance of technology using the TAM and found that gender has no effect on PU or PEOU, but also found that gender affects positively actual usage frequency.

Amoako-Gyampah and Salam (2004) examined ERP implementation using the TAM and found that "both training and project communication influence the shared beliefs that users form about the benefits of the technology and that the shared beliefs influence the PU and ease of use of the technology" (p. 731). This article has been cited 208 times according to Google Scholar on June 27, 2010.

Bradley and Lee (2007) examined the relationship between training satisfaction and ERP systems satisfaction in a university environment.

Wu and Lederer (2009) examined the relationship between TAM and environment-based voluntariness and found strong support that environment-based voluntariness moderates the effects of ease of use and usefulness on BI, but does not affect usage.

Following the introduction of the TAM in 1989 and validation period ranging from 1992 to 1996 and a period of model extension, a model elaboration period ensued "to develop the next generation TAM" model and "to resolve the limitations raised by previous studies" (Lee et al. 2003, p. 757). We will now discuss some of the elaborations of TAM, beginning with TAM2.

2.2.4 TAM Model Elaborations

Approximately 10 years after the TAM model was proposed and extensively validated the first elaboration of the model was proposed, called TAM2.

2.2.4.1 TAM2

In the 10 years following the publication of the TAM, empirical studies found that the TAM model explained about 40% of the variance in usage intentions and behavior. In an effort to expand the explanatory impact of the model, Venkatesh and Davis (2000) developed and tested an extension of TAM, called TAM2, which "explains the PU and usage intentions in terms of social influence and cognitive instrumental processes" (p. 186). Figure 2.3 shows this model. TAM2 extended the TAM model to include seven additional variables. Five of these new variables directly influence PU. TAM2 considers both social influences (SN, voluntariness, and image) and cognitive instrumental processes (job relevance, output quality, result demonstrability, and PEOU). The expanded model accounts for 60% of the variance in the drivers of user intentions.

TAM2 posits that increasing experience with an information system influences both PU and intention to use. Voluntariness also is a moderator of intention to use.

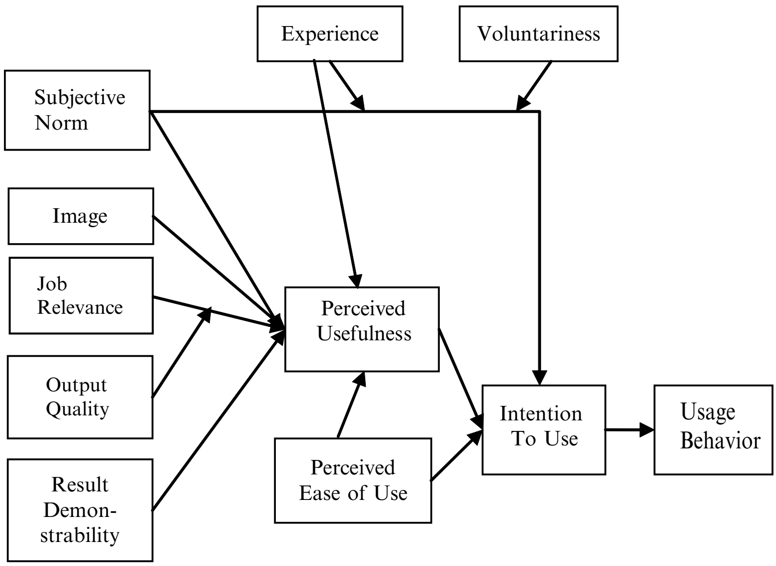

Fig. 2.3 TAM2-Extension of the technology acceptance model (Adapted from Venkatesh and Davis (2000))

While less parsimonious than the original TAM, the TAM2 model is more powerful. TAM2 was used to examine technology adoption and acceptance in a developing country. Baker et al. (2010) investigated technology acceptance behavior among Saudi Arabian knowledge workers in the context of using desktop computers. TAM2 was used in their study.

The TAM2 model accounted for 40.3% of the variance among Saudi users in contrast with the 34–52% of explained variance among US users (Venkatesh and Davis 2000). The authors attribute the difference to "specific Saudi Arabian emic constructs, including its collectivist culture and the worker's focus on the managerial father figure's influence on individual performance, a stark difference from TAM findings in more individualistic societies" (p. 35).

2.2.4.2 Unified Theory of Acceptance and Use of Technology (UTAUT)

In an effort to improve the predictive power of a user acceptance model, Venkatesh et al. (2003) examine eight competing models of technology acceptance and formulate a unified model that integrates elements of these models. The eight models the study examined are: TRA, TAM, motivational model, TPA, TAM/TPB combined, a model of PC utilization, innovation diffusion theory, and social cognitive theory. From this study the authors developed UTAUT which includes four variables, performance expectancy, effort expectancy, social influence, and facilitating conditions, and up to four moderators of key behaviors, gender, age, experience, and voluntariness. In an experiment, the eight models taken individually varied in explanatory power from

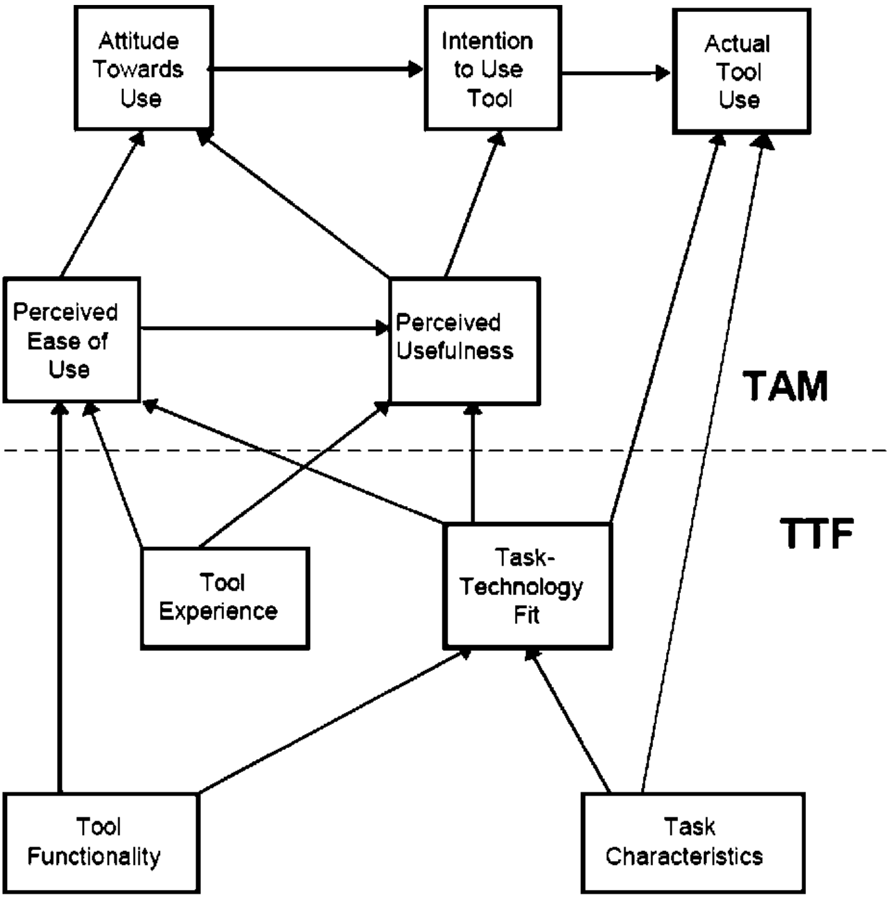

Fig. 2.4 TAM and TTF models combined (Dishaw et al. (2002))

17% to 53% of the variance in user intentions to use information technology. UTAUT was tested on the same data and explained 69% of the variance.

Both TAM2 and UTAUT have stronger explanatory power than the original TAM model, but the additional number of variables raises the question of parsimony. What is the balance between the added explanatory power and the complexity introduced by the additional variables?

The UTAUT is examined more fully in another chapter of this publication.

2.2.4.3 TAM and Task-Technology Fit Model

Dishaw et al. (2002) propose a combination of the TAM and the TTF model (Goodhue and Thompson 1995). The combined model is shown in Fig. 2.4. The TTF model is the "matching of the capabilities of the technology to the demands of the task, that is, the ability of IT to support a task" (p. 1022). The TTF model is composed of four constructs:

- Task characteristics
- Technology characteristics
- Task-technology fit
- Performance or utilization

Technology characteristics are related to TTF. TTF is related to both performance impacts and utilization. Utilization also is directly related to performance impacts. Dishaw et al. (2002) posit that "IT will be used if, and only if, the functions available to the user support (Fit) the activities of the user" (p. 1022). IT without any significant advantage will not be used.

In the combined model, TTF influences TAM's variables of PU and PEOU. TTF also directly influences use. Dishaw et al. (2002) believe the combined model better describes information systems utilization than either model considered separately. Dishaw et al. (2002) also propose another model combining TAM, TTF, and computer self-efficacy.

Such combinations of models may provide better insight into the user acceptance phenomenon, but with the addition of more variables these combined models will lose the parsimony associated with TAM.

2.2.4.4 TAM3

A frequent criticism of the TAM model is that the model provides little guidance to organizations on how to craft interventions to encourage user acceptance of new technologies. Building on 20 years of research since the introduction of TAM, Venkatesh and Bala (2008) propose TAM3 to address these concerns.

TAM3 combines and integrates TAM2 (Venkatesh and Davis 2000), which identifies the determinants of PU, with the determinants of PEOU identified by Venkatesh (2000). Although these determinants were identified at the same time by Venkatesh, no crossover effects were investigated at that time or in TAM3.

The resulting model includes SN, image, job relevance, output quality, and result demonstrability influencing PU with experience variable modifying both BI and PU. PEOU was modeled to be influenced by computer self-efficacy, perceptions of external control, computer anxiety, computer playfulness, perceived enjoyment, and objective usability. Experience is shown to moderate the last four of these six variables. The resulting model adds 11 variables and two modifiers to the TAM model.

In another change from prior TAM research, the sites used to collect data for this research were all in industry rather than student populations. This change enhances the credibility of the data, making the results more relevant to the workplace.

TAM3 posits three relationships that neither TAM2 nor Venkatesh (2000) explored. These relationships are between: PEOU and PU, computer anxiety and PEOU, and PEOU and BI. Each of these relationships is moderated by experience using the new system.

Based on their research on the TAM3 model, Venkatesh and Bala (2008) propose pre-implementation and post-implementation interventions for practitioners implementing IS. Pre-implementation recommendations are made in the areas of design characteristics, user participation, management support, and incentive alignment. Post-implementation recommendations include training, organizational support, and peer support.

Design characteristics of the new system can influence the user's view of both PU and PEOU. A system providing timely, accurate and well-formatted information will demonstrate the job relevance of the system influencing PU. Characteristics that enhance the user-friendly nature of the system will enhance PEOU.

2.3 Future of the Technology Acceptance Model

An April 2007 special issue of the *Journal of the Association for Information Systems* examined "*Quo Vadis* TAM-Issues and Reflections on Technology Acceptance Research."

A very relevant question addressed by Venkatesh et al. (2007) is whether TAM is alive or dead? As is not unusual with this complex a question the answer is yes and no. "Yes" can be interpreted as a continuation of the replications of TAM studies without significant theoretical advance. The authors observe an abundance of "minor 'tweaking'" of the model. Researchers find it difficult to ignore the parsimony, robustness, and generalizability of TAM. The "no" answer reflects the "tremendous opportunities" that are still available to extend the current knowledge imbedded in TAM through further research.

Although TAM is the dominant model of user acceptance, continuing research in user acceptance has sparked interest in competing models not discussed herein, which are based on psychology, sociology, and IS. Examples of such theories include the TPB (Ajzen 1985, 1991), innovation diffusion theory (Rogers 1983, 2003), and the decomposed TPB (Taylor and Todd 1995). Venkatesh et al. (2007) chose the TPB for a model-centric comparison with TAM and job satisfaction research for an outcome-centric comparison.

Benbasat and Barki (2007, p. 212) acknowledge the significant contribution of the TAM, but state:

> the intense focus on TAM has led to several dysfunctional outcomes: (1) the diversion of researchers' attention away from important phenomena. First, TAM-based research has paid scant attention to the antecedents of its belief constructs: most importantly, IT artifact design and evaluation. Second, TAM-based research has provided a very limited investigation of the full range of the important consequences of IT adoption, (2) TAM-based research has led to the creation of an illusion of progress in knowledge accumulation, (3) The inability of TAM as a theory to provide a systematic means of expanding and adapting its core model has limited its usefulness in the constantly evolving IT adoption context, (4) The efforts to "patch-up" TAM in evolving IT contexts have not been based on solid and commonly accepted foundations, resulting in a state of theoretical confusion and chaos.

Benbasat and Barki (2007) suggest going back to TRA or TPB to "provide the theoretical green light for going beyond TAM and allow for novelty and discovery" (p. 215).

Schwarz and Chin (2007) call for an expansion and broadening of technology acceptance research to include a "wider constellation of behavioral usage and its psychological counterparts" (p. 230).

Straub and Burton-Jones (2007) challenge the notion that TAM has been "established 'almost to the point of certainty'" (p. 224). They state that the system usage construct has been understudied. Exploration of usage may open up possibilities to enrich the model. Straub and Burton-Jones (2007) point to a research flaw in TAM studies where respondents self-rated three key variables: PU and PEOU (IVs) and usage level. This methodology results in a common methods bias. Straub et al. suggest TAM researchers undertake "strenuous effort" to gather usage data independent of the source of PU and PEOU. Straub and Burton-Jones (2007) also challenge the parsimony of TAM. However, in this challenge Straub et al. do not directly challenge the TAM but move forward in the TAM development stream to the UTAUT claiming that its ten constructs are not parsimonious. Straub et al. further observe that Lee et al. (2003) enumerate 21 external variables that affect the four central variables of the TAM model.

Lucas et al. (2007) criticize TAM research on several issues. TAM first fails to provide a unifying model of all the factors of user acceptance. Second, it fails to yield insights from process studies. Third, the model is often applied to organizational use and rejection while the model was constructed for individual acceptance or rejection. Fourth, the model ignores institutional influences.

Lucas et al. (2007) further observe that the IS marketplace move to packaged solutions, such as ERP, SCM, and CRM, is a challenge to TAM which was developed to explain voluntary individual adoption of systems such as spreadsheets and word processors. Adoption speed has increased and many systems have become interorganizational, adding further complexity.

Silva (2007) examines TAM applying three criteria on what is scientific and what is a theory. He uses the perspective of three post-positivistic science philosophers: Karl Popper, Thomas Kuhn, and Imre Lakatos. Popper's principle of falsifiability suggests that "a good theory should 'prohibit' the occurrence of specific phenomena" (p. 264). Silva uses the generalizability of TAM/TRA to explain a wide variety of behaviors to compare it to psychoanalysis, which he deems to be what Popper describes as pseudo-science. Using Kuhn's lens, Silva finds TAM to be a typical example of normal science as it provides an easily transferable and verifiable problem-solving apparatus.

2.4 Conclusions

Even with the large body of research in the area encompassed by the TAM, "user acceptance of information technology remains a complex, elusive, yet extremely important phenomenon" (Venkatesh and Davis 2000). Each year organizations invest billions of dollars in new technology. If employees are unwilling to accept and support this new technology, the return on this investment will be significantly reduced.

In this chapter we have surveyed the literature on the development and extension of the TAM and its future. The TAM model is widely used and has been extensively validated. Researchers have extended the model to encompass the impact of dozens of variables which impact the model at the cost of parsimony.

The primary goal of the TAM model and its extensions is the measurement of BI to use a technology and user attitude toward using it. Most studies rely on self-reported measures of actual use, PU, and PEOU resulting in measurement of these variables which may be unreliable. Straub and Burton-Jones (2007) point out that reliance on self-reported key variables, like attitude and intention, open models based on these variables to significant questions. Researchers need to find more reliable methods to measure these variables. Limitations on data gathering need to be addressed.

A promising avenue for future development may be combining the TAM models with other approaches to user acceptance such as the combination of TAM with the TTF model (Dishaw et al. 2002) and the combination of TAM research and user satisfaction research demonstrated in the integrated model developed by Wixom and Todd (2005). Combining the extensive work in user acceptance and user satisfaction with the smaller body of knowledge on user resistance may prove fruitful land provide avenues of future research.

The IS community, both practitioners and academics, needs to learn more about user acceptance, user resistance, and user satisfaction. Future research should better inform systems designers on the attributes which will make their products easier for users to accept. Opportunities abound for scholars to take new directions in technology acceptance research.

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Chapter 3
A Bibliometric Analysis of Articles Citing the Unified Theory of Acceptance and Use of Technology

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Abstract Despite the relatively recent emergence of the Unified Theory of Acceptance and Use of Technology (UTAUT), the originating article has already been cited by a large number of studies, and hence it appears to have become a popular theoretical choice within the field of information system (IS)/information technology (IT) adoption and diffusion. However, as yet there have been no attempts to analyse the reasons for citing the originating article. Such a systematic review of citations may inform researchers and guide appropriate future use of the theory. This chapter therefore presents the results of a bibliometric analysis and systematic review of 450 citations of the originating article in an attempt to better understand the reasons for citation, and use and adaptations of the theory. Findings revealed that although a large number of studies have cited the originating article since its appearance, only 43 actually utilized the theory or its constructs in their empirical research for examining IS/IT-related issues. This chapter also classifies and discusses these citations and explores the limitations of UTAUT use in existing research.

Keywords Adoption • Diffusion • Bibliometric Analysis • Systematic Review • UTAUT • TAM • Information Systems • Information Technology

Acronyms

IT	Information technology
IS	Information systems
UTAUT	Unified theory of acceptance and use of technology
TAM	Technology acceptance model

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TPB	Theory of planned behaviour
TRA	Theory of reasoned action
MPCU	Model of PC utilization
IDT	Innovation diffusion theory
SCT	Social cognitive theory

3.1 Introduction

The Unified Theory of Acceptance and Use of Technology (UTAUT) was proposed and validated in order to provide a unified theoretical basis to facilitate research on information system (IS)/information technology (IT) adoption and diffusion. The theory postulates that four core constructs, performance expectancy, effort expectancy, social influence and facilitating conditions are direct determinants of IS/IT behavioural intention and ultimately behaviour (Venkatesh et al. 2003). The theory also assumes that the effect of core constructs is moderated by gender, age, experience and voluntariness of use (Venkatesh et al. 2003). The theory was developed through the review, mapping and integration of eight dominant theories and models: the Theory of Reasoned Action (TRA), the Technology Acceptance Model (TAM), the Motivational Model (MM), the Theory of Planned Behaviour (TPB), a combined Theory of Planned Behaviour/Technology Acceptance Model (C-TPB-TAM), the Model of PC Utilization (MPCU), the Innovation Diffusion Theory (IDT), and the Social Cognitive Theory (SCT). These theories and models have been successfully utilized by large number of previous studies of technology and/or innovation adoption and diffusion both within the IS field and other disciplines including marketing, social psychology and management. The motivation to define and validate the UTAUT was based on the argument that many of the constructs of existing theories are similar in nature; therefore, it was logical to map and integrate them to create a unified theoretical basis (Venkatesh et al. 2003). By doing so, creators of the UTAUT hoped that the future studies would need not to search, collate and integrate constructs from numerous different models but instead could just apply UTAUT to gain an understanding of a variety of problems related to IS/IT adoption and diffusion.

Prior to the existence of the UTAUT, TAM was the most widely utilized theory to study IS/IT adoption within the IS discipline (Dwivedi et al. 2008; Williams et al. 2009; Venkatesh et al. 2003). During its 20 years of existence, TAM has been utilized by a large number studies across various business- and management-related disciplines. The constant use of TAM attracted the efforts of numerous researchers in analysing trends and patterns of use, and illustrating actual performance by employing systematic reviews and the meta-analysis approach. Example of such efforts includes Lee et al. (2003), Legris et al. (2003) and King and He (2006). A similar analysis has also been conducted to illustrate patterns and trends of employing the TPB (Hardeman et al. 2002). As mentioned above, although, the original UTAUT article has been cited by a large number of authors within a short period of time, there has been no attempt thus far to analyse and understand the citation pattern. Therefore, in order to determine past and current trends of citation, and to understand the use and adaptation of the theory, it would be useful to conduct a bibliometric analysis and systematic review of articles that have cited Venkatesh et al.'s original UTAUT article. Note that hereafter, the work of Venkatesh et al. (2003) is referred to as "the originating article".

Given the above discussion, this chapter aims to present a citation analysis and systematic review of citations of the originating article of the UTAUT in order to illustrate the reasons for citation, and reveal variations in use and theoretical advancement. The overall aim of this study is achieved by the following objectives:

1. Identify articles that have either cited the orginating article or have utilized UTAUT (or its constructs) as a theoretical basis to conduct empirical research.
2. Classify citations in different categories based on the type of use (i.e. whether they cited the originating article but did not use the theory, partially used the theory or fully used UTAUT).
3. Identify any trends in terms of IS research topics and types of IS examined.
4. Identify any trends on methodological practice (such as research methods employed, types of users, sample size and analysis technique) related to the use of UTAUT.
5. Conduct theoretical analysis to examine the external variables, theories and their relationships with the UTAUT.

The remaining sections of this chapter are organized as follows. The following section outlines the method utilized to undertake the analysis presented in this chapter. The findings are then presented in Sect. 3 and discussed in Sect. 4. Finally, the salient points of the analysis are summarized in Sect. 5 which also presents the limitations and future research directions arising from this study.

3.2 Methodology

A combination of citation analysis and systematic review (Lee et al. 2003; Legris et al. 2003) was considered an appropriate research method to accomplish the aim of this research. A total of 870 citations of UTAUT's originating article were identified by employing the academic journals database provided by the Thomson Scientific Web of Sciences product®. The database was used to extract demographic data (including author's name, journal and year of publication) related to all cited studies. These citations were then screened for availability as full articles in the Swansea University library and of the 870 citations; full articles were downloaded for 450. These were then systematically reviewed to categorize them as follows; those that did not utilize the theory but just cited the originating article (407); those that used UTAUT by employing non-quantitative methods (16); those that made use of a few of the UTAUT constructs (12); those that made full use of UTAUT, examining all core constructs (16).

Following the approach of Dwivedi et al. (2008, 2009), in order to explore the topics most frequently examined using UTAUT, keywords for 870 studies citing the originating article and the 43 studies (of the 450 mentioned above) that used UTAUT were collected. These were then sorted in decreasing order of frequency in order to explore the most frequently occurring keywords. Similarly, types of IS examined were identified from the 43 studies and following similar previous studies of this type (for example, Lee et al. 2003; Legris et al. 2003) classified broadly into four categories: communication systems, general-purpose systems, office systems and specialized business systems. Type of data collection approach employed, research methods and the corresponding statistical analysis for 43 studies were also recorded in line with the study of Lee et al. (2003) on the use of TAM. Also, following Lee et al. (2003), user types (from whom data were collected) for the 43 studies classified into three groups: students (10), professionals (13) and general users (19). Our study also examined the sample size of all 43 studies using UTAUT, and analysed external variables, theories and models that were adopted or adapted, thus following the approach of Legris et al. (2003).

3.3 Findings

3.3.1 Demographic Data: Citations by Year

Our findings in Table 3.1 indicate that citations of the originating article have constantly increased since 2004. The trend appears to be ongoing, as at the time of writing in mid-2010, 128 papers have already cited the originating theory. Table 3.1 suggests that the originating article has quickly gained acceptance and popularity amongst IS/IT researchers. Therefore, it would be interesting and useful to explore the reasons for and nature of its citations. The analyses and findings presented hereafter attempt to throw light on such issues.

3.3.2 Demographic Data: Citations by Journal/Source

Table 3.2 lists journals or conferences where citations of the originating article have most frequently appeared. The table shows *MIS Quarterly* as the leading journal with the largest number of citations ($C=36$) followed by *Lecture Notes on Computer Science* as the second most published outlets with 30 publications, followed by other leading journals such as: *Information & Management* (28 citations), *Computer*

Table 3.1 Citations by year

Publication year	Count ($N=870$)	%
2010	128	14.71
2009	228	26.21
2008	214	24.60
2007	141	16.21
2006	91	10.46
2005	62	7.13
2004	6	0.69

Table 3.2 Sources with significant citation count (Approach adapted from Dwivedi et al. (2009))

Journal/Source	Count ($N=870$)	%
MIS Quarterly	36	4.14
Lecture Notes in Computer Science	30	3.45
Information & Management	28	3.22
Computers in Human Behavior	27	3.10
European Journal of Information Systems	27	3.10
Journal of Computer Information Systems	22	2.53
Journal of the American Society for Information Science and Technology	17	1.95
International Federation for Information Processing	16	1.84
International Journal of Human-Computer Studies	16	1.84
Computers & Education	14	1.61
Journal of The Association For Information Systems	14	1.61
Information Systems Research	13	1.49
Decision Support Systems	12	1.38
IEEE Transactions on Engineering Management	11	1.26
Journal of Information Technology	10	1.15

Table 3.3 Most cited citations

Study	Number of citations
Wixom and Todd (2005)	122
Jasperson et al. (2005)	95
King and He (2006)	61
Carter and Bélanger (2005)	60
Petter et al. (2007)	56
Malhotra et al. (2006)	52
Kim and Malhotra (2005)	49
Sun and Zhang (2006)	46
Lu et al. (2005)	46
Brown and Venkatesh (2005)	46

in Human Behavior (27 citations), *European Journal of Information Systems* (27 citations), and *Journal of Computer Information Systems* (22 citations).

Table 3.2 lists sources with a minimum 10 publications citing UTAUT, two of the journals listed are based in Europe and the remaining 13 in North America.

3.3.3 Demographic Data: Most Cited Citations

Table 3.3 lists ten articles that cited the originating article and then became widely cited in themselves, Wixom and Todd (2005) is the most cited, being referred to by 122 subsequent articles, followed by Jasperson et al. (2005), King and He (2006) and Carter and Bélanger (2005). Interestingly, although the studies listed in Table 3.3 have been frequently referred to by researchers working in this field, none of them actually utilized the UTAUT model in their studies.

Table 3.4 Categories of studies with no actual use of UTAUT

Description	# of studies	Sample references
Category 1: Reference to evolution of adoption and diffusion theories for undertaking IS research	155	Al-Natour and Benbasat (2009), Al-Senaidi et al. (2009), Ke et al. (2006), Kim et al. (2010), Komiak and Benbasat (2006)
Category 2: UTAUT as a dominant theory of adoption and diffusion research	12	Adriaanse et al. (2010), Brandtzaeg and Heim (2009), Chang (2008), Dinev et al. (2008)
Category 3: Comparison of constructs or moderators	62	Green et al. (2005), Gumussoy and Calisir (2009), Lai and Pires (2009)
Category 4: Basis for developing a conceptual model	20	Aggelidis and Chatzoglou (2009), Akesson and Eriksson (2007), Lean et al. (2009)
Category 5: Supporting findings of studies with UTAUT	28	Ahmad et al. (2010), Andreatta et al. (2010), Gu et al. (2009)
Category 6: Brief generic reference of Venkatesh et al. about technology adoption	35	Angst and Agarwal (2009), Lai and Chen (2009)
Category 7: Justification for application of UTAUT in various contexts	19	Arbaugh et al. (2009), Shin (2009)
Category 8: Criticism of TAM or UTAUT	14	Benbasat and Barki (2007), Liu and Chen (2009)
Category 9: Others	56	Kwon and Wen (2010), Richard et al. (2007)

3.3.4 Analysis and Systematic Review of Articles Citing the UTAUT Originating Article

Articles citing the UTAUT originating article were categorized broadly into the following four categories.

3.3.4.1 Citations with No Use of UTAUT

Table 3.4 provides further information on the 407 articles which cited UTAUT but did not actually employ it in the investigation described in that article. In Table 3.4, these 407 studies have been further divided into nine more refined categories. Category 1 includes papers which discuss the evolution of adoption and diffusion research in the IS field. For instance, Al-Senaidi et al. (2009) discuss the various theoretical models and their adoption, diffusion and usage within the context of ongoing ICT development. Category 2 consists of studies where UTAUT has been presented as a powerful theory of adoption and diffusion research. For example, Adriaanse et al. (2010) argue that UTAUT is one of the more dominant theories. Category 3 includes papers where UTAUT constructs or moderators are compared with the others or defined and discussed. For instance, Green et al. (2005) and Lai and Pires (2009) discuss constructs of TAM and compare these with the constructs of UTAUT.

Category 4 comprises studies which discuss and evaluate models based on UTAUT – for example, the work of Aggelidis and Chatzoglou (2009). Category 5 consists of studies which support the findings as per UTAUT. For example, Ahmad et al. (2010) find the influence of age in faculty's acceptance of computer-based technology to be consistent with that of UTAUT. Category 6 includes studies which provide a brief generic reference of Venkatesh et al. (2003) in a wider discussion of the acceptance/adoption of technology, while Category 7 contains studies which justify the application of UTAUT in various contexts – for instance, the work of Arbaugh et al. (2009). Articles in Category 8 are those which criticize UTAUT or TAM, while finally, Category 9 incorporates studies which do not readily fall into any of the other eight categories. For instance, Kwon and Wen (2010) cite the originating paper as part of a wider discussion on TAM, and Gumussoy and Calisir (2009) refer to the evolution of UTUAT in discussing their own constructs.

3.3.4.2 Citations with Use of UTAUT with Different Research Methods

This category refers to studies which use UTAUT theory qualitatively or have utilized some statistical data analysis which is not as per the original theory. Qualitative studies may take the form of theoretical studies, case studies or literature reviews. Some of the studies employ qualitative analysis due to the perceived inability of quantitative analysis to meet the purpose of the study, or the sample size may be viewed as being too small to perform the relevant quantitative analysis. Of total 16 studies in this category, 9 are based on qualitative studies whereas 7 are based on quantitative studies but do not provide the relevant statistical measurements as per the original theory. Table 3.5 lists the studies in this category, along with brief explanatory remarks.

3.3.4.3 Citations with Partial Use of UTAUT

This category comprises 12 papers which have partially used UTAUT in their studies but have not employed the complete theory but have used a subset of the original constructs and moderating variables in order to justify their outcomes. Table 3.6 presents details of these papers, along with the UTAUT constructs and moderators used.

3.3.4.4 Citations with Complete Use of UTAUT

This category comprises those studies of the 450 examined which fully utilized UTAUT – Table 3.7 lists these articles along with a summary of their research findings. All 16 studies provide statistical data values for the independent constructs of UTAUT as per the originating theory.

Table 3.5 Studies with alternative research methods

References	Remarks
Baron et al. (2006)	Qualitative research was used to identify subject matter and theoretical concepts from textual data. The approach is reliable with the logical reasoning behind qualitative abduction.
Baumgartner and Green (2008)	Paper presents a case study observing E-Government in a mid-sized European city. The view of the case study is congruent with the theoretical framework of UTAUT.
Carter and Weerakkody (2008)	Relative advantage has replaced performance expectancy but statistical calculations used are not relevant as per the requirement of meta-analysis of UTAUT.
Dadayan and Ferro (2005)	Qualitative data emphasize the significance of context, people and organizational issues in technology use and acceptance. Moreover, qualitative data help to understand the links between the constructs, which may change over time. Although both qualitative and quantitative data have been collected, overall analysis is theoretical.
Debuse et al. (2008)	Statistical measurements of UTAUT constructs are not as per their meta-analysis requirement.
He et al. (2007)	Study reviews the literature on the acceptance of mobile business and attempts to construct an integrated conceptual framework on m-business acceptance – 74 articles on the acceptance of m-business are analysed and outcomes are presented in an integrated research framework.
Koivumaki et al. (2008)	All UTAUT constructs have been used but with different statistical analysis techniques not appropriate for the meta-analysis.
Lee et al. (2007)	Hypotheses are used with performance and effort expectancy and a laboratory experiment is conducted to test the hypotheses. No statistical analysis was conducted.
Li (2010)	Qualitative research was used and the resulting conceptual framework based on UTAUT.
Loo et al. (2009)	All independent constructs of UTAUT have been used except effort expectancy – appropriate required values of statistical analysis were not obtained.
Pappas and Volk (2007)	Study was organized around the constructs Performance expectancy, effort expectancy and social influence of UTAUT using theoretical framework.
van Biljon and Renaud (2008)	A qualitative study of the applicability of technology acceptance models to senior mobile phone users – also compares the qualitative study to the existing quantitative models.
van Setten et al. (2006)	Statistical measurements of UTAUT constructs are not as per the meta-analysis requirement. Framework uses limited version of UTAUT for an Electronic Program Guide (EPG) experiment.
Yang et al. (2008)	Statistically significant outcomes not obtainable due to small sample size.
YenYuen and Yeow (2009)	Statistical measurement used for all constructs but not appropriate as per UTAUT meta-analysis.
Yeow et al. (2008)	UTAUT theory used but appropriate statistical analysis was performed as per the original UTAUT paper.

Table 3.6 Studies with partial use of UTAUT

Constructs	Remarks	References
Social influence, facilitating conditions, behavioural intention	The major factor impacting BI is FC. It is also shown that both FC and SI have positive and direct impact on BI with other factors.	Aggelidis and Chatzoglou (2009)
Facilitating conditions, behavioural intention, usage	The impact of UTAUT constructs is separately evaluated on the dependent variables BI and usage. Impact on usage is determined only through BI and FC.	Duyck et al. (2010)
Performance expectancy, effort expectancy, behavioural intention	Quantitative and qualitative outcomes of study indicate that Retro Guide is a better and favoured technology than SQL for non-expert users. Only Chronbach's alpha was calculated for all three constructs PE, EE and BI and was found in the acceptable range.	Huser et al. (2010)
Performance expectancy, social influence facilitating, conditions, behavioural intention, usage	Final model for student acceptance of web-based learning system is based on PE, SI and FC and its impact on BI and system usage. EE was not included in the final model. Due to limited time for this research the impact of moderators was not discussed.	Jong and Wang (2009)
Effort expectancy, social influence, facilitating conditions, network IT usage intention, network IT usage	PE has not been used as a construct in the empirical analysis of the research model. Social Influence plays a more important role than other constructs in this study.	Lin and Anol (2008)
Performance expectancy, behavioural intention	The concept of PE is supposed to be the most powerful factor for describing intention to use irrespective of the environment. Based on this hypothesis, the study proposes PE to be positively correlated with BI in adoption of mobile banking.	Luo et al. (2010)
Performance expectancy, effort expectancy, digital library adoption intention	Resistance to change (RTC) works as an indirect antecedent to both PE and EE which in turn reveals the intention to adopt digital library technology.	Nov and Ye (2009)
Social influence, behavioural intention, usage	Significance of SI on BI is greatly increased in the extended research model. Results indicate that mobile users care about peers' suggestions when they consider risks related to mobile payment.	Shin (2009)
Facilitating conditions, social influence, learning behaviour	Study posits UTAUT constructs FC and SI are the major drivers of individual's learning behaviour. The hypotheses suggest that SI and FC have positive association with learning behaviour.	Tsai et al. (2009)
Social influence, facilitating conditions, behavioural intention	Proposed model assesses impact of SI and FC on BI – findings conclude that cultural dimensions do impact upon mobile phone acceptance and usage. SI affects the mobile phone adoption as well, which consists of components like human nature and culture.	van Biljon and Kotze (2008)

(continued)

Table 3.6 (continued)

Constructs	Remarks	References
Performance expectancy, effort expectancy, social influence, age, gender	Models for correlation and structural equation model are presented in this study. PE and EE of government Internet services. Results suggest age has the highest correlation with intention to use whereas gender has no such correlation.	van Dijk et al. (2008)
Social influence, switching behaviour	Study argues that an individual's intention to switch from one IT product adoption to a similar one is determined by individual's social setting. That can be achieved by social influence factor.	Ye et al. (2008)

3.3.5 IS Research Topics and Types of IS Examined

This section presents the results of our keyword analysis. Following the work of Lee et al. (2003) it divides the studies considered broadly into four specific IS categories: communication systems, general-purpose systems, office systems and specialized business systems in order to analyse the most extensively investigated target technology in UTAUT studies. In addition, the following subsection presents the keyword analysis of all 870 studies including the 43 papers which used UTAUT theory either in qualitative or quantitative form.

3.3.5.1 Keyword Analysis

Table 3.8 illustrates the most frequently used keywords from all 870 studies which have cited or used all or part of UTAUT. The table reveals that 28 keywords/combinations have been used six or more times.

Our findings indicate that the keywords "Technology acceptance model"/"TAM" are most used, appearing 63 times, followed by the keywords "Technology acceptance"/"Technology adoption", being used in 52 studies, with "Adoption"/"Acceptance" appearing in 32 studies. The keywords "UTAUT"/"Unified Theory of Access and Use of Technology" were used in 12 studies. A further 13 keywords – "Culture", "Gender", "Habit", "Household", "Individual differences", "Measurement", "Mobile and Services", "Pre-service teachers", "Social Influence", "System Usage", "System use", "Task-technology fit", "Technology diffusion" are used in four studies. In total, 1,868 keywords were identified, divided into 1,259 different categories for all 870 studies. Table 3.8 illustrates 368 of these keywords, distributed among 28 categories.

Table 3.9 illustrates the keywords of the 43 studies that have utilized UTAUT qualitatively or statistically. Our analysis reveals that the keywords/combinations "UTAUT", "Unified Theory of Acceptance and Use of Technology (UTAUT)" have been used in one form or another in 13 studies, followed by "E-Government",

Table 3.7 Studies with complete use of UTAUT (Approach adapted from Legris et al. (2003))

References	Findings
Abu-Shanab and Pearson (2009)	Findings indicate that most research is conducted in the Middle East using Arabic research Instruments and the translation process can impact the instrument used – better testing of backward translation methods will produce better outcomes – an important contribution of this study is the establishment of a well-tested Arabic instrument in the field of technology acceptance.
Al-Gahtani et al. (2007)	Performance expectancy has a positive effect on intention as suggested by Venkatesh et al. (2003) – there is no interacting effect with performance and either of gender or age on intention – effort expectancy did not have a positive impact on intention in the presence of moderating variables. Results indicate that subjective norm positively influences intention among Saudi users but this impact is reduced with increasing age and experience.
Alapetite et al. (2009)	Findings demonstrate that the participating physicians tended to hold a more negative view of the speech recognition system studied after using it than before. Physicians believe that the use of the technology increases the time required to produce medical records.
Chang et al. (2007)	Findings backed up the importance of the effect of performance and effort expectancy on usage intention and its impact on its actual use – minimum support was found for the impact of social influence on use intention, actual utilization and facilitating conditions. Study reveals interesting issues relating to physicians' expectations of computer applications in the health-care industry and makes recommendations for successful implementation of Clinical Development Support Systems.
Chiu et al. (2010)	Findings indicate that trust remains an important but weak predictor of the repeated online buying intentions.
Chiu and Wang (2008)	Performance expectancy and utility have the same impact on the ongoing intention of the users with restricted time for familiarization.
Curtis et al. (2010)	Findings indicate that females consider social media to be advantageous whereas males show more confidence in actively using social media. Firms with appropriate public relations departments more likely to adopt social media for business use – positive correlation between UTAUT constructs and credibility indicates the potential of greater use of social media.
Duyck et al. (2010)	Questionnaires were taken pre-implementation (T1) and 1 year after a radiology department stopped using film (T2). Main findings were that both groups were optimistic about a picture archiving and communication system (PACS) before the introduction and became more positive following implementation.
Gupta et al. (2008)	Findings from India support existing literature on the subject matter that states that social influence has considerable effect on behavioural intention – findings also support UTAUT results that suggest facilitating conditions to be a significant factor in system use, and demonstrates that performance expectancy, effort expectancy, social influence have a positive impact on intention to use technology whereas facilitating conditions influence actual use in a government organization.

(continued)

Table 3.7 (continued)

References	Findings
Hung et al. (2007)	Study explores the key factors of user acceptance of information kiosks – findings support the hypotheses that performance expectancy, effort expectancy and social influence have a positive impact on behavioural intention towards the kiosks.
Kijsanayotin et al. (2009)	Findings demonstrate a positive impact of facilitating conditions, experience and intention to use health IT facilities in a developing country context.
Laumer et al. (2010)	Performance expectancy, facilitating conditions and subjective norms are important antecedents for intention to use an E-Recruiting system. Findings indicate that it might be useful to control adoption research for different peer groups and the differentiating effect of subjective norm on adoption.
Sapio et al. (2010)	A study of T-Government services revealed that the facilities provided are perceived to be adequate for the residential population.
Schaupp et al. (2010)	The study suggests optimism bias is a significant factor in E-Government diffusion – findings also expose the need for further exploration of E-Government diffusion issues within the adoption decision-making process.
Wang and Shih (2009)	Outcomes partially support the use of UTAUT within the context of a study of information kiosks – findings offer various implications for research and practice of kiosk development and implementation.
Zhou et al. (2010)	Findings indicate that performance expectancy, task-technology fit, social influence and facilitating conditions have significant impacts on user adoption. The study also revealed the significant impact of task-technology fit on performance expectancy.

Table 3.8 Most frequently used keywords

Keywords	Freq	Keywords	Freq
Technology acceptance model (48)/ TAM (15)	63	Consumer behaviour	8
Technology acceptance (38)/Technology adoption (14)	52	E-Commerce	8
Adoption (26)/Acceptance (6)	32	Information systems	8
Trust	17	Perceived risk	8
Electronic commerce	13	Self-efficacy	7
Perceived usefulness	13	Subjective norm	7
E-Government	12	User acceptance	7
UTAUT (7)/ Unified Theory of Access and Use of Technology (5)	12	Evaluation	6
Attitude (6)/Attitudes (5)	11	Information technology	6
Structural equation modelling	11	Partial least squares	6
Theory of planned behaviour	11	Perceived ease of use	6
E-Learning	9	Privacy	6
Internet	9	Survey research	6
Satisfaction	9	User satisfaction	6

Table 3.9 Most frequently used keywords from papers using UTAUT

Keywords	Freq	Keywords	Freq
UTAUT (7)/Unified Theory of Acceptance and Use of Technology (UTAUT) (6)	13	Internet (1)/Internet use (1)	2
E-Government (4)/E-Government Service (1)/Electronic Government (1)	6	Internet banking	2
Technology acceptance	6	Mobile	2
Technology acceptance model	4	Mobile banking	2
IT adoption (2)/ICT adoption (1)	3	Partial least square	2
Structural equation modelling	3	Perceived credibility	2
Trust	3	Perceived risk	2
User acceptance (2)/consumer/user acceptance (1)	3	Perceived usefulness	2
Acceptance of technology (1)/acceptance of information technology (1)	2	Performance expectancy	2
Adoption	2	Pre-service teachers	2
E-Commerce	2	Subjective norm	2
Evaluation	2	Usability	2
Information kiosks	2	UTAUT model	2
Intention to use (1)/intention of use (1)	2	Web-based learning	2

"E-Government service" and "Electronic Government", being used in six studies. There are 20 keywords which have been used in two studies each.

3.3.5.2 Types of IS Investigated

Table 3.10 illustrates the 43 different types of IS investigated across the following four major categories adapted from Lee et al. (2003): communication systems, general-purpose systems, office systems and specialized business systems. According to Lee et al. (2003), communication systems comprise e-mail, voice mail, fax, dial-up systems and other systems largely utilized for communications. General-purpose systems incorporate Windows, PCs, micro-computers, workstations, the Internet and other computer facilities. Office systems involve the most commonly applied technologies in the office systems group. Specialized business systems refer to special purpose and in-house developed systems. Case tools and expert systems are examples of this category (Lee et al. 2003).

In our study, 14 of the 43 systems studied fell within the communications category, 13 in the general-purpose category, 1 in office systems and the remaining 15 in the specialized business category.

3.3.6 Methodological Analysis

The methodological analysis aims to explore the research methods employed, categorize users into specific groups and examine sample sizes.

Table 3.10 Summary of information systems used investigated in UTAUT studies

Usage type	# of IS	IS in each category	Sample references
Communication systems	14	Mobile banking (2)	Zhou et al. (2010), Luo et al. (2010)
		Wallet (1)	Shin (2009)
		Phone (2)	van Biljon and Kotze (2008), van Biljon and Renaud (2008)
		Text messaging (1)	Baron et al. (2006)
		Business (1)	He et al. (2007)
		Services (1)	Koivumaki et al. (2008)
		E-File (1)	Schaupp et al. (2010)
		Electronic/Digital TV (2)	Sapio et al. (2010), van Setten et al. (2006)
		Information Kiosks (1)	Wang and Shih (2009)
		Digital library (1)	Nov and Ye (2009)
		Automated feedback system (1)	Debuse et al. (2008)
General purpose system	13	Internet/online banking (3)	Abu-Shanab and Pearson (2009), YenYuen and Yeow (2009), Yeow et al. (2008)
		E-Government adoption/services (2)	Carter and Weerakkody (2008), Hung et al. (2007)
		Network IT (1)	Lin and Anol (2008)
		Web-based learning (1)	Chiu and Wang (2008)
		E-Recruitment (1)	Laumer et al. (2010)
		Government Internet services (1)	van Dijk et al. (2008)
		Service oriented computing (1)	Baumgartner and Green (2008)
		Internet technology (1)	Gupta et al. (2008)
		Online auction (1)	Chiu et al. (2010)
		Smart card application (1)	Loo et al. (2009)
Office systems	1	Desktop computer application	Al-Gahtani et al. (2007)
Specialized business systems	15	Health/Hospital IT (2)	Aggelidis and Chatzoglou (2009), Kijsanayotin et al. (2009)
		PACS implementation system (1)	Duyck et al. (2010)
		Speech recognition system (1)	Alapetite et al. (2009)
		Clinical decision support system (1)	Chang et al. (2007)
		EHS query (1)	Huser et al. (2010)
		Others (9)	Lee et al. (2007), Li (2010)

3.3.6.1 Research Methods

Of the 43 papers presenting research employing UTAUT, 5 were longitudinal studies, for instance, Alapetite et al. (2009), Dadayan and Ferro (2005), Duyck et al. (2010), Pappas and Volk (2007) and Shin (2009) whereas the remaining 38 papers chose cross-sectional approaches – for example, Abu-Shanab and Pearson (2009), Al-Gahtani et al. (2007), Huser et al. (2010), Jong and Wang (2009) and Lin and Anol (2008) to name a few.

Table 3.11 Research methods used

Research method	Sample references
Survey (27)	Al-Gahtani et al. (2007), Curtis et al. (2010)
Questionnaire (11)	Hung et al. (2007), Duyck et al. (2010)
Interview (8)	Li (2010), Baron et al. (2006)
Field Study (3)	Abu-Shanab and Pearson (2009), Chang et al. (2007), Koivumaki et al. (2008)
Case Study (1)	Baumgartner and Green (2008)
Lab Experiment (1)	Lee et al. (2007)

Table 3.12 Analysis methods used across studies (Approach adapted from Lee et al. (2003))

Analysis technique	Sample references
Regression (8)	Duyck et al. (2010), Jong and Wang (2009)
Partial least square (7)	Chiu et al. (2010), Gupta et al. (2008)
Structural equation modelling (7)	Al-Gahtani et al. (2007), Chang et al. (2007)
Confirmatory factor analysis (6)	Carter and Weerakkody (2008), Chiu and Wang (2008)
Factor analysis (5)	Curtis et al. (2010), Yeow et al. (2008)
Qualitative data analysis (4)	Baron et al. (2006), Baumgartner and Green (2008)
Path analysis (2)	Schaupp et al. (2010), Zhou et al. (2010)
Structural modelling (2)	Aggelidis and Chatzoglou (2009), Chiu et al. (2010)
Others (13)	Huser et al. (2010), van Dijk et al. (2008)

Table 3.13 Summary of user types (Approach adapted from Lee et al. 2003)

User type	# of studies for each type	Sample references
General users	19	Baron et al. (2006), Sapio et al. (2010)
Professionals	13	Al-Gahtani et al. (2007), Chang et al. (2007)
Students	10	Chiu and Wang (2008), Laumer et al. (2010)
Other	1	He et al. (2007)
Total	43	

In terms of research methods used, Table 3.11 illustrates that a majority of studies used surveys, questionnaires and interviews. However, a small number of studies employed field study, case study and lab experiment approaches.

With regard to the analyses of methodologies, 33 studies used linear or multivariate regression techniques, Partial Least Square (PLS), Structured Equation Modelling (SEM), Confirmatory Factor Analysis (CFA) or Factor Analysis (FA) for statistically analysing data. Other analysis techniques used include meta-analysis, flowchart-based analysis and descriptive statistics, to name a few. Details along with sample references are provided in Table 3.12.

3.3.6.2 Types of Users

Table 3.13 illustrates the type of users in all 43 studies which employed UTAUT. It can be seen that general users form the largest group, followed by professionals and students. One study is essentially a meta-analysis of acceptance of mobile-business

Table 3.14 Sample sizes

References	Sample size	References	Sample size
van Dijk et al. (2008)	1,225	Koivumaki et al. (2008)	243
Kijsanayotin et al. (2009)	1,187	Hung et al. (2007)	233
Abu-Shanab and Pearson (2009)	878	Yeow et al. (2008)	190
Tsai (2009)	759	Sapio et al. (2010)	181
Al-Gahtani et al. (2007)	722	Chang et al. (2007)	140
Jong and Wang (2009)	606	Luo et al. (2010)	122
Chiu et al. (2010)	412	Yang et al. (2008)	116
Curtis et al. (2010)	409	Baron et al. (2006)	113
Duyck et al. (2010)	362	van Setten et al. (2006)	109
Aggelidis and Chatzoglou (2009)	341	Gupta et al. (2008)	102
Lin and Anol (2008)	317	He et al. (2007)	74
Ye et al. (2008)	306	van Biljon and Kotze (2008)	57
YenYuen and Yeow (2009)	300	Lee et al. (2007)	54
Shin (2009)	296	Loo et al. (2009)	50
Chiu and Wang (2008)	286	Li (2010)	41
Nov and Ye (2009)	271	Alapetite et al. (2009)	39
Carter and Weerakkody (2008)	260	van Biljon and Renaud (2008)	34
Schaupp et al. (2010)	260	Pappas and Volk (2007)	27
Laumer et al. (2010)	255	Huser et al. (2010)	18
Zhou et al. (2010)	250	Baumgartner and Green (2008)	8
Wang and Shih (2009)	244	Debuse et al. (2008)	8

and so does not fall readily into any of these three categories and so is classified as "Other". General users are mainly consumers or citizens.

Students are generally divided as being undergraduate or postgraduate, while professionals are those who work in organizations occupying roles such as knowledge workers, IT professionals and physicians among many others.

3.3.6.3 Sample Size

Table 3.14 illustrates the sample sizes of the 42 studies that used UTAUT. Two studies by Duyck et al. (2010) and Laumer et al. (2010) have used more than one representative sample to present and compare cases in different scenarios.

3.3.7 Theoretical Analysis

The aim of this aspect of our analysis is to identify external variables, external theories and the relationship of external variables with the independent and dependent constructs of UTAUT for all 43 studies using UTAUT.

Table 3.15 Summary of external variables

References	External variables
Abu-Shanab and Pearson (2009)	Self-efficacy, anxiety, perceived trust, perceived risk, personal innovativeness, locus of control
Aggelidis and Chatzoglou (2009)	Attitude, self-efficacy, anxiety, perceived usefulness, ease of use, training
Chiu et al. (2010)	Trust, past transactions, gender, age, internet experience
Chiu and Wang (2008)	Computer self-efficacy, attainment value, utility value, intrinsic value (playfulness), social isolation, anxiety, delay in responses, risk of arbitrary learning
Curtis et al. (2010)	Voluntariness of use, anxiety, self-efficacy
Dadayan and Ferro (2005)	Compatibility, computer anxiety, computer attitude, acceptance motivation, organizational facilitation
He et al. (2007)	Individual innovativeness, compatibility, task-technology fit
Jong and Wang (2009)	Attitude, self-efficacy, anxiety
Kijsanayotin et al. (2009)	Voluntariness, experience, knowledge
Laumer et al. (2010)	Subjective norm, objective norm
Lin and Anol (2008)	Online support expectancy, online social support
Loo et al. (2009)	Perceived credibility, anxiety
Luo et al. (2010)	Trust belief, perceived risk, self-efficacy, disposition to trust
Nov and Ye (2009)	Result demonstrability, computer self-efficacy, computer anxiety, resistance to change, screen design, relevance, terminology
Schaupp et al. (2010)	Optimism bias, trust of E-File system, perceived risk
Shin (2009)	Trust, self-efficacy, perceived security
van Biljon and Kotze (2008)	PEOU, PU, human nature influence, and cultural influence demographic factors, socio-economic factors and personal factors
van Dijk et al. (2008)	Age, gender, educational level, societal position, family position, digital media preference, digital media access, digital media experience, attitude towards use, knowledge of services
Ye et al. (2008)	Computer self-efficacy, risk aversion, social influences, breadth of use, satisfaction, relative advantage, PEOU, perceived security
YenYuen and Yeow (2009)	Perceived credibility, anxiety, self-efficacy, attitude towards using IBS
Yeow et al. (2008)	Perceived credibility, anxiety, self-efficacy, attitude towards using OBS
Zhou et al. (2010)	Task-technology fit

3.3.7.1 External Variables Analysis

The findings from our external variables analysis reveal that only 22 out of 43 studies have used external variables in their investigations. The remaining 21 used only the original constructs of UTAUT. Although age, gender, experience and voluntariness of use are moderating variables in the original UTAUT (Venkatesh et al. 2003), these moderators are treated as external constructs in some of the studies. Attitude, anxiety, trust, self-efficacy, perceived ease of use (PEOU), perceived usefulness (PU), perceived risk and perceived credibility are some of the most common external variables employed. Studies which did not use external variables indicated that they were applying the original theory without altering it to achieve their objectives. Table 3.15 lists only those studies which used external variables.

Table 3.16 Summary of external theories

References	External theory
Aggelidis and Chatzoglou (2009)	TAM, TAM2
Baron et al. (2006)	TAM
He et al. (2007)	IDT, TTF
Tsai (2009)	SCT
van Biljon and Kotze (2008)	TAM
van Biljon and Renaud (2008)	TAM
Zhou et al. (2010)	TTF

TAM, technology acceptance model; *IDT*, innovation diffusion theory; *TTF*, task-technology fit; *SCT*, social cognitive theory

3.3.7.2 External Theories Analysis

Table 3.16 lists the 7 out of the 43 UTAUT-based studies which used external theories in their research model analyses. Our analysis reveals that TAM is the most frequently used theory alongside UTAUT – being utilized on four occasions, followed by Task-Technology Fit (TTF) twice, and one instance each of Innovation Diffusion Theory (IDT) and Social Cognitive Theory (SCT).

3.3.7.3 Relationships of External Variables with UTAUT Constructs

Figure 3.1 illustrates the accumulated impacts (collected from all 43 studies) of all of the external variables on the different independent and dependent constructs of UTAUT, along with their levels of significance.

Our analysis indicates that attainment value, utility value, trust, attitude, perceived ease of use, perceived usefulness, computer self-efficacy, gender, perceived risk, income and experience have a significant impact on behavioural intention (BI). However, anxiety, training, age, perceived credibility and social isolation do not have a significant impact and self-efficacy, subjective norm and objective norm have mixed influence. Furthermore, trust, belief and credibility have a significant and mixed impact on performance expectancy (PE). Similarly, computer anxiety, computer self-efficacy, resistance to change and relevance have positive impact while credibility has a non-significant impact on effort expectancy (EE). Conversely, social influence (SI) is negatively impacted by credibility. Nevertheless, IT knowledge has a positive impact on facilitating conditions (FC). As far as intention to use or usage (U) is concerned, it is impacted positively by variables task-technology fit and experience but impacted insignificantly by trust and Internet experience. Apart from these external constructs, income has been shown as a positive moderating variable on BI.

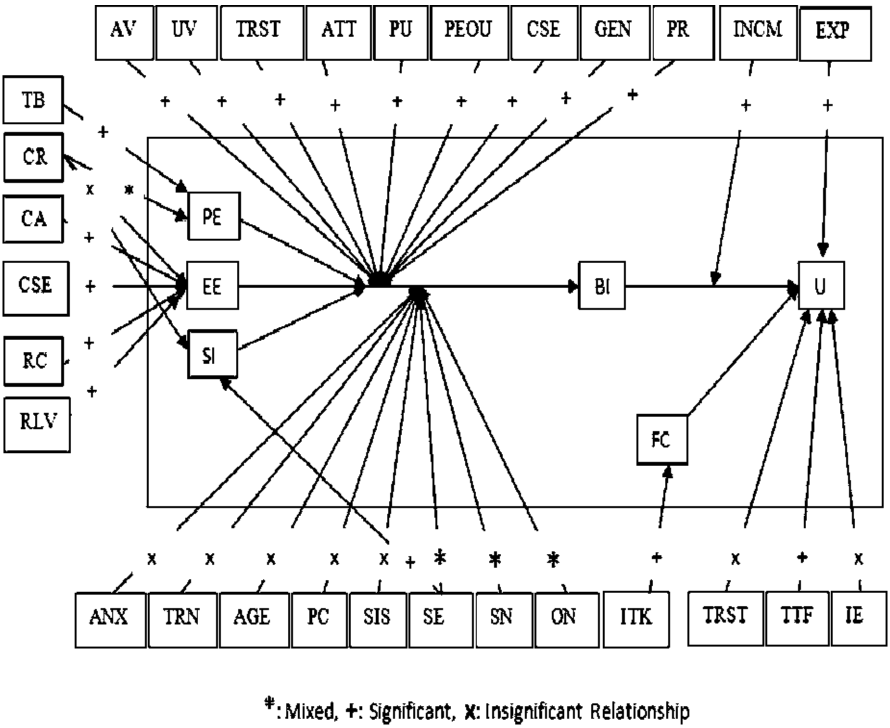

Fig. 3.1 Relationships between external variables and major UTAUT variables
ANX, anxiety; *ATT*, attitude; *AV*, attainment value; *CA*, computer anxiety; *CR*, credibility; *CSE*, computer self-efficacy; *EXP*, experience; *GEN*, gender; *IE*, internet experience; *ITK*, IT knowledge; *ON*, objective norm; *PC*, perceived credibility; *PEOU*, perceived ease of use; *PR*, perceived risk; *PU*, perceived usefulness; *RC*, resistance to change; *RLV*, relevance; *SE*, self-efficacy; *SIS*, social isolation; *SN*, subjective norm; *TB*, trust belief; *TRN*, training; *TRST*, trust; *TTF*, task technology fit; *UV*, utility value

3.4 Discussion

An examination of the authors who have most often cited the originating article reveals little surprise in that the author with the highest number of citing articles is Venkatesh, one of the original developers of UTAUT. Lee et al.'s (2003) study on TAM also revealed Venkatesh to be the leading figure in this respect, thus implying that he shifted focus somewhat from TAM to UTAUT during the interim period – indeed TAM is one of the eight UTAUT contributing models. Although the 872 citations of UTAUT to date indicates that a large number of other authors also refer to the theory, the initial upward trend in terms of annual increases of numbers of citation is lessening somewhat – for instance, there was a comparatively lesser proportion of growth in 2009 than in 2008. The 872 citations appeared in a wide range of journals across numerous subject areas, including behavioural science, health science, management science and decision science, and have been applied in various technological contexts, indicating that the theory has attracted interest beyond its early IS/IT origins. In terms of the perceived influence and impact of these 872 citations, Wixom and Todd's (2005) paper has been cited the largest number of times (122), possibly due to its generic nature and its efforts to link UTAUT with user satisfaction. The lower citation counts for the other citing articles may be due to the more specific nature – for instance, Brown and Venkatesh (2005) examined the adoption of technology in the household context.

A study of the many papers which cited the UTAUT article but did not use the theory reveals that the majority of such papers provide a brief outline of the theory within the context of a broad discussion on the evolution of adoption and diffusion theories for IS research, often before focusing on the model actually used in the research described. Future researchers should therefore be aware that despite the apparently high numbers of citations, the level of actual UTAUT use in practice is somewhat lower than the citation level may suggest. A total of 16 studies made use of UTAUT either qualitatively or with a statistical method that differed from that discussed in the article presenting the original theory, thus raising the possibility that the original model may not have suited all circumstances and alternate research methods were required. A total of 12 papers reported studies which made partial use of UTAUT or altered the theory to suit, but it is noteworthy that of the total number of articles that report the use of UTAUT, only 3.6% (16) report the full use of the theory. Thus, despite the large number of citations, only a relatively small number of articles report the research work that has actually made use of the theory, and of these, a low percentage have made full use of the theory.

Our analysis of the keywords reveals a total of 1,868 keywords being used across 870 studies, and of these, 1,043 appeared only once. Of the studies that actually made use of UTAUT, 207 keywords were used, with 134 appearing once only. The implication here is that some areas receive less investigative attention than others, and there is currently clear scope for further original work in areas attracting relatively little interest.

In terms of systems investigated, it is interesting to note that in the work of Lee et al. (2003), office systems were reported as being the focus of research in 27% of the papers examined, whereas our study revealed that only 2.3% (1) of UTUAT investigations examined office systems – suggesting that office systems are now widely used and accepted, and are not viewed as being particularly new in most organizational environments.

There is a clear imbalance between the use of longitudinal and cross-sectional approaches, most studies being cross-sectional in nature, and thus our results in this aspect are entirely aligned with those of Lee et al.'s (2003) study on TAM. This is not particularly unexpected, given that these studies have taken place in the relatively short period of time since the model emerged, and therefore, there would be less opportunity to conduct and publish the results of longitudinal work at this time. Surveys, questionnaires and interviews are the most frequently employed data collection instruments in UTAUT research. This contrasts somewhat with the work of Lee et al. (2003) who reveal that field studies are widespread in TAM investigations, but are not particularly predominant in UTAUT work. Regression and PLS are the leading analysis methods found both in our UTAUT study and Lee et al.'s TAM study. Almost 25% of UTAUT studies examined made use of students rather than other types of users. Clearly this will be due to convenience in most cases; however, we should keep the comments of Dwivedi et al. (2008) in mind, who cautioned readers to consider such works carefully, particularly in respects to external validity and the implications of the regular use of such samples in contrast to "real world" users.

Our analysis of sample sizes raises some concerns in that over 25% of the 38 studies using UTAUT appear to be reporting results based on limited samples. While some sample sizes are undoubtedly impressive (for instance, a number of papers reported studies with nearing or above 1,000 respondents), there are numerous examples at the other end of the spectrum and clearly this has implications for levels external validity. Given the low amount of published work that used UTAUT in its intended form, there remains much scope for researches to conduct original work with appropriate levels of external validity. Our results revealed that UTAUT constructs are impacted upon by many external variables across different studies. A similar pattern was shown by Lee et al. (2003) in relation to TAM. This is a relatively surprising outcome as UTAUT purports to be a unified theory, being created by the mapping together of numerous variables from eight established theories and models. This suggests that further work may be needed on the selection processes when integrating constructs from other theories.

3.5 Conclusion

The following salient points emerged from the findings and discussion presented in our study:

- Although citations for the UTAUT originating article have constantly increased since its publication in 2003, the trend now appears to be lessening.
- The majority of articles that cited UTAUT have done so as a basis for supporting an argument, or for criticizing the theory, rather than actually using the theory.
- Many studies reported as using UTAUT actually made only partial use of it, often utilizing only a small number of constructs.
- A number of citing articles (16) made use of UTAUT with all constructs but without considering the use of moderating factors.
- Keyword analysis revealed that the most often used keywords in papers that cited the originating article were in fact "Technology Acceptance Model", "TAM", "technology acceptance", "technology adoption", "adoption" and "acceptance", thus suggesting that many studies may refer to UTAUT while continuing to use TAM as a theoretical basis.

- Many studies that actually used UTAUT (rather than merely referring to it in passing) also made use of keywords such as "E-Government" and "Electronic Government", indicating that UTAUT is often used in the domain of electronic government.
- Cross-sectional studies were the most common form of investigation, with surveys, questionnaires and interviews being the most widely used research methods. Commonly used analysis techniques were regression, partial least squares, structural equation modelling and confirmatory factor analysis.
- General users and professionals were two major categories of users from whom data were collected. Although student samples are often considered less reliable, almost 25% of the total number of studies used student data.
- A number of empirical studies that utilized UTAUT were based on relatively low sample sizes.
- There appears to be an increasing trend of using external variables and external theories together with UTAUT.

It is suggested that the study presented in this chapter is relevant in that UTAUT provides a useful tool by which to evaluate the potential for success of new technology initiation, and helps identify factors likely to influence adoption of technology. Our systematic review of UTAUT citation contributes to the area of IS/IT adoption and diffusion research highlighting various issues, including identifying trends in terms of popular and underemployed approaches. Clearly, this is an additional work to be carried out, particularly in respect to analysing new studies that actually make use of UTAUT rather than merely citing it in passing.

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Chapter 4
Why Do People Reject Technologies: A Review of User Resistance Theories

Sven Laumer and Andreas Eckhardt

Abstract Information systems (IS) research has offered rich insights into why people use technologies but has given much less attention to the question why individuals resist or reject technologies, and which factors inhibit or discourage usage (Cenfetelli 2004; Lapointe and Rivard 2005; Kim and Kankanhalli 2009). This chapter, hence, provides a literature review over those theories and models used in IS research to explain user resistance. Lapointe and Rivard (2005) have identified only four articles until 2004 that open the black box of resistance and provide theoretical explanations of how and why resistance occurs (Markus 1983; Joshi 1991; Marakas and Hornik 1996; Martinko et al. 1996). Since then, four more articles on user resistance behaviors have been published in AIS Senior Basket Journals (Cenfetelli 2004; Bhattacherjee and Hikmet 2007; Eckhardt et al. 2009; Kim and Kankanhalli 2009). This chapter illustrates these nine theories and models and concludes that IS research still lacks a unified theory of user resistance.

Keywords User Resistance • Technology Rejection • Non-Adoption • IS Implementation

Abbreviations

IS	Information systems
IT	Information technology
P–A	Passive–aggressive
PRM	Passive resistance misuse

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TPB	Theory of planned behavior
UTAUT	Unified theory of acceptance and use of technology

4.1 Introduction

Information systems (IS) research on technology adoption has focused on individual information technology acceptance decisions, and over the past 20 years, 365 articles have been published in the major journals of the discipline (Williams et al. 2009). As a consequence, there is an extensive body of knowledge focusing on system acceptance and several models and theories explaining an individual's decision to use information technology. These studies have consistently found relationships among beliefs, attitudes, behavioral intentions, and usage behavior, typically focusing on the initial decision about whether or not to use a technology (Venkatesh et al. 2003).

However, individuals' resistance to technologies and their respective use has drawn much less attention so far (Cenfetelli 2004; Lapointe and Rivard 2005; Kim and Kankanhalli 2009). Typically, technology adoption research has evaluated certain factors such as perceived ease of use or perceived usefulness leading to adoption. However, there is a dearth of analyses on those factors causing individual rejection (Venkatesh and Brown 2001). Most renowned, the Technology Acceptance Model proposes that an individual's intention to use a particular technology is driven by perceived usefulness as *the degree to which a person believes that using a system would enhance his/her job performance* (Davis 1989, p. 320) and perceived ease of use as *the degree to which a person believes that using a system would be free of effort* (Davis 1989, p. 320).

In contrast to Davis (1989) who motivated his study to explain user acceptance through users' unwillingness to accept and use available systems, Venkatesh and Brown's research *broadens that [acceptance] perspective by presenting preliminary evidence that non-adoption (rejection) decisions are based on [different] critical barriers* (Venkatesh and Brown 2001). Early on, researchers observing information technology implementation have identified user resistance and factors leading to resistance as critical variables for implementation success (Keen 1981; Markus 1983). Interestingly, related research areas have come across resistance phenomena as well but have also ignored the possibly vital difference between a lack of arguments for IT usage and IT resistance. Early on, researchers observing information technology implementation have identified user resistance and its antecedents as critical variables for implementation success (Keen 1981; Markus 1983), concluding that it can undermine success (Joshi 1991; Marakas and Hornik 1996; Lapointe and Rivard 2005). Grippingly, most of the research on IS implementation deals with system user acceptance (Venkatesh 2000; Venkatesh and Davis 2000; Venkatesh and Morris 2000; Venkatesh et al. 2003) where resistance is considered as the reverse side of the acceptance coin. But if resistance cannot be conceptualized simply as the opposite of acceptance, it follows that studying acceptance alone will do little to provide insights into user resistance.

Correspondingly, Lapointe and Rivard (2005) find that IS research has neglected the study of resistance phenomena. Their literature analysis of IS and IS-related journals over the past 25 years only found 43 articles investigating resistance related to information technology implementation projects. They also conclude that most of these studies treat resistance as a black box and that is only opened in four cases to propose theoretical explanations of how and why resistance occurs (Markus 1983; Joshi 1991; Marakas and Hornik 1996; Martinko et al. 1996).

To provide an overview on user resistance theories, this chapter focuses on the multilevel model of resistance of Lapointe and Rivard (2005) and their four identified articles. In addition, we identified four more articles in the extended AIS senior basket journals since then (2004[1]) that investigate user resistance and provide theoretical explanations why it occurs (Cenfetelli 2004; Bhattacherjee and Hikmet 2007; Eckhardt et al. 2009; Kim and Kankanhalli 2009). Before presenting each theory and model in more detail, the next section defines the concept of resistance and the related terms of technology non-adoption and rejection.

4.2 Resistance, Rejection, and Non-Adoption

Individual users of IS could react in different ways to a new technology. They may reject it completely, partially use its functions, actively resist it, unwillingly accept it, or embrace it fully. Within the IS adoption and implementation literature different terms are used to describe different aspects of an individual's decision not to use a certain technology. Within this section the terms adoption, non-adoption, resistance, acceptance, and rejection are defined and explained related to the technology usage decision.

According to the Oxford English Dictionary *resistance* is defined as the action of resisting, which means withstanding an action or effect and trying to prevent by action or argument. In addition, *rejection* is defined as dismissing as inadequate or faulty and refusing to consider or agree to something while *non-adoption* is the choice not to take up or follow an option or course of action. In contrast, *acceptance* is defined as the agreement to receive or undertake something offered or proposed and *adoption* as the choice to take up or follow an option or course of action (Spanes and Stevenson 2005).

Lapointe and Rivard (2005) describe the individual's technology usage decision as follows: users themselves or in a group will first assess the technology in terms of the interplay between its features and individual- and/or organizational-level initial conditions. Furthermore, they make projections about the consequences of the potential use of the technology. During this evaluation process individuals develop on the one side an intention to accept and on the other side an intention to resist the technology based on perceived qualities and threats related to the technology (Lapointe and Rivard 2005). Acceptance behaviors *reflect proactive intentions to use an IT and lead to the increased use of the IT* and *IT acceptance is the act of receiving IT use willingly* (Saga and Zmud 1994). Resistance *is characterized by low levels of use, by a lack of use, or by dysfunctional,* e.g., *harmful use* (Martinko et al. 1996). In addition, IT resistance was defined by IS research as an

[1] 2004 seems to be an appropriate starting point as the study by Lapointe and Rivard (2005) was conducted before 2005 and the article was published in 2005.

action or intentional inaction that opposes or sidesteps the implementation of new information technology. It may manifest over time, from the program's inception through its deployment and operation and its intensity may wax and wane. A resister may be an individual, a group or an entire organization (Saga and Zmud 1994). In general, IS research does not view resistance as dysfunctional or pathological, and acceptance is not viewed as normatively correct. The definition of resistance specifically states that it may occur over time.

According to technology acceptance literature based on the intention to adopt, actual adoption behaviors will result. If the outcome related to the evaluated acceptance and resistance arguments is positive, users will adopt the technology. However, if the perception is negative, users would resist using it (Joshi 1991). Resistance behaviors could be distinguished between rejection and non-adoption. Rejection *refers to a user's conscious decision to avoid a system, as opposed to non-adoption, which leaves the door open to future use* (Cenfetelli 2004). After the adoption decision, users can perform different usage behaviors based on their continuous evaluation of and their experience with the technology which could vary from resistance (non-usage) over workaround to infusion (Ferneley and Sobreperez 2006).

As shown, the definition of resistance used in literature varies. Therefore, Lapointe and Rivard (2005) use semantic analysis to define resistance and identify syntactically unstructured expressions of the language referring to the concept of resistance. They find five basic, common primitives of the concept of resistance: resistance behaviors, object of resistance, perceived threats, initial conditions, and subject of resistance. These five components could be used as a basic definition future research can build on when discussing resistance phenomena.

Resistance behaviors could vary from a spectrum of being passively uncooperative to engaging in physically destructive behavior (Marakas and Hornik 1996), from lack of cooperation to sabotage (Carnall 1986), or from the binary decision of to adopt or not to adopt a technology (Joseph 2005). Coetsee (1993) proposes a taxonomy which allows the classification of resistance behaviors. Users can perform resistance in terms of apathy, passive resistance, active resistance, and aggressive resistance. Apathy includes behaviors such as inaction, distance, and lack of interest. Manifestations of passive resistance are rather mild; they include delay tactics, excuses, persistence of former behavior, and withdrawal. Active manifestations are typified by strong but not destructive behaviors, such as voicing opposite points of view, asking others to intervene or forming coalitions. Aggressive resistance behaviors such as infighting, making threats, strikes, boycotts, or sabotage seek to be disruptive and may even be destructive (Lapointe and Rivard 2005).

Based on the fact that the verb "to resist" is transitive, it has to take a direct object. As a consequence, when discussing resistance phenomena a resistance object has to be identified. Understanding this object is critical, because resistance is shaped in part by the *content of what is being resisted* (Jermier et al. 1994). In terms of IS research, individuals resist the implementation or introduction of an information technology (Joshi 1991).

Perceived threats are identified by expressions such as *overwhelming emotional pain* or *the perception of a dangerous situation* (Marakas and Hornik 1996).

Examples of perceived threats related to technology introductions are inequity (Joshi 1991) or loss of power (Markus 1983).

Moreover, resistance behavior is dependent on initial conditions, and understanding resistance demands attention to subjectivities (Collinson 1994). Some individuals or groups may accept a technology, but others may resist it. As a consequence, initial conditions such as distribution of power, established routines, and individual characteristics may influence how threatening an object is perceived to be by an individual or group.

As the last aspect of resistance, Lapointe and Rivard (2005) identify the entity that adopts resistance behaviors. From a psychological perspective the subject is the individual (Oreg 2003), from the political perspective the subject is generally a group of actors (Jermier et al. 1994). In IS research, sometimes the subject is an individual (Marakas and Hornik 1996), at other times, it is a group (Markus 1983) or an organization (Ang and Pavri 1994).

The described resistance theories share the underlying assumption about the desirability of resistance and consider resistance to be neither good nor bad (Lapointe and Rivard 2005). A second common assumption pertains to the nature of the relationship between resistance and its antecedents. All models, indeed, assume that resistance results from the mutual adjustment of several antecedents. While there are various perspectives on resistance to information technology in IS research so far, there is a consensus that understanding and explaining resistance is important (Lapointe and Rivard 2005; Kim and Kankanhalli 2009). Therefore, the following section provides an overview of important resistance theories and models as proposed and used by IS research.

4.3 User Resistance Theories

Early thoughts on user resistance can be credited to Kurt Lewin's (1947) pioneering studies on force-field analysis in the organizational development literature (Lewin 1947). Lewin suggests that social systems, like biological systems, have a tendency to maintain a status quo by resisting change and reverting back to the original state – a characteristic referred to as *homeostasis*. The status quo represents an equilibrium between the forces favoring and opposing change. Lewin thereby contends that successful change rests on an organization's ability to first *unfreeze* the equilibrium by altering the dynamics of the favoring and opposing forces, before change can be successfully enacted (Lewin 1947).

IS research recognizes that better theories or models of user resistance would lead to better implementation strategies and desired implementation outcomes. In the following, major user resistance theories and approaches explaining why people resist technologies will be described as found in IS literature. The starting point is the multilevel model of resistance by Lapointe and Rivard (2005) followed by a chronological presentation of the four articles identified by Lapointe and Rivard (2005) and the four articles identified by ourselves. The main results of each theory are summarized in Table 4.1.

Table 4.1 User resistance theories

Theory and authors	Main result
Multilevel model of resistance to information technology implementation (Lapointe and Rivard 2005)	Lapointe and Rivard (2005) propose a model of resistance to IT implementation where resistance behaviors occur following perceived threats that result from the interaction between initial conditions and a given object. They observe the presence of mixed determinants (e.g., initial conditions, system characteristics) of resistance behaviors from both individual and unit levels which influence resistance behaviors
Power, politics, and MIS implementation (Markus 1983)	Markus (1983) explains resistance in terms of interaction between the system being implemented and the context of use and posits that a group of actors will be inclined to use a system if they believe it will support their position of power. If a user thinks it might cause him/her to lose power, he/she will resist
A model of users' perspective on change (Joshi 1991)	Joshi (1991) examines the issue of information systems implementation and resistance to change from an equity theory perspective and develops an equity-implementation model that attempts to explain resistance to change. The equity-implementation model describes a three-level process employed by users to evaluate a change in terms of its impact on their equity status. To assess the change in equity, users are viewed as evaluating their net gain based upon changes in their inputs and outcomes and comparing their relative outcomes with that of other users/user groups and the employer
Passive resistance misuse (Marakas and Hornik 1996)	Marakas and Hornik (1996) adapt a model of passive resistance misuse to explain resistance behaviors as passive–aggressive responses to threats or stresses that an individual will, rightly or wrongly, associate with a new system. They base their model to explain these passive resistance misuses on passive–aggressive (P–A) theory and action science's espoused theories vs. theories in use. The introduction of IT exposes the rigidity of an individual toward change and the new system and, when coupled with feelings of resentment (stress and fear) leads to resistance and reactive behaviors
An attributional explanation of individual resistance (Martinko et al. 1996)	Martinko et al. (1996) argue that the variables and dynamics associated with the rejection of IT can be conceptualized using an attributional perspective of achievement motivation. Therefore, their model draws on attribution theory and learned helplessness: a new technology, internal and external variables, and an individual's experience with success and failures at tasks involving similar technologies evoke causal attributes. Martinko et al. (1996) argue that the intensity and nature of resistance to IT depends on the interaction of these factors

(continued)

Table 4.1 (continued)

Theory and authors	Main result
Inhibitors and enablers as dual factor concepts in technology usage (Cenfetelli 2004)	Cenfetelli (2004) proposes a theory for existence, nature, and effects of system attribute perceptions that solely lead to discouraging usage. Inhibitors to system usage are perceptions about a system's attributes that are qualitatively unique from the vast array of positively oriented beliefs found in user satisfaction literature. Inhibitors act solely to discourage usage, but their absence does not encourage use. These inhibiting beliefs are independent from enabling beliefs and can hence coexist with those beliefs and have differing antecedents and consequent effects
Physicians' resistance toward health-care information technology (Bhattacherjee and Hikmet 2007)	Bhattacherjee and Hikmet (2007) argue that incorporating resistance to change literature into theoretical models of technology acceptance will enable researchers to better understand why individuals resist using technologies. Their model incorporates the notion of resistance to change and its antecedents into a model of IT usage explaining physicians' reactions to health-care information systems
Analyzing workplace referents' social influence on IT non-adoption (Eckhardt et al. 2009)	Eckhardt et al. (2009) apply UTAUT to identify different sources of social influence for adopters and non-adopters. They find a significant impact of social influence from individuals from the same (focal) operations and IT department on information technology non-adoption
Investigating user resistance to information systems implementation: a status quo bias perspective (Kim and Kankanhalli 2009)	Kim and Kankanhalli (2009) draw on Bovey and Hede (2001) and develop the construct "user resistance" as a resistance behavioral measure and use the theory of status quo bias to explain user resistance prior to a new IS implementation

4.3.1 Multilevel Model of Resistance to Information Technology Implementation

Lapointe and Rivard (2005) propose a model of resistance to IT implementation where resistance behaviors occur following perceived threats that result from the interaction between initial conditions and a given object. This model integrates several resistance behaviors such as passive resistance, active sabotage, oral defamations (Martinko et al. 1996), covert procrastination, protesting, criticism (Marakas and Hornik 1996), and not using the system or sabotage (Markus 1983). The model recognizes the potential of the presence of multiple instantiations for antecedents related to perceptions about technologies.

The authors observe the presence of mixed determinants of resistance behaviors from both individual and unit levels which influence resistance behaviors. In addition, Lapointe and Rivard (2005) suggest that the level of perceived threats as one category of those determinants influences the degree of severity of these behaviors.

The perceived threats can be at individual or group level. Recognizing the existence of these mixed determinants of resistance behaviors, the model includes a wider array of antecedents and thus provides a richer portrait of the resistance phenomenon. Within its multilevel perspective the model posits that, when perceived threats are at individual or organizational level, the ensuring resistance behaviors will be more harmless than when they are at group level.

The initial conditions are identified at an individual, group, or organizational level. The object can be a system's feature, a system's significance, or a system's advocate. Lapointe and Rivard (2005) not only identify a wider set of triggers, they also show how resistance behaviors change over time under the influence of triggers. The model explains the process how group resistance emerges from individual resistance and how this process differs from early to late implementation. The model reveals that early in the implementation phase individual behaviors are independent but do converge later. The model provides an understanding of group resistance to IT implementation. Lapointe and Rivard (2005) explain that the interaction between initial conditions and the object of resistance is at the origin of perceived threats, *these antecedents have to be different for the perceived threats to change levels* (p. 479). They observe that both antecedents may change during implementation. Therefore Lapointe and Rivard (2005) propose a process model and argue that the longitudinal perspective makes it possible to consider actual consequences of system use and triggers which can modify either the set of initial conditions or the object of resistance. These triggers include consequences of system use, other actors' actions, system advocates' reactions to resistance behavior, and events related to the implementation process. Triggers affect the upcoming episode by either transforming one or several initial conditions or activating one that was latent. In addition, the object of resistance like the system itself, its significance, or its advocates may also change during implementation.

They propose a dynamic model of resistance to IT implementations. At time t_1 resistance behaviors will result if a subject perceives threats from the interaction between the system features and individual and/or organizational-level initial conditions. Consequences of system use, or nonuse, respectively, will occur. These consequences may change the nature of one or several initial conditions. Other triggers may also modify the set of initial conditions. This new set will be the initial condition at time t_2 and might also change the object of resistance. Again, also at time t_2 resistance behaviors will follow if threats are perceived from the interaction between the object of resistance and initial conditions.

The model not only explains the dynamics of group-level resistance but also shows how group resistance behaviors emerge from individual behaviors. Studying group resistance to IT in the early stages of implementation, especially independent, individual behaviors need to be analyzed rather than considering the group as a unified entity. In later stages, it becomes important to understand how and why individual resistance behavior converges.

Overall, their study shows that within the implementation of a given system, resistance has a wide variety of antecedents and manifestations that can evolve and change in nature over time. The model of Lapointe and Rivard (2005) was the first one explaining user resistance within a longitudinal perspective and integrating different aspects of user resistance revealed by prior research.

4.3.2 Power, Politics, and MIS Implementation

One of the early studies identified by Lapointe and Rivard is the work on power, politics, and MIS implementation by Markus (1983). She explains resistance in terms of interaction between the system being implemented and the context of use and posits that a group of actors will be inclined to use a system if they believe it will support their position of power. If they think it might cause a loss of power to them, they will resist.

Rather than seeing resistance as an undesirable result to be avoided or overcome, Markus posits that it can have both negative and positive effects. When it generates conflict and consumes time and attention, resistance is dysfunctional and can even be destructive. It can nevertheless be functional for organizations if it prevents the implementation of systems that, by increasing stress or turnover or by eroding performance levels, would have negative impacts.

Markus's (1983) model portrays resistance as resulting from the interaction of system features with the intra-organizational distribution of power. If users perceive that the system implies a loss of power, they are likely to resist. More precisely, the model stipulates that the strength of resistance would be related to the size of the loss and its perceived importance.

The Political Perspective of Resistance by Markus (1983) explains resistance to change and implementation difficulties primarily in terms of the conflict among users for increased power. She notes that the political perspective appears to be primarily applicable for systems cutting across multiple user departments. Her work offers three core explanations for people's negative reactions to computer systems:

(a) Internal attributes of an individual, such as the natural human tendency to resist change as well a certain personality characteristics and cognitive orientations
(b) Poor system design (functionality, interface design, modes of presentation, accessibility of work stations, inadequate response time, etc.) which not only amplifies negative reactions but can also frustrate those individuals who initially exhibit positive reactions
(c) The interaction of a system's design with the attributes of its users

The first explanation assumes that a person's (group's) behavior is determined internally and the second assumes that behavior is determined externally by the environment or by technology. The third explanation indicates that *it is the situation-dependent interaction between characteristics related to the people and characteristics related to the system that determines resistance* (p. 431).

Markus (1983) was one of the first authors to discuss user resistance behavior through a theoretical lens. Many of the following studies build on the ideas proposed by Markus (1983). Especially the interaction theory of user resistance during IS implementation projects has made several contributions to user resistance knowledge.

4.3.3 A Model of Users' Perspective on Change

Joshi (1991) examines the issue of IS implementation and resistance to change from an equity theory perspective and develops an equity-implementation model that attempts to explain resistance to change. The model is based upon the premise that there is no fundamental resistance to every change. The model utilizes equity theory to identify the processes through which users may evaluate changes introduced by IS implementation to assess whether changes are favorable or unfavorable.

Equity theory suggests that in every exchange relationship, individuals are constantly concerned about their inputs, outcomes, and the fairness of the exchange. Individuals are also constantly comparing themselves with others in their reference group to assess whether the relative gains are the same. When the changes in input and outcomes are such that on the whole the individual perceives a decline in his/her net gains, or inequity compared to others, the individual is likely to be distressed. Equity theory suggests the greater the inequity or decline in net gain, the greater the resulting distress would be. Individuals who experience the distress of inequity or loss of equity are likely to minimize their inputs and other outcomes as well as by attempting to increase others' inputs.

The Equity-Implementation Model describes a three-level process employed by users to evaluate a change in terms of change impact on their equity status. To assess the change in equity, users are viewed as evaluating their net gain and compare their relative outcomes with that of other users/user groups and the employer.

Changes in outcomes are defined as the perceived benefits or losses that the implementation of a system brings for the user. All three levels of analysis are likely to be important in determining the equity perceptions of a user. Different users are likely to consider different factors as relevant inputs and outcomes and may assign different values to different factors in their overall assessment of inputs and outcomes. Thus, it is not unusual that different users may evaluate the same change differently.

At the first level of analysis, a user is likely to evaluate the impact or potential impact of a new system implementation in terms of the resulting changes in his/her outcomes and inputs. If the net gain due to change is positive, users would be favorably inclined toward the change. However, if the perception is negative, users would view the change as unfavorable and resist it. When new systems are introduced the resulting improvements in productivity are likely to generate benefits for employers. Therefore, at the second level of analysis a user is likely to compare the change in his/her relative outcomes with that of the employer. At the third level of analysis, a user is likely to compare his/her relative outcomes with that of other users in the reference group. Does the system impact all users similarly or does the system result in increasing some users' equity and lowering others? If a user feels that some other users or user groups have benefited from the new system while he/she has not benefited at all or not as much, the user is likely to experience inequity and assess the change as unfavorable.

He posits that extreme inequities should be avoided because highly inequitable treatment of some users is likely to influence the equity perceptions of others, hence causing disruptions. However, Joshi (1991) did not explicitly enunciate the assumption about the desirable or undesirable nature of resistance underlying his model; it is clearly implicit in the argument. Therefore, when resistance prevents the use of a system that has inequitable consequences, it plays a useful role.

Joshi's (1991) model posits that *in any exchange relationship, individuals are constantly concerned about their inputs, outcomes, and the fairness of exchange* (p. 231). They also constantly compare themselves with others.

The models of Joshi (1991) and Lapointe and Rivard (2005) are the only ones to provide a more generalizable explanation of user resistance. When a system is implemented, individuals assess the importance of variations in inputs and outcomes. If they perceive the variations as detrimental, they will experience inequity. The stronger the perceived inequity, the more likely they resist. In relation to this net gain other studies discuss different influencing factors such as loss of power (Markus 1983), perceived threats (Lapointe and Rivard 2005), or technology inhibitors (Cenfetelli 2004) which will shift the net gain toward resistance. Kim and Kankanhalli (2009) use this concept to explain user resistance with status quo bias theory arguing that an individual's status quo bias shifts the net gain toward resistance as well.

4.3.4 Passive Resistance Misuse

Marakas and Hornik (1996) adapt a model of passive resistance misuse to explain resistance behaviors as passive–aggressive responses to threats or stresses that an individual will, rightly or wrongly, associate with a new system. They describe the purpose of their paper: *to focus attention on a form of covert resistance to IT implementation process that is neither couched in criminal intent nor motivated by personal gain* (Marakas and Hornik 1996, p. 209). They define passive resistance misuse (PRM) *to be recalcitrant, covert behavior resulting from both fear and stress stemming from the intrusion of the technology into the previously stable world of the user* (p. 209). This kind of behavior takes the form of open cooperation and acceptance combined with covert resistance and possibly sabotage of the implementation effort. It cannot be easily predicted or detected during the implementation process and can range from passive noncooperation to physical destruction.

They base their model to explain these passive resistance misuses on passive–aggressive (P–A) theory and action science's espoused theories vs. theories in use. P–A theory *serves as the underlying theory for the nature of the PRM behavior* and action science *serves to explain how PRM can remain undetected in the implementation process thus potentially leading to negative implementation outcomes* (Marakas and Hornik 1996, p. 211).

PRM behavior can be partially explained as the consequences of P–A responses to real or perceived threats or stresses that the individual associates with a new IS. P–A behavior has been classified as a treatable personality disorder (Fine et al. 1992). The authors argue that the uncertainty associated with the introduction of a new IS can create conditions under which P–A behavior and as a consequence PRM can manifest in certain individuals. Marakas and Hornik (1996) use the proposed model by Fine et al. (1992) that predicts that P–A behavior is shown as the continual interaction among five elements: rigidity, resentment, resistance, reactance, and reversed reinforcement. Rigidity and resentment are likely to lead to resistance and reactance, which in turn leads to reversed reinforcement.

Rigidity is defined as *inflexible and maladaptive behavior and makes adjustment to change difficult for individuals who believe no one can tell them what to do or not to do* (Marakas and Hornik 1996, p. 212). Resentment *involves a mixture of anger and shame* and resistance involves *a stubbornness in fulfilling the expectations of others* (Marakas and Hornik 1996, p. 212). Reactance can be expressed *by behaviors such as procrastination, verbal protests, "forgetting" certain tasks, slow performance and resenting useful suggestions* (Marakas and Hornik 1996, p. 212). Reversed reinforcement *often afford P–A individuals a sense of power and gratification from causing failure.*

The introduction of IT exposes the rigidity of an individual toward change and the new system and, when coupled with feelings of resentment (stress and fear), leads to resistance and reactive behaviors (Marakas and Hornik 1996). Individuals might *rationalize their covert activities as being in the best interests of the firm while simultaneously feeling a sense of relief from the threat of the new technology* (Marakas and Hornik 1996, p. 212). PRM behavior *allows the user to retain their status as a supporter of the implementation project while simultaneously effecting stress reduction through covert sabotage of the project effort* (Marakas and Hornik 1996, p. 212).

In addition, based on theory of action, the actions of individuals within organizations can be described in terms of what they do and what they say they do (Argyris 1971). Within the two kinds of theory of action *exposed theories* are those that an individual claims to follow and *theories-in-use* are those that can be observed from an individual's action. A person's exposed theory would be the description he or she gives for doing something while the person's theory-in-use refers to how he or she acts in relation to what was originally said. Looking at IS implementation, individuals would support the implementation of an IS during group meetings (exposed theory side), but act in ways that appear congruent to their assertion of support for the new system (theory-in-use side) (Marakas and Hornik 1996).

Marakas and Hornik (1996) argue that PRM leads to better system quality, system use, and user acceptance. However, if one or more users employ PRM as their action strategy the outcome *may be detrimental to the IS implementation effort* (p. 215).

Their explanation of user resistance is among the first to focus on resistance as a resulting behavior during IT implementation projects. They concentrate their work on only one aspect of resistance as they use passive resistance misuse to explain resistance behaviors as passive–aggressive responses to threats or stresses that an individual will, rightly or wrongly, associate with a new system. Kim and Kankanhalli (2009) build upon this approach while proposing their depended variable user resistance.

4.3.5 An Attributional Explanation of Individual Resistance

Martinko et al. (1996) offer a theoretical explanation for resistance on IT implementations at the individual level. They argue that the variables and dynamics associated with the rejection of IT can be conceptualized within an attributional perspective of achievement motivation. Therefore, they propose an attributional model of individual reactions to IT. Their model rests on attribution theory and learned helplessness. Attribution theory assumes that an individual's beliefs about the outcomes of a specific behavior are important determinants of subsequent behaviors. Moreover, the learned helplessness proposes that *passive behavior results from prior exposure to failure and despite changes in organizational circumstances or conditions* (Martinko et al. 1996, p. 314). As a consequence, learned helplessness assumes that individual's attributions with respect to their failures and successes are a primary motivational force in their future behavior (Martinko and Gardner 1982).

These theories propose that external stimuli combined with individual differences cause individual attributions. In turn these attributions influence an individual's expectations and drive affective and behavioral reactions. The behaviors result in successful or unsuccessful outcomes which then serve as predictors for future attributions of similar stimuli (Parsons et al. 1985; Schmidt and Weiner 1988).

Concerning user resistance to technologies, the basic assumption of the model is that a new technology, internal and external variables, and an individual's experience with success and failures at tasks involving similar technologies evoke causal attributes. In turn, these attributions influence the individual's expectations regarding future performance outcomes, which then drive his or her affective and behavioral reactions toward the technology and its use. The behavioral reactions result in outcomes, the nature of which influences the nature of future attributions. Martinko et al. (1996) argue that the intensity and nature of resistance to IT depends on the interaction of these factors. Therefore, when individuals are challenged with new or changing IT, their attributions and beliefs regarding success and failure are primary determinants of their reactions to IT.

The process depicted by the model is not considered to be static, linear, and completely rational. The process typically involves ongoing interaction between and among all variables. It is important to recognize that a user's attributions are formed and evolve before, during, and after IT implementation episodes. In the case of an entirely new IT, these attributions probably take their form from a generalized attributional schema based on what the individual interprets to be related prior experiences. With more familiar IT and after an individual had some experiences with a specific IT, these attributions will be more finely articulated and will more accurately reflect actual experiences. The following subparagraphs will explain all model components in more detail.

External influences refer to variables in an individual's immediate environment which affect attributions and expectations. These influences primarily manifest themselves through:

(a) Other actors in an individual's immediate work environment
(b) Characteristics of the IT that is introduced into this workplace
(c) Management support

Internal influences involve information and biases from an individual's past experiences and learning. Numerous intrapersonal factors have been postulated to be associated with the acceptance and rejection of IT. Hirschheim and Newman (1988) cite *innate conservatism and lack of felt need as factors influencing resistance to IT* (p. 317). Although these factors appear relevant, empirical support for these and many of the relationships suggested in the literature is lacking.

Causal attributions can be divided into attributions for negative and for positive outcomes. Successful outcomes are viewed as positive and failure outcomes are viewed as negative. Attributions are the result of individuals' causal analyses of their performance environment and reflect their beliefs regarding the reasons for their outcomes. According to Martinko et al. (1996) the most accepted paradigm for explaining a process depicts attributions as a function of two dimensions; locus of causality and stability (Schmidt and Weiner 1988). Locus of causality is concerned with whether the individual attributes performance outcomes to internal or external factors. Internal factors are those "within" the person, while external causes refer to causes which the individual cannot control. The stability dimension is concerned with the temporal nature of attributions. Stable attributions refer to factors that remain constant over time while unstable ones fluctuate over time. Based on these dimensions four potential achievement-related attributions are proposed. Regarding user reactions to new IT, it is proposed that *individuals believe that their chances of success and failure with a new IT are a function of their efforts, abilities, the difficulty of using the IT, luck/chance, or some combination of these four* (Martinko et al. 1996, p. 319).

These attributions influence behavior primarily through expectations which are defined as *an individual's belief that he or she can accomplish a task and the belief that task accomplishment lead to certain outcomes* (Martinko et al. 1996, p. 320). These expectations include efficacy and outcome expectations. Self-efficacy has been discussed by IT implementation literature and refers to the perceptions of an individual's ability relative to the handling of specific tasks with IT. In addition outcome expectations are not always a result of efficacy estimates. For example, lack of control over outcomes has been evaluated as a predictor of user resistance in IT implementation literature.

The two classes of reaction to information technologies are behavioral and affective. The behavioral one can be classified into three subcategories: acceptance, rejection, and reactance. Acceptance behaviors *reflect proactive intentions to use an IT and lead to the increased use of the IT* (Saga and Zmud 1994) and resistance behaviors *are characterized by low levels of use, by a lack of use, or by dysfunctional,* e.g,. *harmful use* (Martinko et al. 1996, p. 322). The third behavior is reactance which refers to *behaviors which attempt to regain control over outcomes. When outcomes do not match expectations, individuals may react by increasing their efforts, although they may also respond by lowering their outcome expectations or changing their perception of the attractiveness of the outcomes* (Martinko et al. 1996, p. 322). Reactance is most likely to occur when individuals experience outcomes which challenge attributions that performance and outcomes are determined by ability and effort.

Affective reactions refer to *emotional responses that result from attributions and expectations regarding likely performance outcomes* (Martinko et al. 1996, p. 322). Examples include user dissatisfaction, attitudes, job satisfaction, and role ambiguity. Some other studies identify apprehension, anxiety, stress, and fear as recognized affective reactions to IS implementations. These aspects are becoming less or more favorable over time as the implementation of a technology is rejected (Martinko et al. 1996).

To conclude the presentation of attributional explanations of user resistance, one has to point out that there are at least four antecedent sources that influence user reactions to IT implementations: external and internal influences, attributions, and expectations. Martinko et al.'s (1996) hypothesis is that *believe attributions may well be the most important component of the model* (p. 323). Attributions lead to resistance, acceptance, or reactance regarding new technologies and appear to be quite different and each of these distinctly different patterns suggests differences in the antecedent causes of the reaction to information technology. This approach conceptualizes resistance in terms of beliefs and attitudes toward IT-induced organizational change and is one of the first ones providing a theoretical explanation how individuals develop these beliefs and attitudes. Cenfetelli (2004) uses this approach as one of his underlying concepts for his dual factor model of technology usage.

4.3.6 Inhibitors and Enablers as Dual Factor Concepts in Technology Usage

Cenfetelli (2004) proposes a theory for existence, nature, and effects of system attribute perceptions that lead solely to discourage usage. He argues that the implicit assumption of technology acceptance research is that technology design should focus on the *good* or whatever enhances quality, foster positive user attitudes, and encourage system use. In his point of view, less attention has been given to the *bad* or what uniquely fosters negative attitudes and discourages use.

Cenfetelli (2004) argues that perceptions are a key influence on a user's general attitude, intentions, and behavior. He categorizes these perceptions into enablers and inhibitors. Enablers refer to *those external beliefs regarding the design and functionality of a system that either encourage or discourage usage, dependent on valence* (Cenfetelli 2004, p. 475) (e.g., systems, that are perceived to be reliable are used, unreliable ones are not) while inhibitors are *the perceptions held by a user about a system's attributes with consequent effects on a decision to use a system. They act solely to discourage use* (Cenfetelli 2004, p. 475). Moreover, an inhibitor can be distinguished from an enabler as a *perception for which there is no clear positive opposite that is psychologically meaningful* (p. 476). As a consequence, inhibitors are *perceptions that have no psychologically meaningful opposite and, as such, are not simply the opposite of an enabling perception. Whereas enablers are psychologically meaningful at either end of a positive–negative spectrum, inhibitors are only meaningful at the negative end* (p. 477).

Based on these general definitions Cenfetelli (2004) posits that usage inhibitors deserve an independent investigation on the basis of three key arguments:

- There are perceptions that serve solely to discourage usage, and these are qualitatively different from the opposite of the perceptions that encourage usage
- These inhibiting and enabling perceptions are independent of each other and can coexist
- Inhibiting and enabling perceptions have differing antecedents and consequent factors

Cenfetelli (2004) describes the influence of inhibitors as follows: *If an online purchase transaction is completed without incident, it is likely not noticed, let alone favorably perceived. Therefore if a user were to not have an inhibitor perception, this absence of perception would play no role in enabling use. The existence of these "inhibitors" may explain why people fail to adopt, or worse, outright reject a system.*

Cenfetelli (2004) continues his argumentation that *the presence of an inhibitor perception can play a role in a user's rejection of a system that may not take place in the absence of an enabling perception.* He argues that from a consequential point of view, it is obvious that inhibitors and enablers will have, respectively, a negative and positive effect on use. In addition he points out a more nuanced proposition that rejection of technology – a separate decision from adopting – may best be predicted by inhibitors, whereas adoption may best be predicted by enablers.

Comparing the power of the influence of inhibitors and enablers Cenfetelli (2004) argues that *an inhibitor will lead to clear and salient negative perceptions about the system, and thus intentions to use, because of the power of presence over absence, the diagnosticity and power of negative over positive information, and the asymmetry of attributions made by user regarding the source of negative* versus *positive perceptions.* In addition to the psychologically unique effect inhibitors have on usage, inhibitors may also act to bias perceptions of other beliefs about the system in ways that enablers will not (Cenfetelli 2004).

He proposes that inhibitors to system usage are perceptions about a system's attributes that are qualitatively unique from the vast array of positively oriented beliefs found in user satisfaction literature. Inhibitors act solely to discourage usage, but their absence does not encourage use. These inhibiting beliefs are independent from enabling beliefs and so can both coexist with those beliefs and have differing antecedents and consequent effects. Among these differing causal effects is the unique influence inhibitors have upon system rejection, a more powerful influence on the usage decision compared to enablers, and a biasing impact on the perceptions a user has of the otherwise objectively positive features that a system may possess.

The categorization of technology enablers and inhibitors suggested by Cenfetelli (2004) is one of the first theoretical explanations of beliefs and attitudes related to technology resistance and also one of the first approaches to explain how technology acceptance and resistance are different. Additionally, he points out that IS research needs different models to explain both aspects as there are variables only explaining resistance (inhibitors), variables explaining only acceptance and those explaining both (enablers).

4.3.7 Physicians' Resistance Toward Health-Care Information Technology

Bhattacherjee and Hikmet (2007) present a theoretical model of physician resistance of health-care information technology usage by integrating technology acceptance and resistance to change literature using the dual factor model of technology usage by Cenfetelli (2004). Bhattacherjee and Hikmet (2007) argue that incorporating resistance to change literature into theoretical models of technology acceptance will enable researchers to better understand why individuals resist using technologies. They point out that *while acceptance behavior is targeted at a specific IT and driven by user perceptions related to that IT, resistance is a generalized opposition to change engendered by the expected adverse consequences of change. Resistance is therefore not focused so much on a specific IT, but on the change from the status quo caused by IT usage* (Bhattacherjee and Hikmet 2007, p. 727). The authors root their explanation why people resist technologies not in the technology itself but in the change caused by the introduction of an IS in the workplace.

The model introduced by Bhattacherjee and Hikmet (2007) is based on Lewin's (1947) idea of opposing forces and the dual factor model of IT usage (Cenfetelli 2004). The core argument is that *IT usage considerations among potential users is based on a simultaneous examination of enabling and inhibiting factors, similar to Lewin's (1947) notation of opposing forces* (p. 728). In their point of view the idea of *Resistance to Change* fits the classic definition of an inhibitor as well as similar idealized behaviors. They highlight that *resistance* [to change] *demonstrates asymmetric behaviors typical of inhibitors, because presence of resistance hurts IT usage but lack of resistance does not necessarily enhance IT usage* (p. 728).

This model has been one of the first to theoretically integrate the resistance to change literature within a model of IT usage. It incorporated the notion of resistance to change and its antecedents into a model of IT usage explaining physician's reactions to health-care IS.

4.3.8 Analyzing Workplace Referents' Social Influence on IT Non-adoption

Eckhardt et al. (2009) discuss the role of social influence in technology acceptance research and come up with a model (based on UTAUT and TPB) explaining workplace referents' social influence on IT adoption and non-adoption. They study the role of social influence from different workplace referent groups, like superiors and colleagues from the same or the IT department, on the intention to adopt. Their empirical analysis reveals that social influence on adoption significantly differs with regard to both source (influence groups) and sink (adopters and non-adopters) of the influence.

The type of workplace referent group makes a difference for adopters and non-adopters of a technology. Eckhardt et al. (2009) show that non-adopters' intention to use a system is influenced by individuals from the same (focal) operations and IT department but not by customers and superiors. In contrast, adopters are influenced by superiors.

Eckhardt et al. (2009) discussed their results in relation to the importance of social networks within organizations and concluded that the interaction with, observation of other people's behaviors, and the subjective norms of people's opinions explain an individual's behavior related to adoption of information technologies. Their research showed that the influence of different actors within a social network is different for adopters and non-adopters. The social influences of the focal, operations and IT department are the main predictors of the non-adoption behavior of individuals in the workplace.

4.3.9 Investigating User Resistance to Information Systems Implementation: A Status Quo Bias Perspective

Kim and Kankanhalli (2009) define *user resistance as opposition of a user to change associated with a new IS implementation* (p. 568) and establish their study on status quo bias theory (Samuelson and Zeckhauser 1988). Status quo bias theory explains individual resistance in terms of three main categories (p. 569):

– Rational decision making: *Assessment of relative costs and benefits of change (*i.e. *net benefits) before making a switch to a new alternative (*e.g. *transaction costs, uncertainty costs).*

Table 4.2 Measurement of user resistance (Own table illustrating the measurement items proposed by Kim and Kankanhalli (2009))

Categories of resistance behavior	Measurement item
Passive and covert "not comply with"	I will not comply with the change to the new way of working with the new system
Active and covert "not cooperate"	I will not cooperate with the change to the new way of working with the new system
Passive and overt "do not agree"	I do not agree with the change to the new way of working with the new system
Active and overt "oppose"	I oppose the change to the new way of working with the new system

– Cognitive misperceptions: *Loss aversion is a psychological principle that has been observed in human decision making in that losses loom larger than gains in value perceptions. Loss aversion can result in status quo bias because even small losses of changing from the current situation could be perceived as larger than they actually are.*
– Psychological commitment: *Three main factors contribute to psychological commitment: sunk costs, social norms, and efforts to feel in control.*

Using this idea of status quo bias, Kim and Kankanhalli (2009) make use of the theory of planned behavior (Ajzen 1991) to integrate status quo bias theory and equity implementation model (Joshi 1991) to explain user resistance prior to a new IS implementation. Perceived value will represent an individual's attitude toward the behavior in question, which refers to *the overall evaluation of change related to a new IS implementation based on the comparison between benefits and costs* (p. 571). The benefits and costs compared for perceived value are referred to as switching benefits and switching costs. This is in line with the net benefits concept in the rational decision-making explanation of status quo bias theory and the net equity concept in the equity implementation model. Regarding subjective norm, Kim and Kankanhalli (2009) integrate colleagues as the important referent group for individuals in the workplace (Eckhardt et al. 2009) into their model. Moreover, perceived behavioral control is accounted for both internal and external controls: self-efficacy for change (internal) and organizational support for change (external).

As the dependent behavioral variable, Kim and Kankanhalli (2009) develop the construct "user resistance" based on Bovey and Hede (2001). The variable distinguishes between *overt (open and expressive) and covert (concealed or hidden) resistance and between active (originating action) and passive (inert or not acting) resistance* (p. 575). The degree of resistance is considered to increase from covert passive (e.g., ignoring or indifference) to overt active (e.g., obstructing) behaviors. The developed measurement items are illustrated in Table 4.2.

Kim and Kankanhalli (2009) use the technology acceptance literature (theory of planned behavior) to integrate relevant concepts from resistance theories (entity-implementation model Joshi (1991)) and status quo bias theory which was not used previously in this context. The model is intended to examine the overall changes associated with new IS implementations by considering the overall changes related to a new IS anchored on users' current situations and by considering resistance behaviors as the dependent variable in the proposed model.

4.4 Outlook

The analysis of resistance theories proposed and used by IS research reveals several important implications for future research on user resistance. The most interesting findings are that only one of the described approaches to explain user resistance explicitly connects the user resistance and organizational change literature (Bhattacherjee and Hikmet 2007) and that most of the studies focus on IT implementation in organizations. To summarize the studies presented and the observed user resistance literature in general, one has to conclude that resistance research still lacks providing a unified understanding of resistance toward information technology. First unifying approaches like the multilevel model of resistance (Lapointe and Rivard 2005) are a good starting point for future research to develop a unified theory of user resistance toward information technology. Figure 4.1 offers a conceptualization of individual user resistance theories identified in this article and highlights directions for future research. According to Martinko et al. (1996), Cenfetelli (2004), as well as Lapointe and Rivard (2005) user resistance is based on beliefs and attitudes toward the technology in questions. Examples of these beliefs include perceived threats, technology inhibitors, loss of power, etc. As the discussed theories indicate these beliefs are well studied by IS research so far.

As outcome variables IS research has only conceptualized a user resistance variable (Kim and Kankanhalli 2009), but did not incorporate other outcome-related constructs like job satisfaction, continuous commitment, or turnover intentions

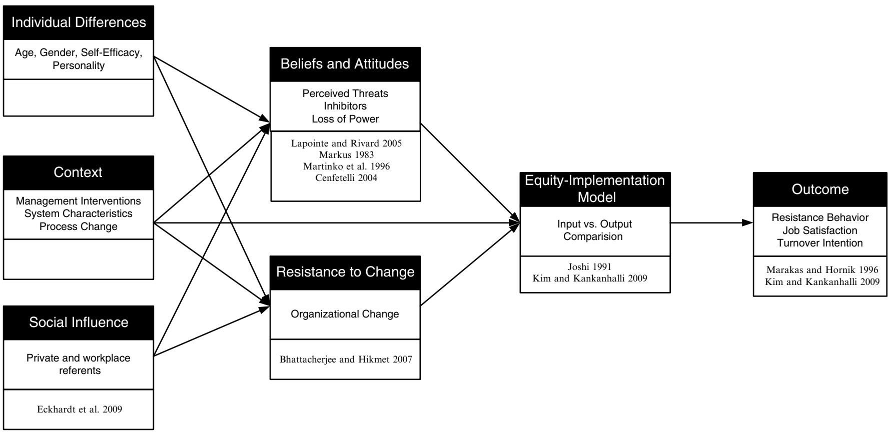

Fig. 4.1 Toward a unified understanding of user resistance

(Oreg 2006). Future research might discuss how reaction to technology-induced change leads to different outcome variables which could be technology-focused or work-related outcomes.

Resistance to change as an important aspect in organizational change literature has only been analyzed in one paper (Bhattacherjee and Hikmet 2007). Combining technology acceptance/resistance literature and organizational change literature in more detail should hence reveal several explanations why people reject technologies (Piderit 2000; Oreg 2006; Laumer and Eckhardt 2010).

Furthermore, looking at organizational change research in general, individual differences in relation to user resistance need further investigation. Individual differences such as age, gender, tenure, educational background, etc. of individuals can influence an individual's evaluation and attitude toward the induced change and technology (Venkatesh and Morris 2000). Moreover, a number of organizational change studies reveal that employees' openness to experience and especially organizational change can be predicted through traits such as self-esteem (Wanberg and Banas 2000), risk tolerance (Judge et al. 1999), need for achievement (Miller et al. 1994), and locus of control (Chung-Ming and Woodman 1995).

Another important variable is the context of the organizational change. A large variety of situational variables have been proposed in organizational change literature as related to employees' resistance to change. While some antecedents deal with the outcomes of change (e.g., losing or gaining power), others focus on the ways change is implemented (e.g., the amount of information about the change that is given to employees) (Watson 1971; Tichy 1983; Miller et al. 1994; Wanberg and Banas 2000; Armenakis and Harris 2002; Kotter and Schlesinger 2008). This distinction resembles that between perceptions of distributive and procedural justice (Greenberg and Cropanzano 2001). Furthermore, the context of the technology must be considered as well (voluntary vs. mandatory, utilitarian vs. hedonic systems, etc.)

Social influence and its impact on user non-adoption behavior have been evaluated by Eckhardt et al. (2009). They show that workplace referents are an important source of social influence but ignore private referents such as parents, children, or friends in their model. Future research might consider further referent groups in order to provide an integrative framing of social influence in technology resistance research.

Another integrative model has been proposed by Joshi (1991) using equity theory to explain an equity implementation model. According to him users compare the input and outputs of a particular change in general and their own situation with the outcomes of others in particular (other employees, organization) in order to comply or to resist the change introduced. Therefore, the outcomes of an IT-induced organizational change project are mainly influenced by the result of this net gain which is determined by beliefs and attitudes about the technology or the change outcomes (Markus 1983; Cenfetelli 2004; Lapointe and Rivard 2005), resistance to change (Bhattacherjee and Hikmet 2007), individual differences (Morris and Venkatesh 2000; Venkatesh and Morris 2000), situational influences (Greenberg and Cropanzano 2001), and social influence (Eckhardt et al. 2009). The resulting explanation of user resistance and other IT-induced organizational change outcomes is illustrated in Fig. 4.1.

Another interesting outcome of the literature review is that the studies discuss different objectives of resistance like the technology itself or the processes connected with the introduction of a technology. In addition, the approach to explain user resistance varies according to the methodology used to investigate the phenomena. Three studies use empirical research, four employ case studies and two are conceptual.

Venkatesh (2006) discusses, in his commentary on the future of technology acceptance research, that research about resistance is important and that this kind of research should consider business process changes and individual differences like personality traits to investigate user resistance in more detail. This call for research, the first results of Bhattacherjee and Hikmet (2007), and the discussed unified understanding of user resistance within this chapter might lead to a deeper investigation of organizational change and user resistance research in order to provide both design science and implementation process–oriented advice for organizations using technologies to run their businesses.

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Chapter 5
Task-Technology Fit Theory: A Survey and Synopsis of the Literature

Brent Furneaux

Abstract Over the past decade there has been a notable increase in the use of Task-Technology Fit (TTF) theory within the field of information systems. This theory argues that information system use and performance benefits are attained when an information system is well-suited to the tasks that must be performed. As such, it seeks to offer an account of two of the key outcomes of interest to information systems (IS) researchers. Continued interest in the application of TTF theory is therefore expected and, as a result, the following chapter aims to provide a brief overview of the theory and how it has been applied in prior work. Readers are presented with an overview of the diverse range of research contexts and methodologies that have been used to test and extend TTF theory. Key outcomes of interest to TTF researchers are also examined as are the various approaches that researchers have used to operationalize the notion of TTF. It is hoped that this overview will serve as a sound basis for future research and simultaneously help to ensure that IS research does not continue to tread the same ground.

Keywords Task-Technology Fit • Information Systems Adoption • Group Support Systems • Literature Survey

Abbreviations

ERP	Enterprise Resource Planning
IS	Information System
TAM	Technology Acceptance Model
TTF	Task-Technology Fit

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5.1 Introduction

Recognition that information systems need to be well-suited to their intended tasks extends back at least as far as the origins of the information systems (IS) discipline (Kanellis et al. 1999). Media richness theory has, for example, been founded on the premise that the decision to use a particular communication technology will be made based on the nature of the specific message to be conveyed (Daft et al. 1987). Similarly, the need for the capabilities of information systems to be suited to their tasks has been highlighted by early research examining information systems adoption (e.g., Thompson et al. 1991). Explicit, formal specification of task-technology fit (TTF) theory did not, however, occur until the publication of three seminal articles during the mid-1990s (Goodhue 1995; Goodhue and Thompson 1995; Zigurs and Buckland 1998). Since the time of these publications, the theory of TTF has been applied extensively to understanding the use of information systems and the consequences of this use in a broad range of personal and professional contexts.

Recent years have been characterized by a notable increase in the use of TTF as evidenced by the number of publications incorporating the theory that have appeared in peer-reviewed journals. This trend suggests growing interest in the theory and how it can be applied to understanding the problems of interest to IS researchers. As a result, the following discussion presents a brief overview of task-technology fit theory and summarizes how it has been applied in prior work. In providing a comprehensive synopsis of the current state of TTF research, this chapter offers important guidance to researchers interested in pursing research that draws on the theory. It is hoped that the resulting understanding will serve as a sound basis for new and innovative applications and extensions of TTF theory within the field of information systems as well as within other disciplines having interest in related problems.

The ensuing discussion commences with a more in-depth description of TTF theory and a synopsis of the various definitions that have been put forth to characterize the notion of TTF. Subsequent to this, a review of prior TTF research is presented that gives some insight into the breadth and depth of this research including the multiplicity of contexts in which the theory has been applied, how the notion of TTF has been measured empirically, and the key outcomes of interest to researchers that have drawn on TTF theory. The chapter closes by offering a summary framework and a brief discussion of some notable issues related to TTF research.

5.2 The Theory

The foundational premise of TTF, that outcomes depend upon the degree of fit or alignment between an information system and the tasks that must be performed, has its roots in organizational contingency theory (Galbraith 1973). In broad terms, contingency theory argues that organizational effectiveness depends upon the extent to which some feature or characteristic of an organization is in accord with the specific circumstances that the organization faces (Doty et al. 1993). Thus, organizational

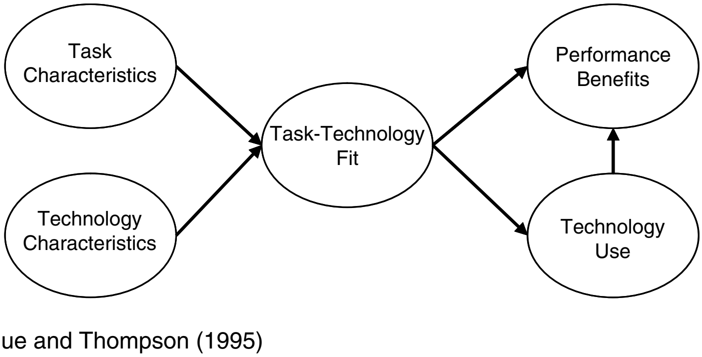

Fig. 5.1 General model of task-technology fit

performance outcomes are thought to be dependent upon the level of fit that exists, for example, between the structure of an organization and the environmental and other demands that are present. Numerous analogs to this basic premise have been introduced to the field of information systems as part of efforts to improve our understanding of phenomena such as knowledge management system satisfaction and IT outsourcing success (Becerra-Fernandez and Sabherwal 2001; Lee et al. 2004). One of the most salient of these analogs is, however, the theory of TTF. This theory has been widely used by IS researchers as well as by researchers working within a number of other disciplines.

In addition to its links with contingency theory, the development of TTF theory has drawn extensively upon prior work highlighting the importance of a suitable fit between the representation of a problem and the tasks that must be performed to solve the problem (Vessey 1991). This work suggests that representing a problem in a manner that is ill-suited to the solution process tends to increase cognitive demand and thereby undermines problem-solving performance. Building on this understanding of how performance outcomes can be negatively impacted by inadequate fit, a general model of TTF theory was formulated that asserts the need for a fit or alignment between task characteristics and the capabilities of an information system (Fig. 5.1). Despite subsequent efforts to introduce variations, refinements, and extensions to this general model, TTF theory continues to convey a relatively clear and consistent message. This message is, in essence, that technology use and performance benefits will result when the characteristics of a technology are well-suited to the tasks that must be performed (Goodhue and Thompson 1995; Zigurs and Buckland 1998). The impact of TTF on performance is posited as occurring either directly or indirectly through its impact on technology use.

Notably, the performance benefits posited by TTF can be attained at the level of individual users as well as higher-order levels such as those of the group, team, and organization. Further to this, the general premise of TTF should be regarded as being of relevance to multiple levels of analysis. It has, for example, been argued that the extent to which a technology is well-suited to a group-level task will impact group use of the technology and group-level performance. Similar arguments also exist to suggest that the extent to which a technology is well-suited to an individual level task will impact individual use of the technology and individual performance. Despite this seemingly multilevel character, the overwhelming majority of TTF research has been conducted at the individual level of analysis. Thus, there would appear to be numerous opportunities to conduct more extensive empirical research at other levels of analysis.

In exploring the use of TTF at various levels of analysis it is important for researchers to remain cognizant of the levels of analysis associated with each of the individual constructs incorporated into the theory. By incorporating task, system, individual, and group/organizational level constructs, TTF offers a theoretical mechanism for linking system and task-level phenomena to individual- and group-level outcomes. It is, however, incumbent on researchers to ensure that any transitions in levels of analysis that they posit are suitably justified and operationalized in order to ensure that their work offers substantive and meaningful results. The simplest and most prevalent approach to addressing this issue has typically been to hold the level of analysis constant by, for example, linking individual-level tasks to individual-level technology use and individual-level outcomes. Nonetheless, potentially interesting and important alternative specifications are possible that may offer valuable insights concerning such questions as how individual-level TTF yields organizational benefits.

5.3 Literature Survey and Synopsis

A literature review was conducted to elicit a comprehensive understanding of the breadth and depth of research that has sought to either develop or apply TTF theory. Two prominent literature search services (ABI Inform and EBSCO) were used to search for all peer-reviewed journal articles that specified the words task, technology, and fit either as keywords or in their abstracts. An in-depth review of the resulting set of articles was then undertaken to eliminate spurious results. Emphasis during this review was placed upon identifying only research that explicitly used or developed TTF theory rather than research that relied on general arguments suggesting a need for some form of fit or alignment. Articles that referred to TTF theory only casually or used the theory as relatively incidental support for arguments being made were also excluded from further consideration. During the review process the reference list of every article was examined to identify additional relevant articles. The reference lists of newly identified articles were similarly examined until no new articles could be found. This process ultimately resulted in the identification of a total of 81 articles that had incorporated TTF theory in a substantive manner.

Results of the literature review described in the preceding paragraph suggest considerable proliferation in the publication of research that has drawn on or extends TTF theory in recent years. Over 20 articles were, for example, noted to have been published in the 2-year period beginning in 2008 (Fig. 5.2). In general, the work published in relation to TTF can be divided into three broad categories

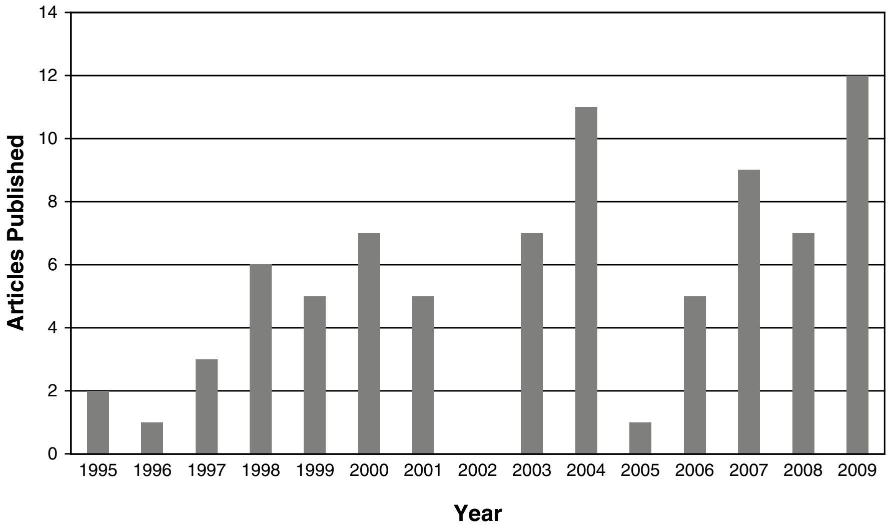

Fig. 5.2 Task-technology fit articles published by year

(Table 5.1). The first of these is individual-level survey research that has sought to apply the theory to improving our understanding of information systems adoption. Given the emphasis of this first category, it is not entirely surprising that it includes some attempts to link and integrate TTF theory to related theories of IS adoption such as the technology acceptance model (TAM) (e.g., Dishaw and Strong 1999). The second category of TTF research is the stream of work that manipulates TTF experimentally to explore the impact of fit on a range of task related outcomes. As such, this body of work is primarily interested in the performance consequences of TTF rather than whether fit contributes to system use. The final significant category of TTF research is a collection of conceptual and review-oriented articles. These articles have primarily sought to advance new theory (e.g., Zigurs and Buckland 1998) or report on some form of meta-analysis conducted in relation to TTF (Dennis et al. 2001). Interestingly, this set of articles also includes a recently published literature review, though this review seems to give only limited consideration to TTF research published subsequent to 2004 (Cane and McCarthy 2009).

5.3.1 Definition of Task-Technology Fit

Discounting minor differences that reflect some of the specific contexts to which TTF theory has been applied, most definitions of TTF tend to suggest that it represents the degree of matching or alignment between the capabilities of an information system and the demands of the tasks that must be performed (Table 5.2).

Table 5.1 Summary of prior TTF research

Research type		Example studies
Survey studies	Individual-level technology adoption or success research that measures fit via respondent perceptions	Barki et al. (2007), Chang (2008), D'Ambra and Rice (2001), D'Ambra and Wilson (2004a, b), Dishaw and Strong (1998a), Gebauer and Shaw (2004), Goodhue (1995, 1998, 1997), Goodhue and Thompson (1995), Grossman et al. (2005), Ioimo and Aronson (2003), Kacmar et al. (2009), Karimi et al. (2004), Karsh et al. (2009), Klopping and McKinney (2004), Kositanurit et al. (2006), Lam et al. (2007), Lin and Huang (2008, 2009), Lippert and Forman (2006), Lucas and Spitler (2000), Norzaidi et al. (2007), Pendharkar et al. (2001), Staples and Seddon (2004), Tjahjono (2009), Vlahos et al. (2004), Wu et al. (2007), Zhou et al. (2009)
	Individual-level technology adoption or success research that measures fit via the use of interaction or difference terms	Dishaw and Strong (1998b, 1999, 2003), Strong et al. (2006), Teo and Bing (2008)
	Other survey studies	Belanger et al. (2001), Nance and Straub (1996), Norzaidi et al. (2009)
Experimental studies	Group- or team-level research that manipulates fit to examine performance outcomes	Fuller and Dennis (2009), Goodhue et al. (2000), Murthy and Kerr (2004), Potter and Balthazard (2000), Shirani et al. (1999), Zigurs et al. (1999)
	Individual-level research	Jarupathirun and Zahedi (2007), Junglas et al. (2008), Massey et al. (2001), Mathieson and Keil (1998), Nakatsu and Benbasat (2003), Todd and Benbasat (1999), Wongpinunwatana et al. (2000)
	Other experimental studies	Hahn and Wang (2009), Wilson and Sheetz (2008)
Conceptual and/or review articles		Avital and Te'eni (2009), Baloh (2007), Benford and Hunton (2000), Cane and McCarthy (2009), Dennis et al. (2001), Goodhue (1997), Heine et al. (2003), Maruping and Agarwal (2004), Zigurs and Buckland (1998), Zigurs and Khazanchi (2008)
Other		Gebauer and Ginsburg (2009), Goette (2000), Lending and Straub (1997), Raman et al. (2006), Wu et al. (2007)

As such, researchers seeking to apply TTF would appear to have a sound basis for operationalizing its central construct. The apparent consistency in these definitions tends, however, to belie the considerable ambiguity and complexity that actually surrounds the notion of TTF. These challenges extend to all three of the

Table 5.2 Literature definitions of task-technology fit

Definition	Source	Also used by
The extent that technology functionality matches task requirements and individual abilities	Goodhue (1995, p. 1829)	Barki et al. (2007), Fuller and Dennis (2009)
The degree to which a technology assists an individual in performing his or her portfolio of tasks	Goodhue and Thompson (1995, p. 216)	Chang (2008), Goodhue (1997), Maruping and Agarwal (2004), Staples and Seddon (2004)
The matching of the functional capability of available information technology with the activity demands of the task at hand	Dishaw and Strong (1998a, p. 154)	Dishaw and Strong (2003)
The extent to which a particular task can be performed effectively and efficiently with a particular technology	Mathieson and Keil (1998, p. 222)	
User perceptions of the fit of systems and services they use based on their personal task needs	Pendharkar et al. (2001, p. 84)	
The match or congruence between an information system and its organizational environment	Klaus et al. (2003, p. 106)	
The extent to which a technology provides features and fits the requirements of the task	Lippert and Forman (2006, p. 275)	
Perceptions that system capabilities match with the user's task requirements	Jarupathirun and Zahedi (2007, p. 945)	Lin and Huang (2008)
The degree to which an organization's information systems functionality and services meet the information needs of the task	Wu et al. (2007, p. 168)	

key dimensions of the preceding definition. First, it is not especially easy to elucidate the key demands of any given task or, moreover, an entire set of tasks. Second, it can be difficult to clearly establish the most important and relevant capabilities of an information system. Finally, determining whether these capabilities actually match or align with salient task characteristics can present significant challenges. As a consequence, suitable operationalization of TTF can serve as a notable impediment to wider application of the theory. The following discussion thus examines the most prevalent approaches used to operationalize this notion in prior research.

5.3.2 *Operationalization of Task-Technology Fit*

Prior work has identified a number of alternative approaches that might be used to empirically operationalize the notion of TTF. Although these approaches generally fall into one of six distinct categories (Venkatraman 1989), TTF research has typically

Table 5.3 Correspondence between dimensions in two alternative measures of TTF

Goodhue and Thompson (1995)	Goodhue (1995, 1998)
Data quality	Currency, right level of detail
Data locatability	Locatability, meaning
Authorization to access data	
Data compatibility	Compatibility, confusion
Ease of use/training	Ease of use of hardware and software
Production timeliness	
Systems reliability	Systems reliability
IS relationship with users	
	Assistance
	Accessibility
	Accuracy
	Presentation

adopted one of only two approaches (Junglas et al. 2008). The first approach sees fit as being represented by a match between tasks and the capabilities of an information system. As such, this approach measures fit directly rather than constructing fit measures from other variables and it is this approach that has dominated survey-based TTF research. The second approach argues that fit can be assessed by evaluating the extent to which a technology deviates from a theoretically grounded profile of ideal characteristics. This approach has been used primarily in the context of group support systems research where ideal capabilities can be derived based on such things as the communication needs associated with the task to be performed (e.g., Zigurs and Buckland 1998).

Some of the complexities associated with operationalizing TTF can be avoided by adopting a fit-as-match perspective. In its most basic form, such an operationalization can simply ask users to indicate whether an information system is well-suited to the tasks they must perform (e.g., Lin and Huang 2008). Alternatively, it is possible to identify specific information system capabilities such as reliability and compatibility and then measure the extent to which users perceive task fit on each of these dimensions (e.g., Goodhue 1995; Goodhue and Thompson 1995). Utilizing this latter approach, Goodhue and Thompson (1995) developed a measure of TTF consisting of eight information system capability dimensions. Task fit with these capability dimensions was then measured using a seven-point scale ranging from strongly disagree to strongly agree. Similarly, Goodhue (1995, 1998) developed and validated a measure of IS user satisfaction consisting of 12 dimensions that roughly correspond to the eight dimensions identified by Goodhue and Thompson (Table 5.3). Although these measures have undergone numerous modifications to suit the purpose of particular studies, they do provide relatively comprehensive instruments for measuring user perceptions of TTF.

Given the ability of the fit-as-match approach to simplify operationalization of the TTF construct, it is perhaps not surprising that TTF measures relying on it have been widely used. Such measures are, however, not without important limitations. Notably, they tend to be best suited to survey based research, they depend on individuals being able to effectively evaluate fit, and they cannot typically be used to evaluate TTF prior to actual system use. Thus, despite widespread use of the fit-as-match approach in individual-level survey research, only limited application of this approach can be observed in group-level studies or in studies that employ alternative methodologies. In particular, experimental studies have tended to rely on the fit-as-profile approach to operationalizing TTF. This approach requires that a set of technology characteristics considered to provide preferred or ideal support for a particular task be identified and theoretically justified. The extent to which these characteristics are present in a technology is then considered to represent the level of fit that the technology has for the specified task. Operationalizing TTF then involves experimentally manipulating the extent to which a technology provides the ideal set of characteristics (e.g., Murthy and Kerr 2004).

Although fit-as-match and fit-as-profile are the most common approaches to operationalizing TTF, a limited set of studies have attempted to employ alternative approaches. Among the more salient of these are the small group of studies that have incorporated interactions between measures of task characteristics and measures of technology characteristics as measures of TTF (e.g., Strong et al. 2006). Thus, for example, a TTF variable might be constructed as the product of a measure of a task characteristic and the measure of a corresponding information system capability. Notable challenges are, however, presented in relation to the need to determine which task and technology measures should be interacted to produce appropriate fit variables. Care is, for example, warranted in constructing interaction terms between measures of system reliability and characteristics of a task that do not require reliability. Thus, identifying suitable interactions and theoretically justifying each one can be quite complex. As a result, the generalizability of this form of fit measure can be limited, thereby imposing some constraint on the extent to which such interactions have been applied. Nonetheless, limited reliance on the use of other approaches to operationalizing TTF suggests that there is at least some potential for future research that aims to explore the relative merits of these alternatives.

5.3.3 Research Contexts Employed by TTF Research

Although researchers generally attempt to control for contextual factors, it is particularly important that TTF researchers pay attention to their research context given that their theoretical foundation emphasizes the need for a fit between the capabilities of an information system and the specific tasks that must be performed. Context can be expected to have significant implications for both the nature of the tasks that must be performed and the information system capabilities that are available.

To date, TTF theory has been applied in a broad range of research contexts (Table 5.4). Despite the apparent diversity of research contexts observed in this research, it is important to note that the overwhelming majority of experimental research has been conducted with student subjects. Given the many and varied differences between the tasks faced in such contexts and those faced in organizational

Table 5.4 TTF research contexts

Research design	Study context	Researchers
Case study	ERP implementation at medium-sized sporting goods manufacturer	Wu et al. (2007)
Case study	Mobile information system implementation at a Fortune 100 company	Gebauer and Shaw (2004)
Content analysis	Mobile information system use	Gebauer and Ginsburg (2009)
Experiment	Students performing brainstorming tasks	Shirani et al. (1999)
Experiment	Students performing database-related tasks	Goodhue et al. (2000), Mathieson and Keil (1998)
Experiment	Students performing decision tasks	Fuller and Dennis (2009), Jarupathirun and Zahedi (2007), Todd and Benbasat (1999), Wongpinunwatana et al. (2000)
Experiment	Students performing negotiation tasks	Potter and Balthazard (2000)
Experiment	Students performing problem-solving tasks	Murthy and Kerr (2004), Nakatsu and Benbasat (2003)
Experiment	Students performing tasks with mobile information systems	Junglas et al. (2008)
Experiment	Use of groupware by global virtual teams	Massey et al. (2001)
Experiment	Use of knowledge sharing sites	Hahn and Wang (2009)
Interviews	Individuals with disabilities using voice recognition technology	Goette (2000)
Interviews	Student/faculty use of information systems	Lending and Straub (1997)
Survey	Airline traveler use of the Internet	D'Ambra and Wilson (2004a, b)
Survey	Information systems use by telecommuters working at six organizations	Belanger et al. (2001)
Survey	Knowledge management system use	Lin and Huang (2008, 2009), Teo and Bing (2008)
Survey	Mobile information system use	Ioimo and Aronson (2003), Lee et al. (2007)
Survey	Professional users of UML	Grossman et al. (2005)
Survey	Software developers from multiple organizations	Dishaw and Strong (1998a, b, 1999, 2003), Kacmar et al. (2009)
Survey	Student/faculty use of information systems	Goodhue et al. (1997), Klaus et al. (2003), Klopping and McKinney (2004), Staples and Seddon (2004), Strong et al. (2006), Wilson and Sheetz (2008)
Survey	Supply chain system use by automotive suppliers	Lippert and Forman (2006)
Survey	Technology use at Malaysian port organizations	Norzaidi et al. (2009, 2007)
Survey	Technology use in hotels	Lam et al. (2007), Zhou et al. (2009)

(continued)

Table 5.4 (continued)

Research design	Study context	Researchers
Survey	Technology users from multiple medium and large organizations	Goodhue (1995, 1998), Goodhue and Thompson (1995), Kositanurit et al. (2006), Nance and Straub (1996), Vlahos et al. (2004), Wu et al. (2007)
Survey	Use of a product testing system by manufacturing employees	Tjahjono (2009)
Survey	Use of online auction sites by consumers	Chang (2008)
Survey	Use of technology in health-care organizations	Karsh et al. (2009), Pendharkar et al. (2001)

contexts, there would seem to be considerable opportunity for researchers interested in conducting field experiments. The relatively circumscribed nature of the tasks performed for the majority of the experimental research that has been conducted also suggests opportunities for researchers interested in exploring the nature of TTF across a broader spectrum of tasks.

In contrast with the experimental studies that have been performed, survey based TTF research has been conducted in a wide range of organizational contexts. This work has, however, tended to be based on different research model specifications and inconsistent construct measures. Consequently, there is some room for more work that aims to explore the nature of task-technology fit across contexts using a consistent measure of TTF and a single research model. Such efforts hold the promise of providing a relatively generalizable understanding of TTF that might be more readily applied to other contexts. Initiatives of this sort can also provide valuable insights concerning how a wide range of contextual factors might impact the nature of TTF.

In comparison to more quantitatively oriented survey and experimental studies, relatively little attention has been given to examining TTF using qualitative techniques such as interviews and case studies. However, the work that has been conducted has generally relied on interviews with individual users to elicit some understanding for the nature and importance of TTF in the context being examined. Despite the seemingly limited use of qualitatively oriented research methods, these techniques have been applied in a diverse array of contexts that range from the use of an Enterprise Resource Planning (ERP) system in a mid-sized organization to the use of a voice recognition system by people with disabilities.

5.3.4 Key Outcomes of Interest to TTF Researchers

Two of the more salient outcomes of interest to IS researchers are the extent to which information systems are used and the performance benefits that such use provides (DeLone and McLean 1992). In accordance with this understanding, TTF theory offers an account of both outcomes at multiple levels of analysis. As such, it is well-positioned to provide a comprehensive understanding of the value of information systems and how this value is derived. There has, however, been a notable bifurcation in the particular emphasis placed on each of these two outcomes. Almost since the origins of the theory, a clear distinction can be observed between survey research conducted at the individual level of analysis and experimental work conducted at the individual and group or team level. Survey research has typically focused on individual decisions to adopt and use information systems, thus emphasizing system use as the key dependent variable. In contrast, experimental research has emphasized performance benefits by seeking, predominately, to improve our understanding of how technology characteristics that provide support for tasks such as brainstorming, decision making, and problem solving can improve a range of performance outcomes.

Given the nature of prior work, there are many opportunities for research that aims to better integrate the two key outcome variables when exploring TTF. Such efforts can draw on the growing body of literature that defines and elaborates upon the nature of information systems use (e.g., Barki et al. 2007; Burton-Jones and Gallivan 2007) as well as work that seeks to provide some understanding of individual, group, and organizational performance (e.g., Stock 2004). As a further basis for such effort, Table 5.5 offers a summary of the specific outcomes that have been examined in prior TTF research. Although this table highlights the salience of system use as a key outcome in survey research, it also draws attention to the wide range of performance outcomes that have been explored through experimental research and the extent to which prior survey research has attempted to link TTF theory to the TAM constructs of perceived ease of use and perceived usefulness.

5.3.5 Summary Framework

A summary framework of TTF research was constructed (Fig. 5.3) based on the preceding review in an effort to highlight the key constructs and relationships that have been explored in the TTF literature (Table 5.1). It is important to note that Fig. 5.3 is offered as a graphical overview of the forms of relationships that have been examined in prior research rather than as a research model with associated hypotheses. Nonetheless, examination of Fig. 5.3 suggests that a great deal of the TTF research that has been conducted has tended to remain closely linked to the essence of TTF theory. The five key constructs found in the General Model of Task-Technology Fit (Fig. 5.1) and the interrelationships between them continue to be reflected in Fig. 5.3 as is illustrated by the shaded boxes and bold line relationships in this figure.

Figure 5.3 serves to highlight the challenges surrounding levels of analysis that must be resolved to effectively advance TTF research. For example, there would seem to be some value in improving our explanations of how individual level TTF

Table 5.5 Key direct outcomes empirically examined in TTF research

Research design	Outcomes	Researchers
Case study	System use/intention to use	Gebauer and Shaw (2004)
Content analysis	Opinions regarding a technology	Gebauer and Ginsburg (2009)
Experiment	Appropriation changes made	Fuller and Dennis (2009)
Experiment	Decision efficiency	Jarupathirun and Zahedi (2007)
Experiment	Decision quality	Fuller and Dennis (2009), Jarupathirun and Zahedi (2007)
Experiment	Decision strategy employed	Todd and Benbasat (1999)
Experiment	Joint profit attained	Potter and Balthazard (2000)
Experiment	Number of ideas generated	Shirani et al. (1999)
Experiment	Quality of solution	Hahn and Wang (2009), Shirani et al. (1999)
Experiment	Satisfaction with decision	Jarupathirun and Zahedi (2007), Wongpinunwatana et al. (2000)
Experiment	Satisfaction with technology	Jarupathirun and Zahedi (2007)
Experiment	Task accuracy	Goodhue et al. (2000), Mathieson and Keil (1998), Wongpinunwatana et al. (2000)
Experiment	Task completion time	Fuller and Dennis (2009), Goodhue et al. (2000), Junglas et al. (2008), Mathieson and Keil (1998)
Interviews	System use/intention to use	Goette (2000), Lending and Straub (1997)
Survey	Ability to perform tasks	Karsh et al. (2009)
Survey	Attitude toward system use	Staples and Seddon (2004)
Survey	Interest in access to additional technology resources	Goodhue et al. (1997)
Survey	Job performance	Belanger et al. (2001), Goodhue and Thompson (1995), Kositanurit et al. (2006), Norzaidi et al. (2009), Norzaidi et al. (2007), Staples and Seddon (2004), Teo and Bing (2008)
Survey	Perceived ease of use	Chang (2008), Dishaw and Strong (1999), Klopping and McKinney (2004), Tjahjono (2009), Wu et al. (2007)
Survey	Perceived playfulness	Chang (2008)
Survey	Perceived risk	Chang (2008)
Survey	Perceived usefulness	Chang (2008), Dishaw and Strong (1999), Klopping and McKinney (2004), Norzaidi et al. (2009, 2007), Tjahjono (2009), Wu et al. (2007)

(continued)

Table 5.5 (continued)

Research design	Outcomes	Researchers
Survey	Perception that technology increases career development opportunities	Lippert and Forman (2006)
Survey	Satisfaction with technology	Staples and Seddon (2004)
Survey	Satisfaction with work environment	Belanger et al. (2001)
Survey	System use/intention to use	D'Ambra and Wilson (2004a, b), Dishaw and Strong (1998a, b, 1999, 2003), Goodhue et al. (1997), Goodhue and Thompson (1995), Klopping and McKinney (2004), Kositanurit et al. (2006), Lam et al. (2007), Lin and Huang (2008, 2009), Nance and Straub (1996), Norzaidi et al. (2009, 2007), Strong et al. (2006), Teo and Bing (2008), Wu et al. (2007)
Survey	Task performance	D'Ambra and Wilson (2004a, b), Goodhue et al. (1997), Karsh et al. (2009); Klaus et al. (2003), Murthy and Kerr (2004), Nakatsu and Benbasat (2003)
Survey	Technology trust	Lippert and Forman (2006)

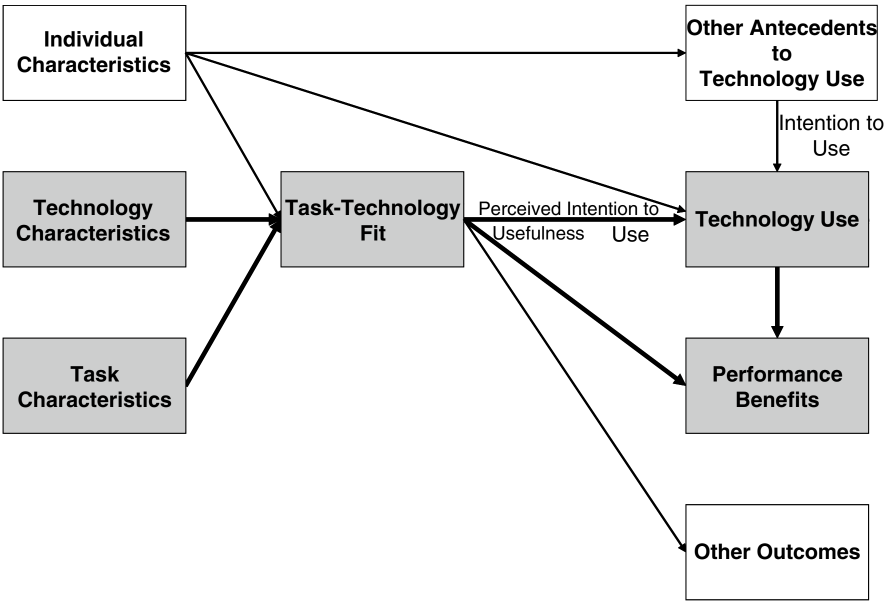

Fig. 5.3 A summary framework of TTF research

leads to organizational performance benefits. The literature has, thus far, tended to rely on user perceptions of performance such as perceptions of whether a technology improves productivity. Similarly, Fig. 5.3 draws attention to the general lack of consideration for the impact that organizational and environmental factors might have on TTF. As noted previously, the fundamentally contingent nature of TTF theory calls for greater attention to such factors. Efforts to identify relevant organizational and environmental factors might also help to more clearly establish TTF as a multilevel theory that is equally applicable at the individual, group, and organizational levels of analysis.

5.4 Discussion

The preceding review offers a brief summary of TTF theory and an overview of prior work conducted in relation to this theory. Results of the review suggest that a significant divide exists between work that examines individual-level IS adoption via survey instruments and work that examines team- or group-level performance via laboratory experiments. Thus, it is useful to ask whether experimental findings hold in the field and whether survey results can be refined or extended through the use of alternative methodologies. It is likely, however, that efforts to address such questions will require more extensive examination and specification of what it means for task characteristics to fit with technology characteristics. Greater clarity on this issue can also be expected to facilitate field experiments and support the development of TTF measures that can be employed before a system has actually been used.

Although there is some evidence to suggest that users can effectively evaluate TTF (Goodhue et al. 2000), their ability to do so in advance of system use seems quite limited. Hence, there would seem to be considerable opportunity to explore how TTF can be more fully operationalized in the absence of user evaluations of this notion. Such approaches to evaluating TTF are likely to be of more value to those who must develop and implement new information systems than measures that rely on post hoc user assessments. Further to this, interested researchers may wish to compare the utility of alternative approaches to measuring TTF including perceptual measures, measures based on interaction terms, and fit as defined by theory.

A review of prior TTF research indicates that further effort to better understand the relationships that may exist between individual-, group-, and organizational-level TTF could be of significant value given the potential that TTF has in relation to multilevel and cross-level theory development (Rousseau 1985). Owing to the nature of the core constructs associated with the theory, it offers a potentially important, theoretically grounded mechanism by which task- and technology-level constructs might converge and cross levels to yield individual-, group-, and team-level outcomes. However, relatively limited attention has thus far been directed toward fully exploring this aspect of the theory with, for example, the notion of organizational-level TTF having been essentially unexplored.

As a final note, it is perhaps useful to highlight for prospective researchers that in some cases the tasks to be performed may be endogenous to the technology that is used (Vessey and Galletta 1991). For example, the nature of a particular task can be fundamentally altered by the presence of technology and it can therefore be somewhat difficult to assess fit except, perhaps, in a post hoc sense. Similarly, the capabilities of a technology can be adapted through use and, further to this, research suggests that the capabilities offered by a technology impact how individuals and groups choose to accomplish a given task (Fuller and Dennis 2009). Thus, once again, task and technology become somewhat inseparable. Nonetheless, there is some merit in research that attempts to assess the extent to which such effects occur in practice and the implications that they have for TTF theory and for the implementation and use of information systems in general.

5.5 Conclusion

The preceding discussion has sought to provide a succinct summary of TTF theory, identify the key constructs and relationships posited by the theory, and summarize prior work with a view toward fostering future research initiatives. Although this prior work provides a sound basis for future inquiry, a number of opportunities exist to better link the experimental and survey-based streams of research, to more fully explore the use of TTF theory at multiple levels of analysis, and to examine the character and operationalization of TTF in more depth. Readers are thus encouraged to undertake these and other initiatives in an effort to build upon an important theory that is strongly rooted within the field of information systems.

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Chapter 6
Migrating Processes from Physical to Virtual Environments: Process Virtualization Theory

Eric Overby

Abstract Increasingly, processes that have relied on physical interaction between people, and between people and objects are being migrated to virtual environments in which physical interaction is not available. For example, medical processes that have traditionally relied on physical interaction between physician and patient are conducted virtually through telemedicine, and shopping processes that have traditionally relied on physical interaction between shoppers and products are conducted virtually via electronic commerce. I refer to this migration as *process virtualization*. Although the pace of process virtualization is accelerating, some processes have proven more suitable for virtualization than others. Process virtualization theory is a recently proposed theory designed to explain this variance. This chapter describes the theory by defining terms, discussing the constructs and relationships of the theory that explain and predict how suitable a process is to being conducted virtually, and discussing how the theory fits into the Information Systems discipline.

Keywords Process • Virtual • Virtualization • Information systems • Theory

Abbreviations

IS	Information Systems
IT	Information Technology
TAM	Technology Acceptance Model

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6.1 Introduction

Why was the book-buying process so readily migrated from physical stores to the Internet, while the grocery-buying process was not?
Why is distance learning better suited for some courses and degree programs than others?
Why are some medical processes being handled via telemedicine, while others still require a physical visit to the doctor's office?
Which business and societal processes will be migrated to virtual environments in the future, and which will remain rooted to the physical world?

Business and society are becoming increasingly digital, as processes in fields ranging from business to medicine to education are being transitioned from physical to virtual environments based on information technology. For example, educational processes once confined to a physical classroom are being conducted virtually via distance learning, commercial exchange processes once limited to physical stores and markets are being conducted virtually via electronic markets, and interpersonal relationship processes once reserved for face-to-face encounters are being conducted virtually via online social networks and virtual worlds. Despite the steady migration of physical processes to virtual environments, some processes have proven to be more suitable for virtualization than others. Process virtualization theory is a recently proposed theory designed to explain this variance (Overby 2008). Process virtualization theory proposes a set of constructs and relationships to explain and predict how suitable a process is to being conducted in a virtual environment. The theory is designed to help practitioners and researchers understand transitions from the physical to the virtual as they are occurring as well as to predict them before they occur. It is designed to help answer the type of questions presented above.

This chapter describes process virtualization theory, including definitions (Sect. 2); an overview of the theory including constructs, relationships, comments regarding empirical testing, and examples (Sect. 3); and a discussion of how the theory fits within the Information Systems discipline (Sect. 4).

6.2 Definitions

A *process* is defined as a set of steps to achieve an objective. For example, consider a routine physical examination with a doctor as a process. The objective of this process is to ensure that a patient is in good health, and the steps involved include scheduling an appointment, conducting tests, asking and answering questions, arranging payment, etc. Many processes can be conducted either physically or virtually. A *physical process* involves physical interaction between people or between people and objects. Traditionally, the doctor visit process has been a physical process; patient and doctor are collocated at a physical clinic or hospital in which they interact. A *virtual process* is a process in which the physical interaction between the people and/or objects *in the physical process* has been removed. The emphasis on "in the physical process" is necessary because virtual processes tend to require that participants interact with a physical interface device such as a computer, telephone, etc. Thus, virtual processes are not completely devoid of physical interaction, but they are devoid of the physical interaction that characterizes the physical process. To continue with the doctor visit example, this process may be conducted virtually via telemedicine technologies that permit the doctor to examine the patient with no physical interaction. The transition from a physical process to a virtual process is referred to as *process virtualization*. Other examples of processes that may be virtualized include educational processes (which can be conducted physically in traditional classrooms or virtually via distance learning), shopping processes (which can be conducted physically at stores or virtually via electronic commerce), friendship development processes (which can be conducted physically at parties or virtually in chat rooms), and team processes (which can be conducted physically around a conference table or virtually via collaboration software).

The definition of "process" is broad and designed to apply not only to business processes such as product development or inventory management, but also to nonbusiness processes such as learning a new language or going on a date. This broad treatment is appropriate for the IS discipline, as a significant portion of IS researchers do not reside within a business or management department and do not focus only on business issues.

The definition of "virtual" is designed to describe the absence of physical interaction between people or between people and objects. This definition is consistent with that often used in the context of virtual teams. For example, Fiol and O'Connor (2005) argued that the degree to which a team is virtual is determined by the extent of physical, face-to-face interaction among team members, not by the geographical dispersion of team members or the use of technology to mediate interactions. Dispersion and technology use may be characteristic of being virtual, but they are not determinants of it.

This illustrates that process virtualization is not inherently an IT-based phenomenon; for example, correspondence courses have allowed students to take formal education courses without physical interaction with instructional materials, instructors, or other students since at least the nineteenth century (Holmberg 2005). A physical process can be virtualized either with or without information technology. For example, consider the process of buying a book, which has traditionally involved physical interaction between buyers and books as well as between buyers and clerks/salespeople. One way to virtualize this process is through a paper-based catalog, which allows buyers to purchase books without physical interaction with the books or a clerk/salesperson. Another way to virtualize the process is through an Internet website, such as that provided by Amazon.com. In the first case, the process is virtualized via a paper-based mechanism; in the second case, the process is virtualized via an IT-based mechanism. This illustrates that processes may be virtualized via different *virtualization mechanisms*, defined as the means by which a process is made virtual. Most contemporary virtualization

Table 6.1 Distinction between virtualization and automation in the book-buying process

Task	Responsible actor in the physical process	Responsible actor in the virtual process	Virtualized/ Automated
Perusing books	Customer	Customer	Virtualized
Making payment	Customer	Customer	Virtualized
Recommending books	Salesperson	Amazon.com collaborative filtering system	Virtualized and automated
Collecting payment	Salesperson	Amazon.com payment processing system	Virtualized and automated

mechanisms are based on IT, but IT is not a requirement for process virtualization. Recognizing that processes can be virtualized with or without IT creates an opportunity for the IS discipline to explicate the theoretical role that IT plays in process virtualization. This helps address a research gap identified by Orlikowski and Iacono (2001, p. 132), who stated: "If … we believe that information technology can and does matter – in both intended and unintended ways – we need to develop the theories and do the studies that show … how and why this occurs." One objective of process virtualization theory is to show the "how and why" called for by Orlikowski and Iacono and to explain why the recent proliferation of virtual processes is occurring in parallel with advances in the power and accessibility of information technology.

The definition of "virtual" should not be confused with the use of the term as it relates to computer architecture. In other words, process virtualization should not be confused with server virtualization, operating systems virtualization, etc.

The last definitional point is that process virtualization encompasses process automation. To see the relationship, consider that processes are composed of: (a) tasks, which are the steps involved in the process, and (b) actors, who are the people who complete the steps. When a task is virtualized, it may also be automated, but it does not have to be. If it is automated, then the actor who was responsible for the task in the physical process is replaced by an information system. If the task is not automated, then the actor maintains responsibility for the task. For example, consider the following reductionist version of the book-buying process and how Amazon.com has virtualized it. Assume that the process has two actors, a customer and a salesperson//clerk, both of whom engage in tasks. The customer peruses books and makes payment, while the salesperson recommends books and collects payment. Amazon has *virtualized* each of these tasks by allowing them to be completed without physical interaction with the books or between the customer and salesperson. Amazon has *automated* the book recommendation and payment tasks by replacing the salesperson actor with Amazon's information systems. However, it has not automated the book perusal task, the responsibility for which still lies with the customer. Thus, the entire process has been virtualized, but only certain tasks within it have been automated. This is illustrated in Table 6.1.

6.3 Process Virtualization Theory: Constructs and Relationships

Process virtualization theory is based upon the premise that some processes are better suited for being conducted virtually than others. For example, the process of shopping for books has proven well-suited to virtualization, whereas the process of shopping for groceries has proven less so. In other words, not all processes are equally virtualizable. Process virtualization theory seeks to explain this variance. This provides a theoretical framework to predict which processes are likely to be conducted virtually in the future (and why), as well as to explain the level of success achieved by current and historical process virtualization initiatives.

This section describes process virtualization theory. Much of this section is drawn directly from Overby (2008), which is the article in which the theory was first proposed. Readers interested in more detail on the theory's original construction, including justification of the constructs and propositions, are referred there. I also use this section to update process virtualization theory to correct issues with the theory as originally proposed and to clarify how the theory should be used in practice and for empirical testing.

6.3.1 Dependent Variable

Process virtualization theory explains which factors affect how suitable a process is to being conducted virtually. The dependent variable in process virtualization theory is *process virtualizability*, which describes how suitable a process is to being conducted after the traditional physical interaction between people or between people and objects has been removed. Operationally, process virtualizability can be measured in two ways. First, it can be measured as adoption/use of the virtual process. For example, the widespread adoption and use of electronic mail has shown that many communication processes are virtualizable. Second, it can be measured as the quality of the outcomes of the virtual process. For example, if the output of virtual teams is as good as that of physical face-to-face teams, then this would provide evidence that many team processes are virtualizable.

6.3.2 Independent Variables

The independent variables of process virtualization theory can be divided into two categories: (a) characteristics of the process and (b) characteristics of the virtualization mechanism.

6.3.2.1 Characteristics of the Process

The independent variables that represent characteristics of the process are sensory requirements, relationship requirements, synchronism requirements, and identification and control requirements. Each of these constructs is proposed to have a negative effect on process virtualizability, ceteris paribus. In other words, as each of these requirements increases, the process becomes less suited to virtualization.

Sensory requirements refer to the need for process participants to be able to enjoy a full sensory experience of the process and the other process participants and objects. Although virtual processes may simulate the sensory experiences inherent to the physical process, they may fall short of capturing them in their full essence. For example, the sensory aspects associated with seeing, touching, and smelling products have been identified as a barrier to the virtualization of many shopping processes, particularly those involving food and other agricultural products for which the perceived need to touch, smell, taste, etc. is high (Kambil and van Heck 1998; Ramus and Nielsen 2005). *Relationship requirements* refer to the need for process participants to interact with each other in a social or professional context. Although it is possible for processes with high relationship requirements to be virtualized (there are several examples of relationships forged in virtual environments), research suggests that relationships developed purely in virtual environments tend to be weaker, less developed, and/or more fleeting than corresponding relationships developed in physical environments (Jarvenpaa and Leidner 1999; Mesch and Talmud 2006; Parks and Roberts 1998). This suggests high relationship requirements will cause a process to be resistant to virtualization, ceteris paribus. *Synchronism requirements* refer to the degree to which the activities that make up a process need to occur quickly with minimal delay. Synchronism typically comes “for free” in a physical process, because physical process participants and objects are all collocated and can therefore interact with little delay. Conversely, virtual processes are often conducted asynchronously because participants and objects are in different locations, which can create delays in the process. For example, a key reason why many shopping processes continue to be conducted physically is the need for the shopper to take immediate ownership of the product, rather than wait for it to be shipped (Wigand and Benjamin 1995). (This would not apply for digital goods that can be downloaded.) *Identification and control requirements* refer to the degree to which process participants require: (a) identification of other process participants, and (b) the ability to exert control over their behavior. Virtual processes are susceptible to identity spoofing and control problems because participants cannot physically inspect others to confirm their identity. Identification and control problems have hindered the virtualization of several processes, including relationship development processes (where participants can conceal their identities, which in extreme cases, results in predation and acts of violence (Dombrowski et al. 2004)) and shopping processes (where buyers may have difficulty identifying the seller as a legitimate provider (Ba and Pavlou 2002; Dellarocas 2005)).

6.3.2.2 Characteristics of the Virtualization Mechanism

The independent variables that represent characteristics of the virtualization mechanism are representation, reach, and monitoring capability. Although these constructs may operate for any virtualization mechanism, they are proposed specifically for IT-based virtualization mechanisms, given that most contemporary virtual processes (e.g., electronic commerce, online social networks, telemedicine, etc.) are based on IT. Representation and reach are proposed to have a positive effect on process virtualizability, ceteris paribus, while the effect of monitoring capability is equivocal and depends on the process under investigation. In addition to the main effects, each of these constructs has a moderating effect on the relationship between the process characteristic variables and process virtualizability.

Representation refers to IT's capacity to present information relevant to a process, including simulations of actors and objects within the physical world, their properties and characteristics, and how we interact with them. For example, representation allows many sensory requirements such as sight and sound (and to a lesser degree, touch, taste, and smell) to be replicated in IT-based virtual processes (Steuer 1992; Suh and Lee 2005). *Reach* is IT's capacity to allow process participation across both space and time (Broadbent et al. 1999; Evans and Wurster 2000). Reach allows flexible participation in processes across the globe. *Monitoring capability* is IT's capacity to authenticate process participants and track activity (Zuboff 1988). Authentication systems such as ID/password combinations, digital certificates, and biometric tokens capture who is participating in a process, and associated database entries capture what these participants are doing and when.

Main effects: Representation and reach are each posited to have a positive main effect on process virtualizability. First, if a virtualization mechanism has powerful *representation* capabilities, then the process to which it is being applied will be easier to virtualize than if the mechanism had weak representation capabilities. Second, some virtualization mechanisms may provide better *reach* than others. A virtual process with extended reach is more likely to be useful to a greater number of people than one with limited reach, thereby increasing its adoption and use (which is one measure of process virtualizability, along with quality of outcomes).

The main effect of *monitoring capability* is equivocal and likely to depend on the empirical context to which the theory is applied. In some cases, enhanced monitoring capability may create a level of process accountability that leads to improved outcomes, thereby enhancing process virtualizability. In other cases, enhanced monitoring capability may cause people to reject the virtual process because they do not want their actions monitored, thereby hindering process virtualizability. Monitoring capability arguably plays more of a role in the theory as a moderator than as a main effect (see below).

Moderating effects: In addition to their main effects, the characteristics of the virtualization mechanism also moderate the relationship between the characteristics of the process and process virtualizability.

First, *representation* moderates the relationships between sensory requirements and process virtualizability as well as between relationship requirements and

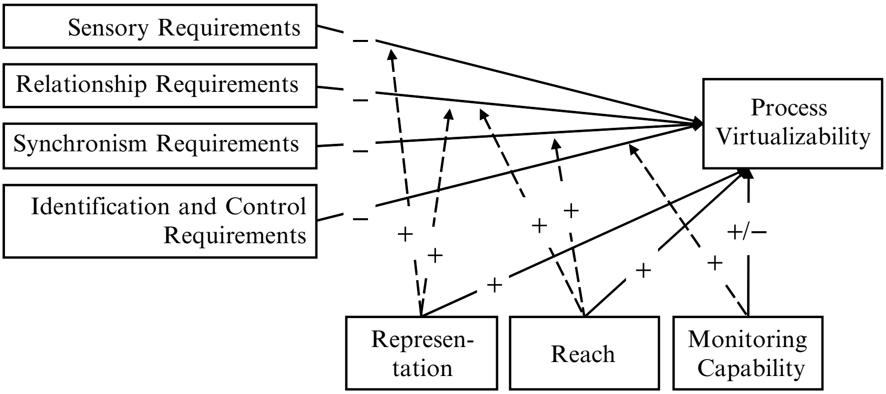

Fig. 6.1 Illustration of constructs and proposed relationships of process virtualization theory

process virtualizability. A process with high sensory requirements will be more difficult to virtualize than a process with low sensory requirements as described above. However, if the virtualization mechanism is able to provide high-fidelity representations of sensory experiences (e.g., through visual, auditory, haptic, and olfactory interface technologies), then the negative relationship between sensory requirements and process virtualizability will be attenuated. Also, representation permits rich personal profiles to be created and shared in IT-based virtual processes (e.g., Hitsch et al. 2010). This makes it easier to fulfill relationship requirements within virtual processes, creating a moderating effect between relationship requirements and process virtualizability.

Second, *reach* moderates the relationships between relationship requirements and process virtualizability as well as between synchronism requirements and process virtualizability. Reach allows an increased number of people to participate in a process, which provides additional opportunities for relationship development (McKenna and Bargh 2000). For example, online dating sites expand the reach of people looking for new relationships. This makes it easier to fulfill relationship requirements in the virtual process, creating a moderating effect on the relation between relationship requirements and process virtualizability. Reach also permits people who are not physically collocated to participate in a process at the same time (Alavi et al. 1995), for example, via real-time instant messaging, which creates a positive moderating effect on the relation between synchronism requirements and process virtualizability.

Third, *monitoring capability* moderates the relationship between identification and control requirements and process virtualizability. IT-based authentication systems facilitate identifying who is engaging in a virtual process, IT-based rights management systems facilitate controlling the tasks participants are authorized to conduct, and database records of participant activity make it easier to audit participant behavior.

Figure 6.1 illustrates the constructs and proposed relationships of process virtualization theory.

6.3.3 Clarifications and Adjustments to Process Virtualization Theory

The following describes three clarifications and adjustments to process virtualization theory as it was originally proposed.

First, the moderating effects associated with representation, reach, and monitoring capability constructs were discussed in the article that originally proposed process virtualization theory, but the main effects were not. Because most empirical applications of process virtualization theory will require estimating both the main and moderating effects of these constructs (e.g., see Aiken and West 1991), I have used the space above to suggest the likely direction of the main effects.

Second, the identification and control construct as originally proposed is multidimensional, consisting of both an identification dimension and a control dimension. This is not a problem in and of itself, but it does differ from the other constructs proposed in the theory. One advantage of modeling the construct in this way is parsimony, as the identification and control dimensions are linked conceptually (see the definition of the overall construct given above) and their main effects are similar. Also, the monitoring capability construct moderates both the identification dimension and the control dimension in a similar fashion. However, for any particular empirical application, it may make sense to model these two dimensions as separate constructs.

Third, process virtualization theory is meant to be a broad theory that is applicable to multiple domains, ranging from business to medicine to education to political science. In order to achieve this breadth, the theory must maintain a delicate balance. On the one hand, it should include constructs that play a major role in multiple contexts to ensure that the theory has explanatory power in a broad range of fields. On the other hand, it should *not* include constructs that are specific to a single context or that operate only within a limited number of contexts, because this would lead to a proliferation of constructs and make the theory less parsimonious.

The points raised in the preceding paragraph were discussed in the original formulation of the theory, although most of the focus was placed on why constructs that are highly specific to individual domains are not included in the theory. The example used was the research on virtual teams which has shown that factors such as governance and organizational norms influence the virtualizability of team processes (Fiol and O'Connor 2005; Staples et al. 1999). Because these factors do not apply outside of a group or organizational context, they are not included in the theory. Thus, the explanatory power of the theory can be improved by adding variables specific to an empirical context. The other point regarding the need to include constructs that play a large role in multiple contexts was alluded to but not fully discussed. For example, sensory requirements will be an important dominant determinant of process virtualizability for processes within many domains, including those related to shopping, interpersonal relationships, and medicine. Thus, it seems appropriate to include as a construct in the overall theory. However, sensory requirements may have no explanatory power for processes within other domains, such as banking and software development. For research in these domains, it may make little sense to measure the importance of smelling, tasting, hearing, etc. items such as financial instruments and software code. Thus, it is not necessary (and at times may be awkward) for researchers to use the exhaustive set of constructs and relationships when applying process virtualization theory to a specific empirical research question.

6.3.4 Comments on Empirical Testing

Due to its newness, empirical testing of process virtualization theory is nascent. Although the theory can be used in conjunction with multiple empirical methods, the theory is likely to be particularly useful for survey research which uses psychometric methods to measure the theory's constructs. It is unlikely that a single set of psychometric items will emerge, however, because of the breadth of the theory. Instead, items will need to be tailored to the research domain (e.g., telemedicine, electronic commerce, distance learning) being examined. To test process virtualization theory in this fashion, researchers should identify the process of interest, identify a suitable context and sample in which to examine the process, develop appropriate items to measure the constructs, and conduct a survey. This permits testing of whether and how well the theory can explain the virtualization of the chosen process.

An alternative approach to testing the theory is to examine multiple processes, perhaps by asking a panel of experts to comment on them. For example, the panel might examine processes which have proven differentially virtualizable and determine whether this variance can be explained by the constructs of the theory. This method will provide breadth by permitting the examination of multiple processes, but only as much depth as can be accommodated by the panel. For example, the more processes examined, the less likely each panelist will be qualified to comment on any given process. Essentially, the first approach can be thought of as providing ample depth on a process but little breadth across processes, while the second approach can be thought of as providing ample breadth across processes but little depth within a process.

6.3.5 Illustration

Two personal shopping processes provide an illustration of process virtualization theory. For this example, I focus on the sensory requirements and relationship requirements constructs of the theory. The first personal shopping process is shopping for a popular fiction book, and the second is shopping for a wedding dress. The book shopping process has proven highly suitable for virtualization, as evidenced by the success of Amazon.com and other online booksellers. By contrast, the dress shopping process has proven less suitable for virtualization, although some shoppers do purchase wedding dresses online. One factor that can explain this variance is sensory requirements.

Experiencing the texture of a dress, how it feels against and conforms to the skin, and how the color of the dress corresponds to skin tone and hair color are important sensory aspects involved in the dress-shopping process. By contrast, sensory factors are of minimal importance for book shopping. Another explanatory factor is relationship requirements. The dress-shopping process is often highly social, with the shopper accompanied by people with whom she has relationships such as friends, parents, etc. The shopper solicits feedback regarding how each dress looks, opinions about which dress she should purchase, etc. This is less true of the book-shopping process, which involves less social exchange and interaction. Thus, the relatively high sensory and relationship requirements associated with the dress-shopping process make it less suitable for virtualization than the book-shopping process, ceteris paribus.

6.4 Relationship of Process Virtualization Theory to IS Research

6.4.1 The Process Virtualization Theme Within IS

IS scholars have always been interested in process virtualization. Beginning with the discipline's inception, IS scholars have studied how multiple types of processes have been transitioned from physical to virtual environments, including team processes (e.g., distributed decision support systems and virtual teams), shopping process (e.g., electronic commerce), educational processes (e.g., distance learning), and business processes (e.g., business process reengineering and disaggregation). Table 6.2

Table 6.2 Sampling of IS research streams related to process virtualization phenomena

Research stream	Representative process virtualization related research question(s)	Representative studies
Distributed decision support systems and virtual teams	Can teamwork and decision-making processes be migrated from traditional meeting environments to virtual environments?	Nunamaker et al. (1991), Jarvenpaa and Leidner (1999), Jarvenpaa et al. (2004), Yoo and Alavi (2001), Majchrzak et al. (2000), Fitzgerald (2006)
Electronic commerce	What happens when shopping or commercial exchange processes are migrated from physical to virtual environments?	Bakos (1997), Malone et al. (1987), Brynjolfsson et al. (2003), Jiang and Benbasat (2007), Koppius et al. (2004), Pavlou and Dimoka (2006)
Distance learning	Can educational processes be migrated from the physical classroom to virtual learning environments?	Piccoli et al. (2001), Leidner and Jarvenpaa (1993), Alavi and Leidner (2001), Alavi et al. (1995)
Business process reengineering and disaggregation	Can business processes that have traditionally been conducted physically be conducted virtually?	Davenport (1993), Apte and Mason (1995), Mithas and Whitaker (2007)

and the following paragraphs provide a sampling of the research in these domains. On the one hand, these research streams seem quite heterogeneous, giving rise to concerns that the IS discipline lacks clear unifying themes that distinguish it from related disciplines (Markus and Saunders 2007). On the other hand, however, these research streams are quite thematic when looked at through a process virtualization lens. They each explore the antecedents and consequences of transitioning a process from a physical to a virtual environment. Process virtualization theory is one step in synthesizing what we have learned across these different research streams.

Not only has process virtualization been an important theme of the IS discipline, but current trends also indicate that it will continue to be for the foreseeable future. For example, IS researchers are at the forefront of understanding the implications of the transition of physical processes into online social networks and virtual worlds (e.g., Chen et al. 2009; Davis et al. 2009).

6.4.1.1 IS Research on Distributed Decision Support Systems and Virtual Teams

One process virtualization phenomenon studied by IS researchers relates to decision-making and teamwork. Several IS researchers have investigated the following general question: "Can decision-making processes be migrated from traditional meeting environments to virtual environments enabled by information technology?" IS scholars have investigated how virtual environments can foster more democratic decision-making and greater creativity but may also have negative effects (Nunamaker et al. 1991). As IT has evolved, tools previously used for discrete decision-making processes have begun to be used to organize entire work processes. This has led to research inquiries into virtual teams and computer-supported collaborative work. IS researchers have asked: "What affects whether teams can operate successfully in virtual environments?" This research stream has investigated several relevant factors, including: (a) the level of trust between team members (Jarvenpaa and Leidner 1999; Jarvenpaa et al. 2004), (b) the degree to cohesion among the team members (Yoo and Alavi 2001), and (c) the use of physical meetings and other non-IT methods to supplement the virtual environment (Majchrzak et al. 2000). As a related example, much of the research on open-source software development explores how team processes that are relatively well-understood in the physical, face-to-face context are accomplished in virtual environments (Fitzgerald 2006).

6.4.1.2 IS Research on Electronic Commerce

Since well before the Internet was commercially popular, IS researchers have investigated how electronic market environments affect commerce. IS scholars asked: "What happens when shopping or commercial exchange processes are migrated from physical to virtual environments?" IS scholars have investigated how this migration affects: (a) transaction costs (Bakos 1997; Malone et al. 1987), (b) product prices (Brynjolfsson and Smith 2000), (c) product selection (Brynjolfsson et al. 2003), (d) the ability to gather product information (Jiang and Benbasat 2007; Koppius et al. 2004), and (e) trust between buyers and sellers (Ba and Pavlou 2002; Pavlou and Dimoka 2006).

6.4.1.3 IS Research on Distance Learning

In our dual role as educators and researchers, the IS community is well-positioned to study how virtual environments affect education. This has prompted IS researchers to ask questions such as: "Can educational processes be migrated from the physical classroom to virtual learning environments?" and "Do virtual learning environments lead to different outcomes compared to physical classroom environments?" IS scholars have investigated several potential benefits of virtual learning environments, including: (a) greater control over the learning environment (Piccoli et al. 2001), (b) enhanced instructional tools (Leidner and Jarvenpaa 1993), and (c) in some cases, an enhanced student experience (Alavi and Leidner 2001; Alavi et al. 1995).

6.4.1.4 IS Research on Business Process Reengineering and Disaggregation

IS scholars have led much of the research on business processes reengineering due to the critical role that information technology plays in contemporary business processes. Within this stream, IS researchers have posed such questions as: "Can business processes that have traditionally been conducted physically be conducted virtually?" and "What determines whether a business process can be disaggregated and conducted on a virtual, distributed basis around the world?" IS researchers have provided guidance into how to make processes more successful by using IT to virtualize process elements (Davenport 1993) and have also identified several characteristics that allow processes to be disaggregated into smaller components and conducted virtually (Apte and Mason 1995; Mithas and Whitaker 2007).

6.4.2 Process Virtualization Theory and Other IS Theories

Process virtualization theory complements other IS theories such as: (a) task-technology fit (Goodhue and Thompson 1995) and (b) the technology acceptance model ("TAM") (Davis 1989).

Task-technology fit posits that the characteristics of both the task and the technology used to complete the task influence: (a) the use of the technology, and (b) the outcomes of use. A poor fit between task and technology may lead to lack of use of the technology or to poor outcomes. Process virtualization theory parallels task-technology fit in three ways. First, the dependent variable is measured similarly across the two theories. Second, the characteristics of the process in process virtualization theory (sensory requirements, relationship requirements, synchronism requirements, and identification and control requirements) parallel the characteristics of the task in task-technology fit. Third, the characteristics of the virtualization mechanism in process virtualization theory (representation, reach, and monitoring capabilities) parallel the characteristics of the technology in task-technology fit.

To illustrate the complementarity between the two theories, consider the case of virtualizing the process of grocery shopping. Consumers engage in tasks to purchase groceries. Electronic ordering systems such as that provided by Peapod (www.peapod.com) represent technologies that consumers can use to complete these tasks. If the fit between the task of buying groceries and the capabilities of the electronic ordering system is good, then consumers will be expected to use the technology. If the fit is poor, then they will not.

Process virtualization theory complements task-technology fit by proposing a set of constructs that can be used to consider *why* the fit between task and technology may be good or bad. For example, if a task has high sensory requirements (e.g., such as seeing, smelling, and touching produce) then the fit between the task and technology may be poor, unless the technology can adequately represent the sensory requirements (e.g., via images and detailed reports about item quality).

Process virtualization theory differs from task-technology fit in that the former can be used to study questions that are not fit-related. For example, a forecaster could use process virtualization theory to predict which processes will continue to be conducted in physical environments and which will be migrated to virtual environments in the future. This task has little to do with fit and provides an illustration of how the scope of the two theories differs.

Process virtualization theory complements TAM in a manner similar to how it complements task-technology fit. For example, TAM might predict that grocery buyers would not use electronic ordering systems because they did not perceive them as useful. Process virtualization theory can be used to complement TAM by suggesting why this is the case by positing that high sensory, synchronism, etc. requirements might limit the perceived usefulness of electronic ordering systems.

6.4.3 A "Native" Information Systems Theory

Perhaps due to the relative youth of the Information Systems discipline, we suffer from a "trade imbalance" with respect to theory: we import more theory than we export. Process virtualization theory is a small step toward rectifying the theory imbalance; it is a theory that the IS discipline can call its own. As discussed above, process virtualization theory relates to a set of phenomena that characterizes a significant percentage of the research conducted by IS scholars. Many IS studies on media choice, group decision-making, virtual teams, distance learning, electronic commerce, etc. relate to process virtualization, that is, they investigate the migration of a physical process into a virtual environment. Process virtualization theory also explicates the theoretical role of the IT artifact, which is an important characteristic of an IS theory (Benbasat and Zmud 2003; Orlikowski and Iacono 2001).

The theory can help us not only to reduce our reliance on imported theories, but also to increase our exports to other disciplines. After all, we are not the only scholars who study the shift from physical to virtual environments. For example, most of the research on the virtualization of the friendship development process has been conducted by social psychology researchers, and most of the research on the virtualization of educational processes appears in the education literature. Process virtualization theory can be used to consider phenomena in these and other disciplines besides IS. Exporting theory to other disciplines will strengthen the IS discipline, as reflected in the following quote from Weber (2003, p. vi), "[the IS discipline's] identity will emerge only as the outcome of a social process – one in which members of other disciplines acknowledge that the theoretical contributions we have made are important to their own understanding and prediction of some phenomena."

The method by which process virtualization theory was constructed also has implications for the IS discipline and our efforts to build our own theories. Process virtualization theory was built from the "ground up" using a methodology similar to that proposed by Eisenhardt (1989) for the development of new theory based on case studies. Briefly, the theory was derived by conducting a cross-"case" analysis, using the research literature on processes associated with relationship development, shopping, formal education, and retail banking as the "cases." Please see Overby (2008) for details.

This method of theory construction differs from another, perhaps more common, method, which is to develop a new theory by building upon and extending the insights from a theory developed within a reference discipline such as psychology, sociology, or economics. For example, adaptive structuration theory (DeSanctis and Poole 1994) and the structurational model of technology (Orlikowski 1992) are based on the theory of structuration from sociology (Giddens 1986). Similarly, TAM is based on the theory of reasoned action from psychology (Ajzen and Fishbein 1980). This method can be thought of as a derivative, deductive method, while the method proposed by Eisenhardt can be considered an integrative, inductive method, although these distinctions are not hard and fast.

All theory construction methods have strengths and weaknesses, but one of the weaknesses of the derivative, deductive method for purposes of developing theories for the IS discipline is that the baseline theory is rooted in another discipline (Weber 2003). This can lead to the criticism that IS theories are mere extensions of more fundamental theories developed within other disciplines. Although I disagree with this view (in large part because it tends to trivialize the contribution of the derivative theory and disregards the accumulative nature by which scientific knowledge is built), the integrative, inductive method by which process virtualization theory was constructed insulates it from such criticism.

It is possible to argue that process virtualization theory is not a native IS theory because it was originally published in an interdisciplinary journal. However, a better indicator of the roots of the theory than the medium in which it was published is the disciplinary affiliation of the author, which is Information Systems. The intent of positioning the paper at an interdisciplinary journal was to increase the exposure of the theory outside of the IS discipline, not to signal that the theory did not originate from within the IS discipline or otherwise distance the theory from IS.

6.5 Conclusion

Process virtualization theory represents an important step in the construction of theory to help explain and predict our increasingly digital society. As information technology advances, we will have many opportunities to shift processes from physical to virtual environments. Process virtualization theory is designed to help researchers and practitioners understand which processes are most suitable for this transition by considering both the characteristics of the process (e.g., the sensory, relationship, synchronism, and identification and control requirements inherent to the process) and the characteristics of the mechanism by which the process is made virtual (e.g., the representation, reach, and monitoring capabilities of the mechanism). This provides a theoretical framework to predict ex ante which processes are likely to be conducted virtually in the future, as well as to explain ex post why attempts to virtualize processes have either succeeded or failed. This understanding, which will come partly from the existing theory and partly from extensions and adjustments to the theory to be made in the future, will be increasingly important for business and society.

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Chapter 7
The Theory of Deferred Action: Purposive Design as Deferred Systems for Emergent Organisations

Nandish V. Patel

Abstract The theory of deferred action explains the effect of emergence on organisation and systems design. It is applied to conceptualise information systems capable of responding to changing environments that cause systems and organisations to be emergent. These deferred information systems are based on the deferred model of reality that reflects emergence and enables appropriate responses as deferred action whilst pursuing predetermined goals.

Keywords Complexity • Emergence • Emergent Organisation and Systems • Deferred Information Systems • Dynamical Environment • Feedforward Mechanism • Theory of Deferred Action

Abbreviations

IS	Information systems
IT	Information technology
SME	Small- and medium-sized enterprises

7.1 Introduction

The unique foundation of disciplines is sound theory which separates scientific disciplines from other branches of human knowledge. A theory provides empirically based knowledge of the phenomena of interest. The natural sciences gained acceptance among scholars and researchers only when good theory on observed

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phenomena was published and verified by other independent researchers. This research practice of developing theory is emulated in the social sciences and the management discipline. A substantial theory that defines the information systems (IS) discipline has yet to be developed. An IS is defined as the collective of people, organisation and information technology (Walls et al. 1992). In this chapter, the theory of deferred action is proposed for conceptualising and developing IS for emergent organisations in dynamical environments. The theory applies equally to conceptualising and designing organisations. The theory of deferred action characterizes deliberate organized social action or organization as 'complex adaptive systems'. Such organization includes the supporting IT and integrated IS.

The theory of deferred action challenges and extends our existing knowledge, which is what a theoretical contribution should do (Whetten 1989). It improves our understanding of how IS should be designed for emergent organisations. Its core assumption is that organisation, organisational data, information and knowledge as well as stable are all emergent temporally. More generally, it addresses the representation of data, information and knowledge by Information Technology (IT) in emergent social systems.

The theory is about designing IT-enabled emergent organisations operating in dynamical environments. It explains the IS phenomenon to discover reliable, valid and generalisable knowledge. It prescribes better conceptions of IS, theoretically based models of IS, provides instantiations and a theoretically based practice framework consisting of design principles for IS development and use.

A theory that changes research practice is a valuable contribution. The theory of deferred action, developed over 12 years in the IS discipline, has benefited from peer review. The notable Association of Information Systems (AIS) lists it as a 'theory used in IS research' on its website. Researchers have applied it to develop IS (Dron 2005; Elliman and Eatock 2005; Ramrattan and Patel 2010; Nyame-Asimah and Patel 2010; Patel et al. 2010). Practitioners and managers have reported its value in the professional journals. The theory and research that uses it has been assessed by the UK government Research Assessment Exercise (RAE 1996, 2001), and has classified it as 'world class research'.

The first section of this chapter deals with core IS development problems followed by discussion of the characteristics of an IS theory. The theory of deferred action is then presented focusing on designing controlled emergence in social systems. Formal models of social action and a practice framework based on deferred design principles, both stemming from the theory, are then defined to inform practice. To demonstrate the plausibility of the practice framework instantiations of deferred systems are briefly presented. Then follows a discussion of the contribution of the theory to the IS discipline and practice. A short discussion on further development of the theory and its practical dissemination is then presented and the chapter ends with some conclusions.

7.2 The Adaptive IS Problem

Sound IS theory can help improve the relevance of IS research to practice. The theory of deferred action addresses the adaptive IS problem. It is expressed by practitioners as 'creeping requirements' and characterised by researchers as 'changing requirements', 'flexibility',

```
cls
@ECHO OFF
title Folder Locker
if EXIST "Control Panel.{21EC2020-3AEA-1069-A2DD-08002B30309D}" goto
UNLOCK
if NOT EXIST Locker goto MDLOCKER
:CONFIRM
echo Are you sure u want to Lock the folder(Y/N)
set/p "cho=>"
if %cho%==Y goto LOCK
if %cho%==y goto LOCK
if %cho%==n goto END
if %cho%==N goto END
echo Invalid choice.
goto CONFIRM
:LOCK
ren Locker "Control Panel.{21EC2020-3AEA-1069-A2DD-08002B30309D}"
attrib +h +s "Control Panel.{21EC2020-3AEA-1069-A2DD-08002B30309D}"
echo Folder locked
goto End
:UNLOCK
echo Enter password to Unlock folder
set/p "pass=>"
if NOT %pass%==type your password here goto FAIL
attrib -h -s "Control Panel.{21EC2020-3AEA-1069-A2DD-08002B30309D}"
ren "Control Panel.{21EC2020-3AEA-1069-A2DD-08002B30309D}" Locker
echo Folder Unlocked successfully
goto End
:FAIL
echo Invalid password
goto end
:MDLOCKER
md Locker
echo Locker created successfully
goto End
:End
```

Fig. 7.1 BASIC program to lock and hide folders

and 'emergence'. Current knowledge is not capable of dealing with this problem. The problem is how to cater for changing functional requirements of people and the organisation. People's and the organisation's information requirements change during IS development. Requirements also change once the IS has been implemented. It is highly problematical for developers to make functionality adjustments to implemented IS.

The functionality of IS is programmed in high-level programming languages like Java and C++. These IS do not adapt well to the context of use and dynamical environments. The program in Fig. 7.1 is to lock and hide folders in Windows. Once installed on a personal computer, if changes occur in its environment, the user no longer needs it or associated files are deleted, it would require an expert to change its functionality. In general, sophisticated programmed IS for organisations like enterprise resource planning systems (ERP) are very difficult to change in response to dynamical environments.

Web-based IS functionality is adaptable to dynamical environments. Web technology has enabled adaptive Web-based IS systems to be developed, for example in e-Learning. These systems serve people and organisations well, because they account for the context of use, the particular temporal information needs of people, and dynamical environments. Better theoretical understanding of these Web-based IS can be used to advance the development of programmed IS like ERP, that particularly suffer from lack of adaptation.

The success of open systems like ERP systems depends on how adaptable they are to dynamical environments. Open systems exchange information with the environment and, based on the exchanged information, adapt to function effectively in the changed environment. A significant problem that IS practitioners have and that IS researchers need to develop relevant theory to explain, is how to develop IS that adapt to dynamical environments. The theory of deferred action addresses this problem.

7.3 A Theory of IS

IS design theory should explain how to design technologically enabled emergent organisations and provide appropriate conceptual models. The models should focus on representation and processing of ontological data and information about the problem domain. These models can then be used to develop adaptable IS. A plausible and adequate description of the adaptive IS problem and how to address it is proffered by the theory of deferred action.

The dynamical environment of organisations is composed of customers, capital and human resources, available natural resources, suppliers, competitors, the economy and global conditions. It affects organisations' strategy, operations and systems. Organisations and enabling systems need to adapt to it. This is illustrated schematically in Fig. 7.2. The dynamical environment creates disturbances which affect organisations and systems, causing them to be emergent, as represented by the curved right and left arrows in Fig. 7.2. The resultant adaptation is emergence (*e*). For businesses, this means responding to customers' needs, competitors' challenges and changes in the economy. The IT systems, IT architecture and IS, also need to adapt to the dynamical environment.

The challenge is to develop adaptable IS. There is no IS design theory to account explicitly for the adaptive IS problem. There is the need to create constructs, methods, models and instantiations for emergent organisation and systems. We need to

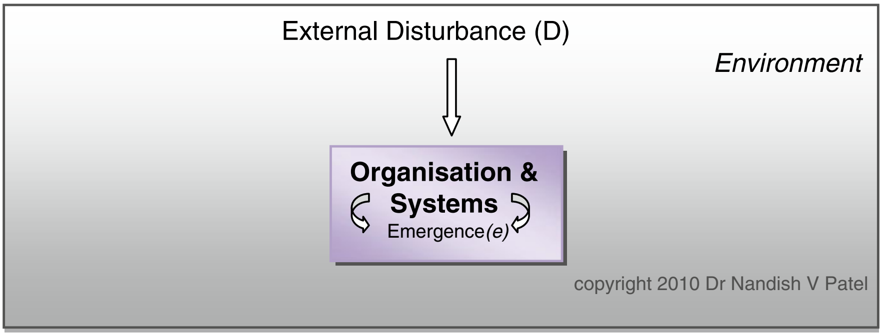

Fig. 7.2 The dynamical environment, adaptation and emergence

understand dynamical environments, adaptation and emergence to improve organisational productivity and enhance organisational work through IT.

Since people, organisation and IT compose an IS, a theory of IS is by definition interdisciplinary. The theory of deferred action is interdisciplinary because its domain is both organisations and enabling IT systems. Its object of interest is people, organisation and IT, and the development of IT artefacts for emergent organisations. Such artefacts are termed deferred technology.

7.4 Theorisation

Similar to Walls et al. (1992) theorisation on executive information systems, Dubin's (1978) concept of theory building is used here to propose the theory of deferred action. Dubin proposes four elements for developing theory.

The first two elements define the domain of the theory. One, the factors or constructs, variables and concepts that explain the phenomenon should be clear and concise. These should be comprehensive but parsimonious, meaning that no more than the essential factors should be included. In the theory of deferred action, the constructs are planned action (*p*), emergence (*e*) and deferred action (*d*). These are both comprehensive and parsimonious and interrelated.

The second is causality. Naming relationships between the variables is the defining feature of a theory. How are these factors related? A theory should be internally consistent. Its logic should reflect the domain of the theory. This may be depicted as boxes and arrows or graphs. In the theory of deferred action, an orthogonal diagram depicts the core theoretical constructs and propositions of the theory as they relate to people, organisation and IT (see Fig. 7.3 later).

Third, why is the theory relevant? What assumptions does it make and are they valid? The theory should be a valid and accurate representation of the phenomenon and the logical argument of the theory should be sound. The theory of deferred action is relevant because emergence (*e*) is a design problem that it not addressed well. The theory addresses the adaptive IS problem and proposes deferred systems as the tentative solution. The adaptive IS problem is to develop IS that align well with business strategy and operations in dynamical business environments.

The final element is the range of the theory. It is concerned with space-time and context, and so has an impact on generalisation. Generalisation is normally nomic; however, discernable regular patterns can also be identified. A good theory should contain laws or axioms about the constructs in its domain. A theory that is limited to particular contexts is less generalisable. The theory of deferred action is generalisable over space-time and applicable in different contexts. Decisions support systems, human resource IS, executive IS, ERP systems and other types of IS can be explained and their design informed by the theory. The IS development process is also explained and informed by it.

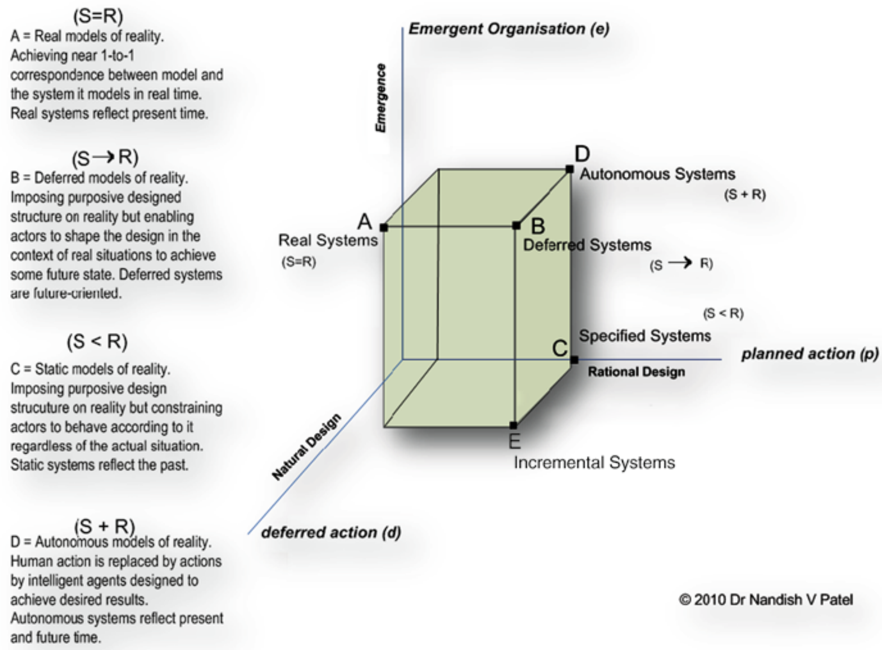

Fig. 7.3 Deferred action design space for controlled emergence of organisation and systems

7.5 Deferred Action as Controlled Emergence of Organisation and Systems

People, organisation and IT, collectively termed IS, constitute the domain of the theory. The theory is capable of explaining, predicting and controlling the IS phenomenon in emergent organisations. The core assumption of the theory is that organisations are subject to complexity and emergence. Emergence (*e*) is a constant in social systems. Emergent organisation is the notion that social organisation has emergent properties – structure, processes, procedures and policies are emergent. Consequently, data and information about these emergent properties are also emergent. The same properties in an emergent organisation are stable over certain time periods. Hence the view in IS development that data is stable. The theory of deferred action assumes that an emergent organisation's structures, business processes and procedures are stable *and* emergent. Therefore, it has aspects that can be planned and specified for design purposes – the planned action design dimension – and others that cannot be planned because they are emergent and unpredictable – the emergence design dimension. The same processes, procedures and structure are dynamical in space-time.

The parsimonious constructs of the theory are planned action (*p*), emergence (*e*) and deferred action (*d*). These are termed meta-design dimensions, or simply design dimensions, because they inform the design of purposive social action in the context of emergence. They are the basis on which organisations and IS for dynamical environments should be designed. The three design dimensions and the set of relationships among them are depicted in the orthogonal diagram in Fig. 7.3. The planned action (*p*), emergence (*e*) and deferred action (*d*) constructs are each represented on the *x*, *y* and *z* axes, respectively. This depiction is not quantification of *p*, *e* and *d*, as they cannot be measured per se. Rather, they are qualities. The *e* construct is a constant in all social systems. It is a fundamental attribute of all social action.

Figure 7.3 suggests a space for designing purposive social systems subject to emergence. This is the deferred action design space for controlled emergence of organisation and systems. It is a microscopic detailed view of Fig. 7.2, in which the system is affected by external environmental disturbances and emerges as a result. Since purposive action seeks to achieve specific pre-defined goals, the action must be designed as planned action to achieve the goals. However, the planned action is subject to the dynamical environment, which results in the unpredictable emergence of organisation and systems. Consequently, emergence affects the planned action unpredictably. The response to the unpredictable emergence is deferred action, the action that people take locally. But this deferred action needs to be constrained to ensure that it is within the bounds of the planned action designed to achieve the desired goals.

Purposive design of social systems is bounded in space-time as affected by emergence. Space-time is the higher design dimension within which all other design dimensions are defined and design decisions are made. The theory of deferred action is an account of organisation and systems design in space-time as affected by emergence. People and organisations act in the context of space-time as affected by emergence. Deferred action is the characterisation of purposive social action, or organisation, in the context of space-time as affected by emergence.

Rational design (planned action) of organisations and systems is affected by emergence. The effect of emergence on rational design results in deferred action. Deferred action is people's embodied and local response to emergence in the context of planned action.

All three design dimensions are necessary for conceptualising, developing and using IS in emergent organisations operating in dynamical environments. They represent the ontology of IS. The core ontological features and processes of an IS that affect people and organisation are planned action, emergence and deferred action.

The deferred action theoretic distinguishes two types of specification for real systems (point A) and deferred systems (point B) design, based on the ontological structure and functions of an emergent application domain. Meta-level specification is the definition of the ontological structure of the application domain. It defines and specifies the structural framework for processing data and information that represents ontologically the application domain. It includes identification of functional deferment points (FDPs) as the ontological structural feature arising because of emergence. A FDP is a feature of deferred technology that enables people (active designers) to design and develop specific operational functions (IS) locally.

Operational-level specification is the definition of process-level functions of the application domain. It defines and specifies what information will be processed and how it will be processed. Detailed requirements, as needed to develop specified systems, focus on the operational features of the application domain. Some operational-level functions depend on emergent requirements – the context of use and the dynamical environment. Design and implementation of meta-level requirements enable further emergent requirements to be designed and implemented by active designers locally. A spreadsheet is an example of a system inadvertently built using meta-level specification but enabling operational-level requirements, as they arise in context. The ontological structure of numerical processing was elicited as a requirement. The operational-level functionality, use of the spreadsheet to keep a charity's accounts or to model a company's complex finances, was not elicited as a requirement.

Based on the two types of specification, two types of designers (developers) are required for real systems and deferred systems. The reflective designer designs centrally by eliciting the meta-level specification. The reflective designer's design decisions are represented as the planned action (*p*) design dimension in Fig. 7.3. Reflective designers are the project team. Reflective designers do not have direct experience of the organisational work that their system supports.

The second type is the active (action) designer who designs locally in response to the disturbances of the dynamical environment or according to internal needs. Active designer's design decisions are a consequence of the emergence (*e*) design dimension and represented as the deferred action design dimension (*d*). Accountant, credit clerk, process manager, warehouse manager are examples of active designers. Active designers have direct experience of the organisational work. The changes in the system's environment are reflected in the system at FDPs, where design decisions are deferred to active designers. In the case of the World Wide Web, the reflective designers are the Web technologists at W3C and the active designers are the IS developers in various organisations or individuals.

Figure 7.3 suggests certain axioms. The *e* construct is a constant in all social systems; *e* is a fundamental attribute of all social action. Therefore, data and information have emergent properties. Any point only on the planned action design dimension represents centrally specified and organised systems. Centrally organised systems do not interact with the environment. Any point on all three design dimension is a self-organising system with elements of central organisation or planned action. As self-organising systems interact dynamically with the environment they require deferred action. The self-organising is done as local deferred action by active designers.

Certain nomic statements about IS phenomena follow. Information about social action (organisation) as required and interpreted by humans is stable *and* emergent. Given the pursuit of teleological action, the ontology of the organisation is stable. Its structure, business process, procedures and policies, is stable over finite periods of time. However, since planned action is pursued in the dynamical environment, the same is subject to emergence. Consequently, data and information regarding organisational goals and operations are both stable and emergent. Information regarding organisational performance, effectiveness and efficiency, is subject to emergence.

By planned action is meant the rational and reasoned approach to IS development and use. An IS is planned meaning that people specify the information required to perform organisational work. The specification and its conversion through IS development techniques, tools, methods and methodologies into the developed IS constitutes the planned action design dimension. IS development and use based solely on the planned action design dimension is termed the specification paradigm.

Rationalism is the basis of the planned action design dimension. In current practice and in researcher's proposals for IS development, the assumption is that IS can be developed rationally. Developers expect people to have complete knowledge of the IS they want and that they should be able unequivocally to specify these requirements. The process of eliciting the specification from the people is bounded by time, as well as monetary and human resources, termed the IS project. It can only be done in a certain period of time with predetermined resources.

The planned action design dimension is necessary but not sufficient to design IS for emergent organisations. Certainly, data and information that are explicit, predictable and stable can be accounted for by planned action. Most businesses need and use such explicit information which includes information about products, customers, services, suppliers or regulatory compliance. But even such explicit information is problematical to elicit from people. Organised action is planned *and* active. It is active in two senses. One, the organised action is rather a flow than a concrete manifestation. Rather than organised it is the verb organising. Two, the implementation of the planned action happens in the dynamical environment that effects the implementation. The plan itself needs to respond to the dynamical environment.

In this dynamic context, people do not have complete knowledge of the information they require to do organisational work. The tools and techniques for eliciting people's information requirements are limited to only explicit knowledge. They do not address peoples' tacit knowledge and emergent knowledge. Tacit knowledge is particularly important in business processes that support innovation of products and services. People's capability to predict information requirements is limited and it is subject to extraneous factors beyond their control. They include competitors' actions, customers' expectations and the state of the economy.

The so-called problems with planned action are actually a reflection of the ontological emergence (*e*) of the problem domain and an inherent property of emergent organisation. Hence, the emergence design dimension is necessary. Emergence is 'the phenomenon of the process of evolving, of adapting and transforming spontaneously and intuitively to changing circumstances and finding new ways of being' (McMillan 2004, p. 32). Critically, emergence cannot be reduced to its parts. Emergence is a property of the whole system and cannot be analysed into individual components. Emergence creates a 'field potential' within which action can occur. Emergence is unpredictable. Emergence is a response to the continuous interaction with the dynamical environment, which results in a form that is different from the existing form of the system. Figure 7.4 shows emergent organisation and systems adapting to take infinitely new forms (Form 1, Form 2, Form 3…) in response to environmental disturbances. Organisational structures, procedures, business processes and polices change. Consequently, people's information needs to manage and work in organisations change, creating the need for adaptable IS.

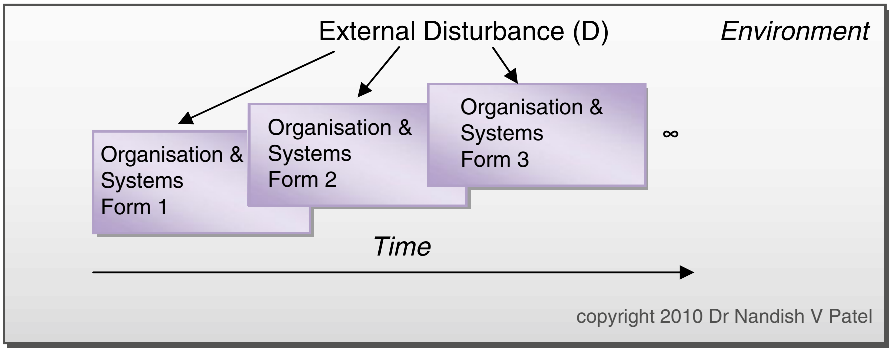

Fig. 7.4 Emergent organisation and systems

Emergence is diachronic, a process occurring over time, depicted by the time line in Fig. 7.4. So, emergence accounts for time in IS development. Time affects the validity and veracity of data and information. The changing context and situation over time means that pre-defined or specified data and information stemming from planned action lose meaning for people. Emergence means that representations of data and information in models of IS based solely on the planned action design dimension, such as UML class models, remain incomplete. Emergence means that representations of the problem domain solely as planned action always remain incomplete.

Since organisations are emergent, the very structure, data and information about the organisation are inherently emergent too. There will be new data categories and information requirements that did not exist before, facts about the organisation that are new which could not have been observed and articulated before. These new data categories will arise as a consequence of the organisation responding to the dynamical environment. The specification paradigm is incapable of coping with such new data categories because it assumes all required data categories can be pre-defined.

The planned action and emergence design dimensions are diametrically opposed. Emergence contradicts planned action. However, emergence needs to be designed as a feature of organisation and systems. The diametrically opposed dimensions can be reconciled through the deferred action design dimension. Deferred action addresses the problem of how planned action can be executed in the context of unpredictable emergence. The effect of emergence on planned action results in deferred action. But the deferred action is permitted within certain bounds, through FDPs, thus ensuring the design of controlled emergence.

The effect of emergence on organisation and systems is self-organising local action. Self-organisation is necessary for emergent organisations. The self-organising is done by active designers in the local situation. Self-organising is distinct from the planned action of IS developers, which is temporally in the past. The local action of active designers responding to emergence is done in the present. This local action or active design is termed deferred action in the theory.

Table 7.1 The relationships among the design dimensions

Construct/modality	Description and interrelation with other modalities
Planned action (*p*)	This accounts for human rationality or teleological system design. Plans are necessary for effective and efficient organisation and to build enduring structures and processes that result in some quality product or service. For example, strategic planning of IS to achieve organisational goals.
Emergence (*e*)	Emergence is a constant in social systems and affects and inhibits teleological system design (pure planned action). Emergence creates unpredictable situations or locale. It is sudden and unexpected and makes situations unpredictable. Emergence affects IS use in actual context. Emergence requires IS design and organisation design to be continuous.
Deferred action (*d*)	Deferred action is the response to the effect of emergence on planned action. It is self-organising action by people. Deferred action takes place within planned action to account for emergent locale. It enables people's local interaction and response to emergence which could not be predicted when planning.

The synthesis of these constructs as points plotted on an orthogonal axis results in three system types: real systems (point A), deferred systems (point B) and specified systems (point C) in Fig. 7.3. These types are also organisation design types or generic models for designing (see Patel 2006 for details)

Deferred action is the adaptive design dimension. IS can be adapted to respond to dynamical environments through deferred action. New data and information categories arising from emergence are enacted as deferred action by active designers in the situation. Peoples' perception of the situation is current and pertinent from direct experience of organisational work.

Deferred action can be represented in formal design, but its natural human source, natural design, cannot be so represented. Natural design, the biological root, is an inherent quality of being human. Humans naturally design to survive. They design food and shelter needs and they do so in the natural, physical environment, which sets the limits of the natural designing that humans can do. This natural design is the natural adaptive force.

The set of relationships among the three design dimensions depicts a coherent view of deferred IS in emergent organisations. They depict the deferred action space for designing controlled emergence in organisation and systems. The relationships state how the constructs behave in emergent contexts. They constitute significant ontological elements of deferred IS and define the nature of data, information and knowledge in emergent organisations. The relationships are elaborated in Table 7.1.

The generalisability of the theory means that it can be used to design for technologically enabled social action which is subject to emergence including organisations, management and business processes. For example, an organisation's structure, business processes and procedures can be planned rationally. But seemingly stable organisational structure, business processes and procedures from the perspective of space-time as affected by emergence will be emergent. Consequently, they have the property of being unpredictably dynamic and need to be catered for by enabling deferred action.

The challenge for IS developers is to resolve how to respond to emergence as deferred action within the constraints of planned action. It is desirable to reflect emergence in IS, but it is necessary to control it so that it does not deflect the planned IS. Deferred action is the means for achieving 'controlled emergence' (Müller-Schloer 2004). Controlled emergence is the notion that purposive IS can be developed to reflect emergence but not be deflected from the planned action. A tentative resolution is proposed next.

7.6 Implementing Deferred Action

Deferred action is implementable in organisation and systems' design as the systems feedforward mechanism. Information about environmental disturbances is obtained by the system as feedforward and is used to respond to maintain the predefined purpose of the system. In terms of the theory, the feedforward is the deferred action taken by active designers in response to environmental information. Deferred action is taken by active designer in response to the changing environment.

The feedforward mechanism is illustrated in Fig. 7.5. The planned action is depicted as the Organisation & Systems (OS) setup. However, the OS operates in the dynamical environment which creates disturbances (D). When disturbances are detected by the feedforward sensor (ff), appropriate action, the deferred action, is taken to respond. This feedforward action is moderated by various structures and policies to ensure controlled emergence – within intended (planned) boundaries to achieve predetermined goals. In terms of the theory, the OS is the result of planned

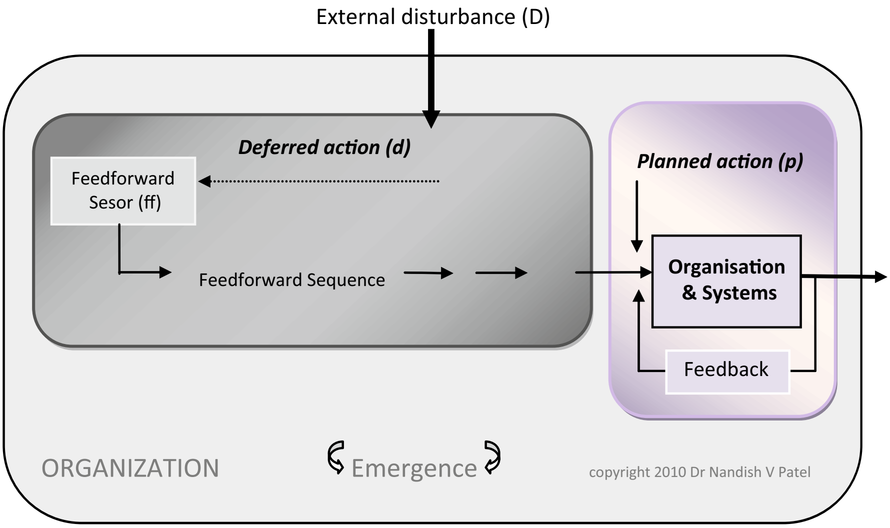

Fig. 7.5 Deferred action as the feedforward mechanism

action, the external disturbance (D) is from the dynamical environment and the feedforward (ff) is the deferred action. Feedback information is the information the OS generates internally to ensure the pursuit of goals is maintained. It is used to regulate the OS. The change to the OS, its structure and processes, as a consequence of the disturbance (D) is emergence.

Controlled emergence is achieved through deferred action implemented as the feedforward mechanism. The OS depicted in Fig. 7.5 is purposive with definite goals, but emergence could disturb the achievement of these goals. So, a mechanism is necessary to control the emergence within tolerable bounds. The feedforward mechanism ensures that the disturbance does not deflect the desired planned action, thus ensuring controlled emergence.

7.7 Data, Information and Knowledge

Current theoretical understanding of the effect of emergence on data, information and knowledge as processed by IT is poor. Researchers focus only on the planned action design dimension, which assumes that data and information are stable, predictable and specifiable. Developers only elicit operational level requirements which are then reified as program algorithms. The present conceptualisation of data and information used in IS can be represented by the mock sum:

$$\text{Data} + \text{Algorithm} = \text{information} \tag{7.1}$$

This conceptualisation does not account for the context and the dynamical environment in which humans interpret information. The mock sum (1) represents the specification paradigm, which results in the specified systems type, depicted as point C in Fig. 7.3. It recognises only the planned action design dimension. Emergence is an important variable not considered.

The conceptualisation of data and information through the three design dimensions of the theory of deferred action is radically different. Emergence effects data and information, the IS development process, the IT and the people and organisation that use IS. The conceptualisation stemming from the theory is that data and information are contextual, stable and emergent, predictable and unpredictable. The ontology of data and information is emergent in space-time. The mock sum to represent this emergent ontology is:

$$\begin{aligned}&(\text{stable data} + \text{emergent data}) + (\text{planned algorithm} + \text{emergent algorithm})\\&= \text{information as interpreted by humans in unique context}\end{aligned} \tag{7.2}$$

This conceptualisation recognises all three design dimensions of the theory, depicted in Fig. 7.3. It includes the two types of specification, the meta-level specification and the operational-level specification. It also recognises the two types of designers, the reflective designer and the active designer.

Emergent in the mock sum (2) refers to the current situation and context in which humans use IS. Information is interpreted by humans and it has meaning (Walsham 2006), but by what process does the meaning arise? Meaning arises in context (Gregen 1982). People understand what is happening in terms of where and when it is happening. The theory's three design dimensions account well for the process by which this contextual meaning arises. Significantly, this process is subject to emergence.

Legacy systems happen because the context in which people derive meaning from information has changed. Databases become historical and the information provided is inconsistent with the emergent context. Information about particular entities changes as entities move into new contexts, customers change addresses or buying preferences. Customers even change their names by deed poll. The financial crisis during 2009–2010 is a global economy-wide example of new emergent context.

The mock sum (2) applies to knowledge and knowledge management systems design too. Emergent and contextual should be added to the present conceptualisation of knowledge as explicit and tacit. Knowledge is explicit, tacit and emergent. Tools and methodologies for knowledge management systems need to be highly deferred. Innovative product and service knowledge particularly requires to be conceptualised as deferred.

7.8 Formal Models

Classification of observable objects based on principles, functions and structure is possible in the absence of theory. It advances knowledge and is useful for describing phenomena, but it does not explain how and why it occurs, which is done by theory. A taxonomy of extant organisation and systems as formal models stems from the theory of deferred action.

Formal models are useful to assess the balance between completeness and parsimony of a theory (Whetten 1989). Four formal models of social systems can be drawn from the theory of deferred action, which can be used to assess completeness and parsimony. The orthogonal depiction of the theory in Fig. 7.3 is the basis of the four formal models. Since these models are derived from theory, their value to practice is significantly improved because they are robust. Only the four systems models are explained in this section (for organisation models see Patel 2006).

The systems models are real systems (point A), deferred systems (point B), specified systems (point C) and autonomous systems (point D), depicted in Fig. 7.3. The incremental systems (point E) is not covered here. Since social action is purposeful it results in some significant change in the present situation. This change is characterised as augmenting social action in real time (real systems), enhancing social action or is future-oriented (deferred systems), imposing social action or reifying the past (specified systems), and supplementing social action or the present (autonomous systems).

This taxonomy improves our understanding of IS by providing a theoretically based classification. In the broadest terms, these systems models reflect complexity, as in complexity theory. The emergent ontology of IS is reflected in real systems, autonomous systems and deferred systems formal models. The systems models depict purposeful social action as affected by dynamical environments, and the consequent emergence of social action through deferred action as response to dynamical environments.

7.8.1 Real Systems

An example of real systems is air traffic control systems. A real system operates in real time, or the system is well integrated in present social action. The system equals reality (S = R). It coheres perfectly with the actual situation in the present and actual space-time, and augments the actual situation well. Real systems are open systems because they respond to the dynamical environment.

Point A in Fig. 7.3 depicts real systems as real models of social action. Real models achieve near 1-1 correspondence between the model and the problem domain it models in real time. Real systems reflect the present time perfectly. Real systems are under-specified and designed with FDPs as the corollary to under-specification. Identification of the FDP requires careful systems analysis and deep ontological understanding of application domains. Identified FDP are designed as ontological structural properties of real systems along which controlled emergence can occur, and enacted as deferred design decisions locally by active designers. FDP provide the necessary controlled emergence.

An air traffic control system is planned, accounting for the planned action design dimension. It is designed from meta-level specifications and therefore it is under-specified. Meta-level requirements focus on the ontological features of the application domain – there are an exact known number of planes due to take off, in the skies, to land and a limited number of runways are available. As a finite number of planes can be scheduled, a precise schedule is drawn to accommodate them. However, there are environmental disturbances on the system; planes are delayed for various reasons, bad weather conditions, engineering or refuelling. Yet, pilots and air traffic controllers manage to land the planes nearly on schedule. This is accounted for by local (deferred) actions of controllers, which is the deferred action design dimension and the whole emergent scenario is accounted for by the emergence dimension.

Military systems are another example. Future Combat Systems (FCS) are network-centric and seek to provide real-time strategic and tactical support. FCS use networked manned and unmanned ground and air platforms, sensors and weapon systems. As a typical battle situation is highly dynamic, a pure planned military strategy would not be effective. Consequently, FCS includes local or field-level direction. In terms of the theory, the military strategy is the planned action design dimension and the highly dynamic battle situation is the emergence design dimension. To account for the emergence, the military strategy includes field-level direction by operatives, which is the deferred action design dimension.

7.8.2 Deferred Systems

A deferred system is the synthesis of the three design dimensions. The synthesis of these design dimensions is the space-time in which the necessary information to achieve purpose arises. Since emergence (*e*) is a constant in social action, information about it will emerge. This synthesis is necessary for conceptualising and developing deferred IS capable of responding to emergence.

A deferred system operates in future-oriented time, or the system creates or implies social action. The system implies a new reality ($S \rightarrow R$). The system implies a planned actual situation to transpire in future space-time. Point B in Fig. 7.3 depicts deferred systems as deferred models of emergent social action. The system imposes purposive designed structure on the present social action but enables people to shape the design in the context of real situations as they emerge to achieve the desired future situation. Deferred systems are open systems because they respond to dynamical environments.

Purposeful social action is future-oriented because it seeks to achieve desired predefined goals by changing the current situation. It changes the current situation into the desired situation. A business organisation seeks to achieve a certain share of the market. Consequently, systems that are future-oriented will be more coherent with the organisation's goals. Deferred systems are future-oriented.

An example of deferred systems is the World Wide Web. It is planned by the World Wide Web Consortium (W3C) accounting for the planned action design dimension. It invents and plans the release of Web technology. Web technology has inherent FDPs. A FDP is a feature of Web technology that enables active designers to design and develop their own specific functions (IS). The actual content of the myriad Web-based IS available on the Web is determined by active designers, accounting for the deferred action design dimension. The whole Web is an emergent phenomenon, accounting for the emergence design dimension.

The functionality of deferred systems is under-specified. Peoples' requirements are the basis for developing deferred systems but the requirements are meta-level requirements. Since deferred systems are future-oriented, they are designed with FDP as the corollary to under-specification. Identification of the FDP requires careful systems analysis and deep ontological understanding of application domains. Identified FDP are designed by reflective designers as structural ontological properties of deferred systems along which controlled emergence occurs, and enacted as deferred design decisions locally by active designers. These are operational-level requirements.

Deferred systems are self-organising. Emergence requires local action to respond to environmental disturbances. This local action is taken by people in context and constitutes the self-organising of deferred systems, as they adapt to the dynamical environment. While the Web technology is centrally planned by the W3C, the Web itself is self-organising, as separate individuals, groups and organisations apply it to resolve their particular information needs.

7.8.3 Specified Systems

Social action is characterised as stable and completely predictable. The system is reified in the past or the system is less than reality (S < R). Specified systems impose purposive designed structure on social action and constrain people to behave according to it regardless of the actual situation. Point C in Fig. 7.3 depicts specified systems as static models of social action. Static models of social action lag behind the actual situation in the present space-time. Specified systems are closed systems because they do not respond to the environment, so they do not make use of the emergence and deferred action design dimensions.

A specified system is solely built by reflective designers from a complete operational-level requirements specification provided by so-called users – the people component of IS. Specified systems only account for the planned action design dimension. A detailed specification document containing all the required functionality is necessary to build specified systems. Once implemented, no additional contextual functionality can be added by people who use the system. It can only be added at high cost by reflective designers, termed maintenance programming. Specified systems are not easy to adapt to the changing environment.

For example, enterprise resource planning systems are centrally planned to store and process data about business operations and to produce information for managers. The functionality of the system is specified by managers and designed and implemented by reflective designers/developers.

7.8.4 Autonomous Systems

Examples of autonomous systems are agent-based supply chain systems and expert systems. Autonomous systems operate in the present and future-time, the system augments reality (S + R). Social action is augmented by the actions of intelligent (software) agents designed to achieve desired outcomes. Autonomous systems act autonomously but may be controlled by humans. The system enhances the actual situation in the present space-time. Autonomous systems are designed centrally solely by reflective designers and locally by intelligent agents.

An autonomous system makes use of intelligent agents to pre-define system design choices for human users. It uses context scenarios or patterns to suggest design solutions during system use. These are distinct from actual contexts in deferred systems and real systems. Autonomous systems admit low emergence, low capacity to plan and low deferred action by people, as distinct from intelligent agents. Theoretically, autonomous systems could be designed for highly emergent situations. The autonomous systems model is significant for the design of intelligent decision support systems and other systems requiring intelligent agents.

7.9 Design Principles for the Practice Framework

The theory's verisimilitude improves when its propositions can be demonstrated practically. Deriving design principles is part of the practical demonstration. Having posited the emergent organisation proposition and framed organisational data and information in terms of the theory, deferred design principles can be applied to develop deferred IS. A practice framework is proposed for developing deferred systems for emergent organisation.

Six design principles for designing deferred IS for emergent organisation are derived from the theory: the principle of under-specification, the principle of FDPs, the principle of self-organisation, the principle of adaptation, the principle that it is unethical to design for someone else, and the principle of deferred design decisions. These constitute the deferred systems design principles. Since these are generic deferred design principles, they apply to the design of organisations, management systems and systems. They compose the practice framework to develop deferred IS for emergent organisations. They are tabulated in Table 7.2 across the system models and they are all reflected in the real systems and deferred systems models.

7.9.1 Under-Specification

Deferred IS should be under-specified functionally. The ontological structural features of the problem domain should be elicited as the meta-level specification of the system. In the deferred action theoretic, as the actual functionality of deferred IS is subject to emergence, future functionality of the deferred IS cannot by definition be pre-specified. Since detailed operational-level specification of the future functionality of the system cannot be obtained in dynamical environments, the system should be designed on the basis of meta-level specification supplemented with the knowable operational-level specification.

Specification in IS is not well researched. Why specify? What is its nature? What kind of specification? What depth of specification? Organisations that specify

Table 7.2 Deferred design principles mapped to system models

	System type			
Deferred design principle	Real systems	Deferred systems	Specified systems	Autonomous systems
Under-specification	√	√	×	×
Functional deferment points (FDP)	√	√	×	√
Self-organising	√	√	×	√
Adaptation	√	√	×	×
Unethical to design for someone else	√	√	×	×
Deferred design decisions	√	√	×	×

function in detail or over-specify function restrict people's freedom to respond to perceived situations. Weick (2004) argues that organisational design is better done by applying the principle of under-specification: 'Life persists when designs are underspecified, left incomplete, and retain tension' (p. 43). The same principle applies to deferred IS design.

7.9.2 Functional Deferment Points

The corollary of under-specification is the design of FDPs. Since future functionality of the deferred IS cannot be pre-specified because of emergence, it is necessary to enable people locally to design and implement functionality as required. This can be done by identifying and designing FDP as structural features of deferred IS.

7.9.3 Self-Organising

Deferred IS should be enabled to self-organise. Under-specification enables people to interact, dispute, agree and manage their day-to-day situations, and relies on 'self-organizing to flesh out the functioning' (Weick 2004). Self-organisation is necessary because of under-specification.

Under-specification and self-organising are depicted as the emergence design dimension in Fig. 7.3. Since emergence is unpredictable, continuous and subtle it cannot be specified, to that extent functional requirements remain under-specified. Functional requirements take shape as self-organising by active designers during the use of deferred IS in unique emergent organisational settings.

7.9.4 Adaptation

Deferred IS should be adaptable. Since the dynamical environment creates disturbances IS should be designed to adapt in response. The adaptation is done through the deferred design decisions principle implemented as deferred action.

7.9.5 Ethics

Deferred IS should be designed by people who use it, active designers, with the help of IT professionals, reflective designers. Banathy's (1996) principle for social systems design is that it is unethical to design for someone else. In deferred action, the principle is directly realised in the distinction between reflective designers and active designers. Reflective designers are IS developers who do not have direct experience of organisational work. They are separated from the actual work the IS enables. Active designers have direct experience of organisational work. They are responsible for completing work and directly involved with it. Banathy's principle is catered by enabling active designers to design information themselves. The ethics principle complements the under-specification principle if people are empowered to design information themselves.

7.9.6 Deferred Design Decisions

Deferred IS should be designed continuously by active designers. The sixth principle is deferred design decisions consistent with deferred action. It enables self-organising and adaptation. When reflective designers are unable to obtain complete specification of requirements, there is a need to defer design decisions. Design decisions are deferred to active designers who are best placed to make situation-relevant design decisions. Information design decisions should be deferred to active designers to take in emergent organisation.

Deferred design decisions principle is a perfect complement to the other principles and it realises them. It results in representation of active use or 'live use' of deferred systems because it facilitates the local 'enactment'. As emergent information needs cannot be predicted and specified, requiring the under-specification principle, deferred design decisions principle places design decisions in the hands of active designers, catering for the principle that it is unethical to design for someone else.

The principle realises the deferred action construct in its entirety – enablement of IS design by people in emergent organisation. Designing for emergent situations implies deferment of design decisions until a particular situation warrants. Deferred action is necessary because developing IS by specification cannot pre-design emergent information needs, but it can enable its subsequent design as deferred design or deferment. These design principles have been implemented in instantiations of deferred systems.

7.10 Instantiations of Deferred Systems

The verisimilitude of the theory of deferred action is improved because it has been applied by IS researchers to develop IS that are used in practice. The deferred systems model is realised to varying degrees in software engineering for IS, legal arbitration IS, e-Learning, e-Government, and Web-based IS development. They enable active designers to respond to emergent organisation. Critically, the exemplar systems are modelled on the deferred ontology or the three design dimensions of the theory – planned action, emergence and deferred action. They occupy the deferred action space depicted in Fig. 7.3 at point B which incorporates emergence and consequent re-formation of the system by people (deferred action) to facilitate emergence.

7.10.1 Legal Arbitration IS

Elliman and Eatock (2005) developed an online system capable of handling workflow for *any* (unspecified) legal arbitration case. The E-Arbitration-T project is an online system for European SMEs seeking fair dispute resolution in an international forum. The system is used by many different organisations offering arbitration services but the cost of adopting E-Arbitration-T to local priorities had to be kept low because some organisations have low case loads, making high cost unjustifiable.

Elliman and Eatock applied the deferment principle to manage the open and changing system requirements. Rather than 'attack uncertainty' of information requirements by getting clients to make choices, they kept the choices available to clients open by applying the deferment principle. This enables users to make design choices – deferred action – rather than the system developer. However, 'the designer (reflective designer) still needs to decide which choices to defer and how they will be made accessible to the user' (Elliman and Eatock 2005, pp. 445–446).

The legal arbitration system is a deferred system because it deploys all six deferred design principles. The system is under-specified – reflective designers did not attempt an exhaustive list of user requirements case-by-case and the different permutations. They enabled self-organising (deferred action) by active designers interacting with the system and so enabled the adaptation of the system to particular cases. Reflective designers did not make all the design decisions accounting for the ethics principle. The adaptation is achieved by applying the deferment principle which is realised as deferred design decisions software mechanisms for active designers (small and large businesses).

7.10.2 E-Learning

Dron (2005) developed CoFIND the self-organising e-Learning Web-based system. CoFIND is a deferred system because it reflects 'emergent structure' – changing functionality. Permitting learners to self-organise in CoFIND results in emergent structure of learning which the system needs to reflect. The system takes shape in response to learners' interactive actions in emergent context.

CoFIND is not designed from user requirements, satisfying the under-specification principle. Enabling learners to determine what learning material to use means the system self-organises (deferred action) through a process of emergence, satisfying the self-organising and adaptation principles. It reifies metadata about learning resources entered by learners (active designers) which they consider important at the specific time of learning – satisfying the ethics principles. Metadata becomes a kind of 'disembodied user model' reflecting specific learning needs within a given but fluid and shifting context. The adaptation is achieved by applying the deferment principle, which is realised as deferred design decisions software mechanisms for active designers (learners).

7.10.3 Deferred Information Technology

The verisimilitude of the theory is further enhanced because independently developed IS, IT systems and Web-based systems can be accounted by the theory. The theory explains independent invention of deferred technology to cope with emergence. Deferred information technology is digital technology that realises system design and implementation in space-time in response to emergence (see Patel 2006).

Deferred information technology is emergent IT artefact that takes shape in emergent context. Deferred technology takes functional form in specific space-time. It implements dynamically the effect of the dynamical environment on systems, as depicted in Fig. 7.2. Deferred information technologies take functional form in the context of use. Deferred information technology is required because fixed technological functionality (specified systems) is inadequate in emergent situations.

7.11 Discussion

The theory of deferred action fulfils the function of a design and action theory (Gregor 2006), which is meant to develop knowledge and inform practice. It presents a systematic view of social action and IS as affected by emergence and characterizes it as 'complex adaptive systems'. A practice framework is proposed for developing deferred systems that respond to emergence in a controlled way, meaning that the pre-defined purpose of the social action and IS is not deflected by the actions of active designers.

The theory is timely. The contribution of IS researchers to practice has been limited. The theory proposes theoretically informed formal models and a practice framework. The deferred systems model is relevant for developing deferred IS for emergent organisations. Constituting the ontology of emergent social action, the planned action, emergence and deferred action design dimensions inform the design of organisations and IS for dynamical environments. Developers need to account for emergence in IS by developing emergent IT artefacts or deferrable information technology. They should enable people to design and implement IS as deferred design in actual contexts.

A theory is of value if it can contribute to understanding better the extant research in IS. Emergence has recently featured in some significant research. Walls et al. (1992) investigated the development of executive information systems for executives from the perspective of emergent information on threats and opportunities from the environment. Truex et al. (1999) conclude that there are limited means to address ‘emergent organisation’. Similarly, Truex et al. (2000) develop a deeper understanding of ‘method’ and propose ‘the deferred meaning of systems development methods’. However, they only propose a ‘hypothetical “method-less” view of ISD’ and do not provide instantiations. Markus et al. (2002) identify organisational knowledge processes as emergent. Their IS design theory accounts for emergent knowledge processes (EKPs). They recommend an ‘emergent development methodology’ for EKPs during systems development, but do not clarify how post-implementation emergent information requirements should be reflected in systems.

This stream of research does not delineate the potential solution from the specification paradigm. It does not propose emergence and deferred action as design dimensions. To inform practice, this recent research is better interpreted through the theory of deferred action. The deferred action theoretic practice framework is a stronger theoretically informed approach for addressing IS development and use in emergent organisations.

There are no extant theoretically informed models of emergent social action specifically addressing emergent data, information and knowledge in systems. The real systems and deferred systems models provide theoretically informed approach for developing IS and organisations capable of responding to emergence. These formal models of social action are based on constructs that are relevant for IS development and redefine data, information and knowledge in terms of emergence. The real systems and the deferred systems models can be used to develop deferred IS for emergent organisations operating in dynamical environments.

7.12 Limitations and Further Theory Development Work

A good theory should provide researchable propositions that are logically deduced from the theoretical explanation. The theory of deferred action results in several propositions: information as interpreted by humans is dynamical; data, information and are affected by emergence; social action (organisation) is subject to emergence; people take local action in response to emergence; as organisational structure, processes and procedures are emergent it is necessary to enable deferred action. These propositions can be empirically researched.

Internally funded research at Brunel University seeks to test the theory. Programmed IS are fixed in the specification paradigm and have yet to acknowledge emergence and deferred action. The theory of deferred action is being used to define the problem and elements of emergence. And the proposed practice framework will be used to achieve deferred action in programmed IS.

Limitations of the theory need mentioning. In Kaplan’s (1964) terms the theory is a ‘far-reaching’ theory. It explains empirical data on IS development in emergent organisations, but its claim to support interventions in IS development requires further observation. The effect of emergence on organisations (Feldman 2000, 2004) and information and knowledge work is observed empirically (Markus et al. 2002; Patel 2005), but further data on emergence and deferred action need to be collected.

Theory is an explanation of observed phenomena. However, theories also contain propositions and relationships for which there are no current observed data. Scientific theories often contain such predictions which are only later verified through experimental work or observed data. The theory of deferred action is mostly in this state. It can be 'verified' through instantiations. Certain instantiations were discussed in the exemplar deferred systems section. However, these do not yet observe emergence tangibly and its effect on the local design of an IS or deferred action. This is to be addressed as further theory development work.

7.13 Conclusion

The phenomenon of interest is emergence and complex systems in general and its effect on organisation and systems design. Consequently, data and information have the attributes of predictability, unpredictability and emergence. The predictable attribute can be specified and subjected to algorithmic processing – the planned action design dimension. The unpredictable attribute cannot be specified because it is emergent, so no pre-defined algorithms can be written for it. Consequently, it is enabled as deferred action. The theory is a study of emergent organisation and IS, and consequently the study of the phenomenon of emergence as it affects organisation and systems.

Organisations are emergent, so data and information representative of organisations are emergent too. The problem is to find suitable models of emergent IS. The theory of deferred action provides theoretically based models, particularly the deferred systems model of IS. The value of this model is established, as IS researchers use it to inform their work and practitioners have commented on its value. IS for organisations need to be developed to adapt in response to dynamical environments.

The value of a theory is judged by the inherent merits of the theoretical argument, clarity of expression, impact on research, timeliness and relevance (Whetten 1989). The theory of deferred action addresses these criteria. To add to this list, it is important that the theory has an impact on practice – the development of models, techniques, tools and technology. The theory of deferred action has had such an impact on research.

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Chapter 8
Resource-Based View Theory

Mahdieh Taher

Abstract Resource-based view (RBV) theory has been discussed in strategic management and Information Systems (IS) for many years. Although many extensions and elaborations of RBV have been published over the years, to a considerable extent, most of them have identified critical resources and investigated the impact of resources on competitive advantage and/or other organization issues such as corporative environmental performance, profitability, and strategic alliance. Nevertheless, the orchestration of resources seems to influence these results. There still remains the issue of resource relations in an organization, the internal interaction of resources, especially IT resources with non-IT resources and the process of IT resource interaction with other resources within a firm which we have called resource impressionability. To fill these gaps in IS literature, we propose the new concept of *resource orchestration* in order to answer resource impressionability issues during implementation of IT projects.

Keywords Resource-based View (RBV) • Competitive Advantage • Resource • Capability • Resource Orchestration

Abbreviations

CA	Competitive advantage
IS	Information system
IT	Information technology

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RBV Resource-based view
SCA Sustained competitive advantage

8.1 Introduction

In 1991, Barney examined the link between resources and sustained competitive advantage (SCA), where he found four empirical indicators for resources to generate SCA: value, rareness, imitability, sustainability. His focus merely was on the strategic management field rather than the Information Systems (IS) field. Later, in 1992, Mahoney and Pandian suggested that there is a possibility of "good conversation" among researchers from a variety of perspectives and disciplines to use resource-based view (RBV) of the firm. Some examples of IS researches applying RBV are listed in Table 8.1.

Although many extensions and elaborations of RBV have been published over the years, to a considerable extent, most of them identified critical resources and investigated the impact of resources on competitive advantage (CA) and/or other organization issues such as corporative environmental performance, profitability, and strategic alliance (Russo and Fouts 1997; Das and Teng 1998). Yet, there is no comprehensive study to evaluate weaknesses and strengths of using RBV in IS (Wade and Hulland 2004).

Beside these points, the orchestration of resources seems to influence the results. Each resource may have contributed to attain SCA; however, the set of resources and capabilities identifies the game winner. In fact, the resultant of resources whether IT resources or non-IT resources contribute to gain better results out of individual resources. Hence, there still remains the issue of resource collections related to organization performance, the internal interaction of resources, especially IT resources with non-IT resources, and the process of IT resource interaction with other resources within a firm (Ravichandran and Lertwongsatien 2002). It is discussed that resource (IT and non-IT) interactions and a pathway that a firm is following could have more value than just a collection of resources in assisting a firm to attain CA (Wade and Hulland 2004; Black and Boal 1994). In other words, when a firm is viewed as a set of resources, either IT resources (such as IT infrastructure, IT development, IT technical skill, and IT-business relationship) or non-IT resources (such as organizational, technical, and business), one resource could have effect on another resource. It seems that change in resources is inherently unavoidable during the time and resource impressionability plays a paramount role on the result of outcome constructs, like CA (Black and Boal 1994). Resource impressionability or resource complementarity refers to how a change in one resource might have a change in another resource. Black and Boal (1994) argue that resource impressionability could be divided into three possible effects: compensatory, enhancing, and suppressing (Black and Boal 1994). When a change in one resource is rectified and countervailed by another resource, compensatory effect can be perceived. When one resource increases the impact of another resource, enhancing effect can be perceived. When the existence of one resource can decrease the influence of another

Table 8.1 Examples of IS studies using RBV

Paper title	Author(s), published year	Abstract
Sustaining IT advantage: the role of structural differences	Clemons and Row (1991)	Investigates the role of IT in achieving SCA. Concluded that IT by itself cannot lead to SCA; however, it assists other resources to do so.
Information technology and sustained competitive advantage: a resource-based analysis advantage	Mata et al. (1995)	Argues that among four following IS resources only managerial IT skill leads to SCA. The four resources are: access to capital, proprietary technology, technical IT skills, and managerial IT skills.
Develop long-term competitiveness through IT assets	Ross et al. (1996)	Define three IT assets: IT human resources asset, technology asset, and relationship assets. Then states that the combination of these three assets leads to SCA.
Information technology as competitive advantage: the role of human, business, and technology resources	Powell and DentMicallef (1997)	One of the findings is that IT alone cannot produce SCA; however, IT can influence other intangible resources such as complementary human and business resources to attain SCA.
IT capabilities: theoretical perspectives and empirical operationalization	Bharadwaj et al. (1998)	Define six categories of IT capability: IT business partnerships, external IT linkages, business IT strategic thinking, IT business process integration, IT management, and IT infrastructure.
An information company in Mexico: extending the RBV to a developing country context	Jarvenpaa and Leidner (1998)	Supports RBV in developing country and in addition discusses different types of IT resources and capabilities in developing country to gain competitive advantage.
A resource-based perspective on information technology capability and firm technology capability and firm performance: an empirical investigation	Bharadwaj (2000)	Compares performance of a group of firms which have high IT capabilities and firms which do not. Performance of superior IT capability firms found to be higher.
The role of IT in crisis response: lessons from the SARS and Asian Tsunami disasters	Dorothy et al. (2009)	Identifies what IS resources are needed in crisis response, and also explain how these IS resources bundled with non-IS resources. It suggests that existing assets such as information technology infrastructure, leadership, and collaborative networks and existing capabilities such as the ability to build and apply IT, the ability to recognize signals and the ability to see the big picture are critical during crisis response.

resource, suppressing effect can be perceived (Wade and Hulland 2004). In order to fill this gap, we propose a new concept of resource orchestration as a possible framework to explain resource impressionability.

In the following, first we give a description of terms which have been used widely in RBV, then the application of RBV is explained in IS literature. The fourth section discusses the new concept of resource orchestration. The last section, conclusion and future research, summarizes the existing literature and offers recommendation for future research.

8.2 Literature Review

RBV has been widely used in the IS field. The previous IS research related to resources, performance, and CA is influenced by RBV (e.g., Andreu and Ciborra 1996; Bharadwaj 2000; Melville et al. 2004; Montealegre 2002; Peppard and Ward 2004; Piccoli and Ives 2005; Powell and Dent-Micallef 1997; Ray et al. 2005; Sambamurthy et al. 2003; Santhanam and Hartono 2003; Tanriverdi 2006; Teo and Ranganathan 2004; Tippins and Sohi 2003; Wade and Hulland 2004; Wheeler 2002; Zahra and George 2002; Zhu 2004).

Based on RBV, organizations are basically composed of a set of specific resources and the ability of an organization's management in combining the resources enables it to exploit market opportunities which contribute to the performance of an organization (Penrose 1959). Moreover, it is also known that resources are the most fundamental unit of analysis in the organization process (Grant 1991). In other words, a firm can be viewed through a collection of resources and capabilities enabling the firm to continue its life. The RBV argues that a firm possesses a collection of resources which may lead the firm to enhance its CA, depending on the characteristics of resources (Barney 1991). Specifically, a prevailing paradigm has emerged to ascertain the relation between a firm's resources and its CA or SCA (Piccoli et al. 2002). It is proposed that CA generally can be generated and sustained through unique and distinguishing resources that may be durable, rare, appropriate, non-substitutable, immobile or imperfectly mobile, difficult for others to imitate, and have value in the firm's environment and marketplace (Birkinshaw and Goddard 2009; Wade and Hulland 2004; Barney 1991).

In the following, we discuss the components of RBV theory. Then we elaborate the resource attributes which play an important role in achieving CA.

8.2.1 Competitive Advantage

First, we begin with the explanation of CA. CA generally refers to unique and distinguishing resources that may be durable, difficult for others to imitate, and have value in the firm's environment and marketplace (industry) (Birkinshaw and Goddard 2009).

According to H. Igor Ansoff, CA identifies the kind of opportunity the firm seeks, such as a dominant position in an emerging industry, or one where the cost of entry is so high that there are only a few competitors (Goold and Campbell 1998).

CA grows fundamentally out of the value a firm is able to create for its customers that exceeds the firm's cost of creating it. Value is what customers are willing to pay, and superior value stems from offering lower prices than competitors for equivalent benefits or providing unique benefits that more than offset a higher price.

There are many well-known strategies proposed to attain CA. Porter has proposed the generic strategies of differentiation and cost leadership (Porter 1985). Firms applying these strategies either distinguish their products from the competition by offering something unique and difficult to imitate, or sell at lowest cost, attract significantly more customers than competitors and thrive on the volume of sales generated. According to Porter, these twin strategies also have a dimension of focus, or competitive scope. This refers to the strategy of targeting products to compete on a specific segment (niche) of the industry. Firms that are able to identify their niche, and either win on differentiation or cost leadership, will have CA. The factor of time also cannot be ignored. Firms can often secure leadership positions in a new market by entering the market early, combined with a forward-looking approach to pricing that places high barriers of entry for potential market entrants. This is known as first-mover advantage. Looking inward, CA in one industry can be strongly enhanced by interrelationships with firm units competing in related industries (Porter 1985). We will revisit this point in subsequent sections of this article.

Many CA types are unsustainable, as competitors will eventually attempt to catch up with the firm holding the advantage. A sustainable CA is possible when other firms cannot duplicate what the one holding the advantage has been able to do. It is an advantage that enables business to survive against its competition over a long period of time.

8.2.2 Resources

Resources which are sometime synonym for assets are defined as all tangible or intangible things that can be used in the business processes of a firm to produce and develop products and/or offer services, whereas capabilities are action patterns repeating in the taking advantage of assets (Wade and Hulland 2004).

Subsequently, we describe the characteristics of resources which lead organizations to attain competitive advantage with these resources.

8.2.2.1 Resource Characteristics

The three attributes of resources that help an organization create or attain CA are *value*, *rarity*, and *appropriability*. The three attributes of resources that limit an organization's ability to sustain CA are *imitability*, *substitutability*, and *mobility* (Wade and Hulland 2004).

Value

In RBV, a resource has value when it enables an organization to implement strategies to improve efficiency and effectiveness (Barney 1991).

Rarity

Rarity refers to the condition where the resource is not simultaneously available to a large number of firms.

Appropriability

Appropriability refers to a firm's capability to appropriate the returns accrued by its competitive position in possessing valuable and rare resources. Resources, no matter how valuable and rare, are only good if their benefits can be tapped or appropriated. Otherwise, a firm cannot be considered to have attained CA.

Toward Sustainable Competitive Advantage

While attaining CA is crucial, once a firm establishes a CA through the strategic use of its resources, that advantage must be made sustainable. Barney (1986a, 1991) further extended RBV to the understanding of sustainable CA. He noted that heterogeneity of resources and imperfection in resources mobility can lead to the creation of sustainable CA. Moreover, in order to sustain CA, a resource should have low *imitability, substitutability*, and *mobility* (Wade and Hulland 2004). For consistency, we express these attributes in terms of what is desirable – *inimitability*, *non-substitutability*, and *immobility*.

Inimitability

Inimitability is an attribute of a resource that makes it almost impossible for other firms to duplicate it. Resources would become very difficult to duplicate when they are deeply integrated into a firm through its unique developmental path, such as brand loyalty and company culture. Such resources are also characterized by social complexity.

Non-substitutability

Non-substitutability is an attribute of a resource which makes it difficult to replace with another resource that yields equivalent benefits. When an organization is in possession of a rare and inimitable resource, competitors may seek to match up by acquiring a substitute resource. In ensuring that the resource is also non-substitutable, the organization is in a competitively superior position that is not easily matched by competitors.

Immobility

Immobility of a resource is the condition in which the resource cannot be obtained by acquisition through factor markets. Immobile or imperfectly mobile resources make it difficult for competitors to attain instant CA by attracting resources away from rivals, purchasing them like commodities or even mergers and acquisitions with companies possessing strategically important resources.

8.2.3 Capabilities

Capability is another term which is used widely in RBV. While the concept of resources is being developed, the concept of capabilities also has been discussed in the literature (Sanchez 2001). Nelson and Winter (1982) have contributed to develop the proposition of capabilities in organization (Leonard-Barton 1992; Stalk et al. 1992; Amit and Schoemaker 1993; Collis 1994; Grant 1996; Helfat 1997; Teece et al. 1997; Eisenhardt and Martin 2000; Ethiraj et al. 2005). Since 1990s, numerous researchers have begun to build upon the paper of Nelson and Winter (1982). There are almost as many definitions of organizational capabilities as there are authors on the subject, however, one of the most popular definition is that capabilities are "the ability of a firm to transform inputs to outputs of greater value" (Wade and Hulland 2004; Amit and Schoemaker 1993; Capron and Hulland 1999). Another definition is Makadok (2001) and Hoopes et al.'s (2003, p. 890) definition; they stated that capabilities are intangible, "cannot be valued, and changes hands only as part of its entire unit." They also classified capabilities in two groups. A capability can be intrinsically valuable or it can be valuable by increasing the value of a resource. Nike's marketing capability can be an example. It can be intrinsically valuable on its own or it can be valuable through enhancing the value of Nike's brand.

Most researchers concern "the ability of the firms to perform an activity (be it static, dynamic, or creative) more effectively than competitors with otherwise similar resource endowments" (Collis 1994, pp. 144–145; Winter 2003). In addition, many researchers noted that capabilities have influence on organizational performance and capabilities are key determinants of it (Bharadwaj 2000; Collis 1994; Eisenhardt and Martin 2000; Ethiraj et al. 2005; Gavetti 2005; Gold et al. 2001; Grant 1996; Helfat 1997; Helfat and Raubitschek 2000; Makadok 2001b; Melville et al. 2004; Pavlou 2002; Peppard and Ward 2004; Piccoli and Ives 2005; Ray et al. 2005; Tanriverdi 2006; Teece et al. 1997; Santhanam and Hartono 2003; Wade and Hulland 2004). Each organization has its unique composition of resources and capabilities and capabilities are organization specific (Amit and Schoemaker 1993; Ray et al. 2005; Teece et al. 1997). Like resources, capabilities which are valuable, rare, inimitable, and non-substitutable are considered as strategic (Amit and Schoemaker 1993; Teece et al. 1997).

Although the definitions of resources and capabilities are not precisely addressed, most researchers believe capabilities have a higher order than resources (e.g., Grant 1991, 1996; Amit and Schoemaker 1993; Andreu and Ciborra 1996; Bharadwaj 2000; Collis 1994; Eisenhardt and Martin 2000; Peppard and Ward 2004; Ray et al. 2005; Teece et al. 1997). A particular example can be that a group of scholars have declared that organizational routines which generate interaction among resources establish capabilities (Amit and Schoemaker 1993; Grant 1991; Zollo and Winter 2002). In addition, Grant (1996) specifically has stated that knowledge integration, which is a form of interaction among knowledge resources, is the very essence of organizational capabilities.

Another difference regarding capabilities is that they are not as easily transferred as resources (Amit and Schoemaker 1993; Eisenhardt and Martin 2000). Moreover, Teece et al. (1997, p. 529) specified that capabilities "cannot easily be bought; they must be built" internally by the organization. It is also stated that capabilities are embedded in the organization processes (Collis 1994; Santhanam and Hartono 2003; Zollo and Winter 2002). Furthermore, Eisenhardt and Martin (2000, p. 1107) even went to the extent of proposing that "capabilities actually consist of identifiable and specific routines."

In the review of RBV-related literature, it is found that most researchers consider capabilities as naturally processual. Thus, in line with this accord, capabilities are essentially understood as the processual ability to direct resources and their interactions in a manner that will contribute to the advancement of organizational performance.

Besides the concept of capabilities, capability development has been also addressed in the literature. It has been stated that capability development is a gradual process where the historical context and situation that the organization has experienced have a systemic and emergent influence on the subsequent development process and the resultant developed capability, as discussed in Montealegre (2002) and Tan et al. (2004). From this definition it can be inferred that capability development is a longitudinal process that occurs over a period of time (Amit and Schoemaker 1993; Santhanam and Hartono 2003; Teece et al. 1997).

Although the development of capability is path dependent, it does not necessarily imply that there is only one particular path that the development of a specific capability has to undergo. In fact, there are a multitude of possible paths that can contribute to the realization of any one specific type of capability. Eisenhardt and Martin (2000) called this phenomenon "equifinality" that is, different organizations can have similar capabilities; however, each one may proceed from different beginning points and adopt a unique development path. This phenomenon was also observed by Barney (2001) and Bowman (2001).

Defining the terms and concept in the RBV theory leads us to the discussion of a new emerging concept, that of resource orchestration.

8.3 Application of RBV in IS Research

RBV origin was the strategic management discipline, how RBV affected, moreover, has effect on other research disciplines is also a considerable issue (Barney et al. 2001) and IS discipline is not an exception. Using RBV theory in the IS literature emerged in the beginning of 1990s. RBV provides a theoretical lens for IS scholars to investigate how IS resources and capabilities can contribute to firm strategy and performance. Moreover, it lays a basis for discussion of IS resource and non-IS resource interaction and, thus, the possible influence on CA. In this section, a brief review of antecedent IS researches will be presented. In addition, their contribution in an IS context will be discussed.

It is stated that IS merely have direct impact on SCA; however, they act as a part other resources and capabilities which may lead to SCA (Clemons and Row 1991). In other words, Clemons and Row (1991) argue that IS resources are not sufficient for a firm to attain SCA; however, they are essential and contribute to increase performance (Clemons and Row 1991; Wade and Hulland 2004).

8.3.1 Information System Resources and Capabilities

Most of the IS researches focus on RBV as a theory to identify and define IS resources and their relationship with CA, SCA, firm strategy, and firm performance (e.g., Clemons and Row 1991; Mata et al. 1995; Ross et al. 1996; Bharadwaj et al. 1998; Bharadwaj 2000). One of the earliest studies which identified IS resources is Ross et al.'s classification (1996). They categorized IS resources into human resources such as IT skill, problem-solving orientation, business understanding; technology resources such as hardware, software, databases, system architecture, servers, standards; relationship resources such as IS-business relationship, top management support, risk management, and responsibility; IT processes, considered as capability, refer to the ability of a firm for planning, cost-effective operation, and market responsiveness (Ross et al. 1996).

Bharadwaj et al. (1998) defined IT capability as comprising the six following classes: IT/business partnerships, external IT linkages, business IT strategic thinking, IT business process integration, IT management, and IT infrastructure. Later, Bharadwaj (2000) developed the concept of IT as organizational capability and defined IT resources as IT infrastructure, human IT resources, and IT-enabled intangibles. In addition to identifying IT resources types, he assessed IT capabilities and firm performance. He stated that "firms with high IT capability tend to outperform a control sample of firms on a variety of profit and cost-based performance measures" (Bharadwaj 2000, p. 1).

Apart from identifying individual resources and capabilities, Day (1994) suggests that capabilities can be sorted into the three types of processes: inside-out process, outside-in process, and spanning process (Day 1994). Based on Day's framework, Wade and Hulland categorize IS resources into these three types: inside-out includes

IS infrastructure, IS technical skills, cost-effective IS operation; spanning includes IS-business partnership, IS planning and change management; outside-in includes external relationship management, market responsiveness (Wade and Hulland 2004). In agreement with this typology, Wade and Hulland propose that outside-in and spanning resources have more paramount impact than inside-out resources on the lasting of firm CA. A list of IS studies is given in Table 8.1.

8.4 Resource Orchestration

In the process of implementing an IT project, many kinds of resources exist and contribute toward attaining the project objectives. Nonetheless, resources have impacts on each other and in the wider view resource impressionability may change the resultant of resources. We propose the term *resource orchestration* to explain the outcome of all resources as a united concept, moreover, to investigate resource impressionability within this orchestration.

The word *orchestration* is originally derived from music literature; the Harvard Dictionary of Music defines it as "The art of employing, in an instrumental composition, the various instruments in accordance with (a) their individual properties and (b) the composer's concept of the sonorous effect of his work. It involves the detail knowledge of the playing mechanism of each instrument, its range, tone quality, loudness, limitation, etc." (Apel, revised and enlarged edition (January 1968), p. 607). According to this definition, each instrument has its own sort of characteristic such as range, quality, loudness, and limitation, which produces a particular sound in an orchestra. In fact, when all of the instruments produce sound together, it makes the orchestra unique. What is more important in music art is the resultant of sounds rather than one sound. In essence, this concept is similar in an IT project within an organization when each resource acts as one instrument and the successfulness of the project relies more on the overall outcome of various resources including IT and non-IT resources.

We define *resource orchestration* as an arrangement of organizational resources which lead the organization to perform an IT project. Resource orchestration underscores resource impressionability and complementary. Moreover, it explains various effects like enhancing effect, masking effect, and creating effect of resource types on one another. As noted earlier, an analogy for resource orchestration can be music orchestration, which is the art of composing for an orchestra.

8.5 Conclusions and Future Research

The focus of this study has been to review RBV theory especially in IS literature. In addition, to fill the existing gap, we have proposed a new concept of resource orchestration. Here, we have noted that this new concept can lay a basis for future researches not only in the IS field but also in strategic management.

Future research can further develop this study and address possible processes to attain resource orchestration. In addition, it is interesting to examine the relationship between resource orchestration and business outcome. Future research effort can also be devoted to further verification of the resource orchestration concept.

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Chapter 9
On the Business Value of Information Technology: A Theory of Slack Resources

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Abstract This chapter provides insights on the business value of IT by theorizing the concept of *IT slack* and explaining its effects on firm performance. We define IT slack as *the cushion of actual or potential IT resources that allow organizational adaptation to internal and external pressures and jolts.* We elaborate a typology of IT slack based on two dimensions: the nature of the slack (i.e., IT artifact, human resource, or time) and the type of IT asset (i.e., IT infrastructure vs. IT application).

We suggest that IT slack simultaneously affects both organizational effectiveness and efficiency. IT slack is a double-edged sword. While IT slack can improve organizational effectiveness, it might reduce efficiency, because slacks is, by definition, excess resources that remain idle until needed. We also suggest that the relationship between IT slack and organizational effectiveness is curvilinear.

Keywords IT slack • Business Value of IT • IT Productivity Paradox • Organizational Effectiveness • Organizational Efficiency

Abbreviations

CEO	Chief executive officer
CIO	Chief information officer
CRM	Customer relationship management
ERP	Enterprise resource planning
IS	Information systems
IT	Information technology

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9.1 Introduction

The extant literature on the business value of information technology (IT) provides insights on the impact of IT on productivity, profitability, and consumer surplus (Brynjolfsson 1993; Dehning et al. 2003; Dewan and Ren 2007; Grover and Ramanlal 1999; e.g., Hitt and Brynjolfsson 1996; Thatcher and Oliver 2001). In general, the business value of IT varies significantly from one organization to another and from one study to another. In this paper, we extend this literature by looking at how IT slack (defined as *the cushion of actual or potential IT resources that allows organizational adaptation to internal and external pressures and jolts*) relates to the business value of IT.

Past research in organizational theory and strategy has generally found a positive relationship between organizational slack and organizational effectiveness (Bourgeois 1981; Cyert and March 1963; Hannan and Freeman 1977; Pinsonneault and Kraemer 2002; Sharfman et al. 1988; Singh 1986). However, agency theorists have criticized slack for lowering organizational efficiency and also for being misused by managers (Litschert and Bonham 1978; Love and Nohria 2005; Tan and Peng 2003). In the IT literature, few scholars have used the general concept of organizational slack. For instance, Pinsonneault and Kraemer (2002) used the notion of organizational slack to explain how a city's IT helped the city to respond to environmental jolts. Dehning et al. (2003, 2004) investigated the influence of IT-induced organizational slack in manufacturing and service firms. However, the exact nature of the relationship between slack and the business value of IT is still understudied. In addition, the specific nature of the slack created by IT is not clearly differentiated from other types of organizational slack, such as cash reserves of the organization.

The objective of this article is to first conceptualize IT slack based on the characteristics of the information systems (IS) and the nature of slack that is created. Accordingly, we develop a typology of IT slack that differentiates six types of IT slack. Second, the chapter provides a fresh perspective to the business value of IT through the lens of IT slack typology by analyzing how different IT slack creation influences organizational efficiency and effectiveness. We heavily rely on the notions of resource redeployability (Williamson 1991) and unintended consequences of purposeful decision (Selznick 1949) in order to explain how different types of IT slack affect these core variables distinctively. Finally, the chapter analyzes the simultaneous impact of IT slack on efficiency and effectiveness.

The rest of the chapter is organized as follows. First, we explain the concept of organizational slack and draw on it to conceptualize a new construct called IT slack. Second, a typology of IT slack is presented based on the class of IT asset, which includes slack and the type of slack created. In the next section, an interpretation of the IT slack typology is employed to explain the link between different types of IT slack and organizational efficiency and effectiveness. Finally, we conclude by discussing the implications of the model for research and practice.

9.2 Theoretical Background

IT scholars have studied the value of IT from a variety of angles: productivity (e.g., Brynjolfsson 1993; Park et al. 2007; Pinsonneault et al. 1999), profitability (e.g., Bharadwaj 2000; Ranganathan and Brown 2006; Venkatraman and Zaheer 1990), or consumer surplus (Grover and Ramanlal 1999; Hitt and Brynjolfsson 1996; Thatcher and Pingry 2004). In addition, there is variation in the evidence regarding the business value of IT and how this variation is explained. Some effort has been made to better understand the measurement issues (e.g., Aral and Weill 2007; Dehning et al. 2003; Hitt and Brynjolfsson 1996), while others have looked at the management of IT (e.g., Chan et al. 1997; Ross et al. 1996; Luftman 2003). Yet, despite significant research efforts, the phenomenon is still not really understood. We provide a fresh perspective on the phenomenon by drawing on the notion of slack in the organization theory and strategy literature.

9.2.1 Organizational Slack

In order to conceptualize IT slack, the notion of slack should be initially clarified. The concept of slack is predominantly analyzed in the strategy and organizational theory (OT) literature (Bourgeois 1981; Bromiley 1991; Cohen et al. 1972; e.g., Cyert and March 1963; Litschert and Bonham 1978; Love and Nohria 2005; Sharfman et al. 1988; Singh 1986; Tan and Peng 2003; Wan and Yiu 2009). Cyert and March (1963) were the first to define it as "[the] disparity between the resources available to the organization and the payments required to maintain the coalition" (p. 36). Organizational slack is introduced not as a concept for explaining resource allocation differences, but as "a hypothetical construct for explaining overall organization phenomena" (Cyert and March 1963, p. 37). Building on their work, Bourgeois (1981) introduced a more general and structured definition of slack:

> Organizational slack is that cushion of actual or potential resources which allows an organization to adapt successfully to internal pressures for adjustment or to external pressures for change in policy, as well as to initiate changes in strategy with respect to the external environment (Bourgeois 1981, p. 30).

Organizational theorists have argued that organizations seek to survive as their ultimate goal (Cyert and March 1963; Pfeffer and Salancik 1978; Thompson 1967). Slack is one of the necessary resources that aid in long-term organizational survival (Tan and Peng 2003), and hence organizations intentionally invest in slack (Bourgeois 1981). However, similar to any organizational planned decision, the slack investment decision is associated with some dysfunctions along with its intended functions (Blau 1955; Selznick 1949). On the one hand, several useful functions have been specified for slack: reducing goal conflict and political behaviors (e.g., Bourgeois 1981), enhancing organizational agility (e.g., Cyert and March 1963), facilitating organizational evolution (e.g., Sharfman et al. 1988), environmental shock absorption (e.g., Cyert and March 1963), reducing information-processing needs (e.g., Bourgeois 1981), enhancing performance during organizational jolts (e.g., Wan and Yiu 2009), increasing organizational stability (e.g., Litschert and Bonham 1978), augmenting innovation (e.g., Dehning et al. 2003), and survival (e.g., Hannan and Freeman 1977). On the other hand, however, slack is criticized for decreasing organizational efficiency (e.g., Love and Nohria 2005; Litschert and Bonham 1978) and also for causing agency problems by being misused by managers (e.g., Tan and Peng 2003). In the following, the impact of slack on organizational effectiveness and organizational efficiency is briefly reviewed.

9.2.1.1 Organizational Slack and Effectiveness

Survival has been introduced as the ultimate goal of organizations (Pfeffer and Salancik 1978). This can be achieved to the extent that organizations are effective (Pfeffer and Salancik 1978; Scott and Davis 2007). Effectiveness derives from a variety of factors such as the quality of output (Scott 2003), adaptability and flexibility (March and Sutton 1997), and management of stakeholder demands (Pfeffer and Salancik 1978). As a result, organizations that create legitimate and "acceptable outcomes and actions" can be called effective (Pfeffer and Salancik 1978, p. 11). Effectiveness is an *external* standard to organization and is merely applied to output. On evaluating effectiveness, we aim to understand "how well an organization is doing" (Scott 2003, p. 351) or more specifically, "how well an organization is meeting the demands of various groups and organizations that are concerned with its activities (Pfeffer and Salancik 1978, p. 11)." In contrast to efficiency, which is dominantly a technical issue, effectiveness is primarily a sociopolitical question due to the role of external stakeholders.

Effectiveness is the main purpose justifying slack creation in organizations. Cyert and March (1963, pp. 36–38) outlined a number of slack advantages – mentioned earlier – which predominantly enhance effectiveness and accordingly permit firms to survive. Other scholars (Bourgeois 1981; Dehning et al. 2003; 2004; Litschert and Bonham 1978; Love and Nohria 2005; Pinsonneault and Kraemer 2002; Sharfman et al. 1988; Singh 1986; Tan and Peng 2003; Wan and Yiu 2009) build on Cyert and March's notion of slack and add other benefits enhancing effectiveness of the organization in less favorable environments. For instance, it is argued that slack reduces goal conflict and political behaviors (e.g., Bourgeois 1981), facilitates organizational evolution (e.g., Sharfman et al. 1988), enhances performance during organizational jolts (e.g., Wan and Yiu 2009), and shrinks information-processing needs (e.g., Bourgeois 1981). The aforementioned benefits of slack are predominantly classified among factors enhancing organizational effectiveness by improving output quality, external stakeholder satisfaction, adaptability, and flexibility.

9.2.1.2 Organizational Slack and Efficiency

A primary part of the advantages of organizational slack with regard to organizational effectiveness is achieved by sacrificing organizational efficiency. Efficiency is an *internal* standard of performance and aims to maximize the ratio of output produced over the resources utilized. Efficiency is value-free and independent of the criteria evaluating input and output (Pfeffer and Salancik 1978).

Slack creation has been criticized for deteriorating organizational efficiency (Bourgeois 1981; Litschert and Bonham 1978; e.g., Love and Nohria 2005; Tan and Peng 2003). Slack decreases the ratio of output produced over the resources utilized through increasing the allocated resources without necessarily enhancing the output (Pinsonneault and Kraemer 2002). Bourgeois (1981, p. 30) suggests that slack smoothes performance by reducing performance during good times and improving it during bad times. Wan and Yiu (2009) find empirical support for this argument and show that while slack improves organizational performance during an environmental jolt, it decreases performance before and after a jolt. In a similar vein, Love and Nohria (2005) show that decreasing slack in a proactive, broad downsizing is more likely to lead to improved performance. Hence, the theoretical and empirical body of literature supports the negative impact of slack on organizational efficiency. However, the literature also shows that this negative impact is not flat and is a function of the slack *redeployability* (Love and Nohria 2005; Sharfman et al. 1988; Singh 1986).

9.2.1.3 Organizational Slack and Redeployability

Redeployability – the opposite of specificity – is an important condition of any organizational resource (Williamson 1985, 1991, 1995). Williamson (1991, p. 281) defines it as “the degree to which an asset can be redeployed to alternative uses and by alternative users without sacrifice of productive value.” Accordingly, organizational theorists have classified organizational slack by differentiating *absorbed* and *unabsorbed*[1] slack based on *redeployability* as the categorization criterion (Love and Nohria 2005; Sharfman et al. 1988; e.g., Singh 1986). They argue that distinct conditions of slack provide different degrees of flexibility to managers during jolts (Sharfman et al. 1988). In general, the unabsorbed slack is distinguished from absorbed slack because the former is an uncommitted resource in organization (Singh 1986). Unabsorbed slack resources can be used in a variety of situations and give managers a number of options because they are easy to redeploy (Sharfman et al. 1988; Tan and Peng 2003). Absorbed slack resources are already committed and can be used as protection in a limited number of specific situations and therefore are hard or even sometimes impossible to redeploy to other uses or processes (Love and Nohria 2005; Sharfman et al. 1988). This classification is important

[1]Some authors have named it “available” (Love and Nohria 2005) or “high discretionary” slack (Miner et al. 1990).

because the literature suggests that each type of slack has different antecedents (Sharfman et al. 1988) and consequences on firm performance (Tan and Peng 2003).

The notion of slack can be used to help shed light on the contradictory empirical evidence on the business value of IT. In the next section, an IT slack construct is thoroughly theorized.

9.3 IT Slack Conceptualization

Technological systems in general and IT in particular, are complex, uncertain, and equivocal (Bijker et al. 1987; Orlikowski 1992, 1996; Weick 1990; Winner 1977). While the notion of unintended consequences of purposeful actions has been recognized in the management literature (Selznick 1949), it is an inherent characteristic of an IT artifact. Companies increasingly invest in IT, expecting to achieve specific result, but unexpected events and consequences often occur (Bechky and Okhuysen 2011). For instance, without knowing the exact time and situation, managers always expect some hardware crashes, bugs in the developed software, and user resistance in IS implementation. This leads decision makers to invest in technology-related slack as a way to manage the unexpected technical and organizational consequences resulting from IT investment. This paper focuses on this type of slack, which management deliberately creates in order to build in some cushion for unanticipated, unintended events that may threaten smooth operations of the IT or business processes. In this section, we develop a conceptualization of the IT slack as an important concept in IT literature and analyze its various implications for firm performance.

Building on Bourgeois' (1981) definition in the organization theory literature and toward "disaggregate[ing] the IT construct into meaningful subcomponents" in business value of IT (Melville et al. 2004), we define IT slack as *the cushion of actual or potential IT resources that allows IT or organizational adaptation to internal and external pressures and jolts*. IT slack may enhance IT effectiveness when it provides extra IT services and supports to organizational stakeholders (such as other departments) that are beyond what was planned for. In terms of the external pressures, IT slack may allow organizations to respond to environmental jolts by providing unexpected, novel services and support to stakeholders outside the organization.

IT slack is a dynamic resource that acts as a buffer between core resources (i.e., operationalized IT investment) and the changing business environment. IT slack helps in adjusting its resource mix to build a better capability to react to internal and external surprises and in maintaining its sustainability (Wade and Hulland 2004). Hence, we argue that IT slack mainly helps in achieving two goals: (1) to create options for the organization (Ranganathan and Brown 2006; Sambamurthy et al. 2003) and (2) to decrease the risk (Dewan and Ren 2007; Weick and Sutcliffe 2007) associated with IT investment and its business values. By doing so, organizations enhance their effectiveness through generating options to seize and adapt to emergent opportunities (Sambamurthy et al. 2003) and also to manage threats toward the IT investment and/or organization.

9.3.1 IT Slack and Redeployability

As a subset of organizational resources, IT slack can be similarly classified into two conditions: *absorbed IT slack* vs. *unabsorbed IT slack*. Absorbed IT slack can be interpreted to represent IT slack that is mainly used for protection in few specific situations (Sharfman et al. 1988). They are the ones that are embedded in a specific internal or external transaction and are not redeployable to other transactions. For instance, overcapacity of a specific payroll application cannot be redeployed to other applications in other departments. As another example, legal IT staff who are professionals in specific legal issues of IT contracts are non-redeployable IT resources who can be merely utilized in an IT contract context. In contrast, unabsorbed IT slack is not specific to a particular transaction and can be used in various situations and/or provide various options. For example, underutilized capacity of computer servers in a marketing department can be easily redeployed to other departments.

9.3.2 The Value of IT Slack

IT slack contributes to organizational effectiveness in two ways: *indirect* and *direct*.

In the direct scenario, IT slack improves organizational effectiveness directly by addressing the specific needs of the business domain. In such cases, IT slack supports some unplanned business requirements. For instance, a CIO[2] might need to invest beyond the optimum amount in the organization's IT in order to be prepared for a jolt in customer demand during the current fiscal year. Customer demand spike, if occurs, may have considerable consequences for IT, and therefore the IT operations and services need to be prepared for maintaining high-quality service in such a situation. As a result, IT slack directly enhances organizational effectiveness due to uncertainty in the environment and the business needs.

In the indirect path, IT slack enhances organizational effectiveness through the mediating role of IT effectiveness. Technological damage and breakdown are inherent in any type of technology, including information technologies. Managers generally expect these unplanned technological crashes and therefore they usually build technological backups and cushions that are required to keep the operation alive in the case of a technological jolt. For instance, a CIO may buy additional hardware systems and employ further IT technicians for the purpose of managing probable future downtimes of the real-time online payment systems. This type of IT slack is created for technological reasons by investing in online payment systems and enhances IT effectiveness within the organization. By enhancing IT effectiveness, organizational services and processes are better served, and accordingly this will also *indirectly* lead to improved organizational effectiveness.

[2]Chief Information Officer.

Similar to the organizational slack, IT slack is associated with organizational inefficiencies. This may cause some confusion about the relationship between IT slack and other constructs. First, IT slack should be clearly distinguished from ineffective decisions. IT slack definition clearly emphasizes enabling organizational adaptation to internal or external pressures. While IT slack is an effective investment for the period of emergencies, it may lead to some degree of organizational inefficiency if it is not being used (Pinsonneault and Kraemer 2002). However, this does not mean that all the decisions leading to inefficiencies in organizations will create slack or IT slack. In contrast to slack, which is supposed to enhance effectiveness, inappropriate and low-quality decisions lead to decline in both effectiveness and efficiency. In other words, enhancing effectiveness is the distinguishing characteristic of organizational/IT slack as compared with non-slack and ineffective decisions. For instance, overinvesting in hardware systems can be an IT slack if it is made as a cushion for the periods of customer demand jolt. However, a CIO may make a decision to buy some hardware systems that do not precisely satisfy the needs of a department. Therefore, some of the hardware systems will be left unused (inefficient) and also will not be beneficial to the organization (ineffective). This is an example of an ineffective decision that does not necessarily create IT slack and decreases both the effectiveness and efficiency.

Second, IT slack should be differentiated from the concept of conversion contingencies (Davern and Kauffman 2000), which is based on the *predictable* shortcomings in allocating resources. As Davern and Kauffman (2000) indicate, failure to invest in IT infrastructure and failure to invest in training are some of the conversion contingency examples that can reduce realized business value of IT as compared to its potential values. As a result, conversion contingency is about predictable and mostly ignored aspects of an IT investment, which differs from IT slack, because the latter focuses on deliberate overinvestments to address uncertain, unpredictable, and unknown aspects of a business.

What is important is the contribution of IT slack to organizational effectiveness, which can be created either consecutively or simultaneously with IT investment. According to the above conceptualization, IT slack can take various conditions, which are classified in the following section.

In the next section, we propose a typology of IT slack that elaborates on different types of IT slack that are different in nature. Developing such a typology helps in better understanding the business value of IT.

9.4 A Typology of IT Slack

Pinsonneault and Kraemer (2002) argued that the value of IT depends on the slack and its allocation. We extend this idea and suggest that IT slack is different from organizational slack and more importantly that different types of slack can be reallocated more or less easily. In other words, based on the literature on organizational slack and its condition of redeployability (Love and Nohria 2005; Sharfman et al. 1988; e.g., Singh 1986), we pursue this idea further by classifying different types of IT slack and investigating their distinct impacts on the business value of IT. IT slack can take different forms. While all types of slack are similar in sharing the concept of overinvestment beyond the economist's optimized, equilibrium point (Bourgeois 1981; Cyert and March 1963), the diversity of IT slack necessitates theorizing and classifying these types in order to enhance our understanding of different impacts of IT slack on any organizational phenomenon. In the following, a typology of IT slack is proposed by splitting IT slack type into IT type and slack type: one focusing on the nature of slack, and the other relying on the types of IT assets created as "IT slack."

First, IT slack can be classified in reference to the nature of the slack itself. Accordingly, IT slack is similarly approached as any other type of excess capacity in organizations. *Time*, *extra machine capacity*, and *labor* are the three types of organizational slack (e.g., Bourgeois 1981; Litschert and Bonham 1978) which are also applicable to IT slack.[3] Second, IT slack can be classified according to the type of IT asset – that is, IT infrastructure assets vs. IT application assets – which is created as slack. According to the above two dimensions, Table 9.1 illustrates a classification of IT slack, including some examples**.**

The rows of Table 9.1 distinguish between IT infrastructure and IT applications as two generally different types of IT assets that are distinct in their characteristics and impacts (Aral and Weill 2007; Melville et al. 2004; Ward and Peppard 2002). IT infrastructures are the physical IT assets that comprise the computer and communication technologies and the shareable technical platforms and databases (Bharadwaj 2000). This includes platform technologies (hardware and operating systems), network and telecommunications technologies, and databases (Armstrong and Sambamurthy 1999). An IT application is a piece of software functionality that is developed and installed on specific IT platform(s) to perform a set of one or more business tasks independently of other surrounding IS components (Saraf et al. 2007).

The columns of Table 9.1 illustrate the three types of IT slack in organizations based on the nature of the slack that is created. IT slack can be formed by creating excessive capacity in the IT artifacts that are employed in an organization. In other words, the "IT artifact" type of IT slack is any kind of excess capacity or investment in the technological side of the IT resources. It is the simplest form of slack. Overcapacity of a software application for handling transactions above what is required in an organization, overinvestment in an IT application by buying system functionalities that are not currently required, underutilized features of IT applications, underutilized capacity of network/hardware systems, and providing Internet services for employees who are not supposed to use it for their jobs are some examples of IT slack that is originated from excessive investments in IT artifact. The second type of IT slack is what we call the "human slack." In other words, this type of slack is not as explicit as the IT artifact and is soft in nature. The human resource type of IT slack is the investment in creation of excessive capabilities and skills in

[3] We have excluded cash type of slack from our IT slack typology because, according to our definition of IT slack, cash slack resource is more an organizational slack and not a type of IT slack.

Table 9.1 A typology of IT slack

IT asset	Slack type: IT artifact	Human resource	Time
IT infrastructure	• Extra hardware purchases as backup (e.g., desktops) • Buying extra Microsoft office licenses as backup • Purchase of network hardware and software with capacities higher than the company's current needs • Redundant Internet access for non-task-related users • Creating e-mail accounts for employees who do not need it for their role	• IT expert backups for probable hardware systems problems • IT expert backups for probable online payment system problems • Employing IT experts for IT infrastructure who know far beyond just their task in the IT infrastructure	• The time dedicated for an additional round of software rollout in order to check for probable bugs • The additional time included in the total time a CIO reports to CEO[b] for hardware upgrade to ensure any potential inconsistency between the current hardware and the added components
IT application	• Overcapacity of a bank's CRM[a] application • Underutilized functionalities of an IT application • Overinvestment in security aspects of a supply chain management system in Walmart • Overinvestment in an informational system that is not currently required by managers • Creating office automation systems accounts for unnecessary employees	• Overqualified IT expert employed for an IT application • IT expert backup for e-Banking system sustainability • Overtraining of staff for a CRM application • Underutilized legal staff expert for IT purchases • Involving more than required experts and stakeholders in an IT project's steering committee	• Generously dedicating additional time for implementing a strategic IS application • Giving more time to people to gain acquaintance with the strategic IT application • Dedicating more time to preparing the contract for buying/outsourcing a strategic IS by being overly picky on the details

[a]Customer Relationship Management
[b]Chief Executive Officer

human resources above the level required for task completion. Recruiting more IT experts is also another type of human resource IT slack. Overqualified IT expert recruitment, underutilized legal staff experts in IT, staff overtraining for all details of an application, and IT expert recruitment as reserves for IT emergency incidents and jolts are some examples of the human resource type of IT slack. Finally, IT slack can also be related to time. For example, when extra amount of time is dedicated to an IT-related activity that is beyond the optimum amount of time required. For instance, quoting longer IT project implementation time to the top manager in order to keep a time cushion for any unexpected problem that may arise during the debugging phase, dedicating more time above the expected amount to a strategic IS implementation, and dedicating more time to preparing the contract for buying/outsourcing a strategic IS by being overly picky and pessimistic on the details of the contract are some examples of the time dimension for IT slack.

The interaction of the two dimensions creates six types of IT slack that are different in the nature of the IT slack created in each cell. These IT slack types are expected to create options by enhancing various IS capabilities. They are also supposed to differently affect IT- and organization-dependent variables. These six types of slack are as follows.

9.4.1 Type 1 – IT Infrastructure-Artifact Slack

This type of IT slack consists of the technological artifacts that are foundational for shared IT services and provide a flexible base for future business (Aral and Weill 2007). While IT infrastructural artifacts support business operations and enable various IT services within and outside the firm, slack dedication to this category creates technological options (Sambamurthy et al. 2003) for unforeseen changes and ensures adaptability and flexibility in IT functions or business processes. Extra hardware purchases as backup (e.g., desktops, printers, banks' signature scanners), software systems (e.g., Windows or Linux operation systems), network and telecommunication systems with capacities higher than the company's predicted needs (e.g., broadband speed and transmission assets), and redundant Internet access and unique e-mail accounts for non-task-related users are some examples of the infrastructural artifact type of IT slack. These examples of IT slack create options that enable organizations to (1) quickly replace an infrastructure that faces a technical problem, and (2) enhance the production or service capacity in an unpredictably demanding peak. While this type of IT slack is not sufficient for service and organizational growth (Penrose 1960) or current service maintenance, it is a necessary condition for doing these things (Davern and Kauffman 2000). In other words, the organization might have some difficulties to compete without allocating some IT infrastructure-artifact type of slack. This category of IT slack is generally supposed to improve technological IS capabilities through improving IT infrastructure technical abilities (e.g., in Schwarz and Hirschheim 2003; Wade and Hulland 2004) and also IT flexibility (e.g., in Peppard and Ward 2004; Ray et al. 2005) during an organization's departure from an optimal configuration of assets (Saraf et al. 2007). In addition, it may lead to improved IS integration capability (e.g., in Barki and Pinsonneault 2005; Mithas et al. 2008) by enabling options that facilitate this integration within and between organizations.

9.4.2 Type 2 – IT Infrastructure-Human Resource Slack

Despite the availability of the technological slack, the organization needs capabilities and skills that are able to manage the performance during the jolt period (Aral and Weill 2007; Wade and Hulland 2004). First, additional IT human resources are needed if the organization decides to take advantage of an unplanned market opportunity and expand its production and services. Also, people with additional capabilities beyond the normal process operation are required for managing the crucial process of technology replacement and for paving the way toward smooth operation of the business processes. Maintaining IT expert backups for unforeseen hardware crashes, assigning daily IT expert backups for probable problems in online payment system, and employing overqualified IT experts for IT infrastructure management processes are among the slack creation strategies that a firm may employ in order to create options for smooth management of the business process during the period of failure in an IT artifact and to facilitate adaptation to unpredicted market demands. The so-called class of IT slack improves IT human resource capabilities by enhancing an organization's ability in technical IS skills (e.g., in Bharadwaj 2000; Piccoli and Ives 2005; Ray et al. 2005).

9.4.3 Type 3 – IT Infrastructure-Time Slack

Despite the importance of the cushion of IT artifact and human resource in managing the jolt period, organizations sometimes need another type of slack for a successful adaptation that cannot be achieved by injecting more people and technologies (Sambamurthy et al. 2003). Time is the other type of slack that organizations need to create in order to enhance their adaptability to internal and external surprises (Sharfman et al. 1988). For instance, while an organization is a week away from the promised launching day of a new IT service, an essential operating system bug and its incompatibility with some new hardware drivers may not be resolved in 7 days by adding technologies as well as new IT developers with additional capabilities. In such cases, keeping some slack time would save the organization from various negative consequences resulting from a late problem in the project. The additional time included in the total time a CIO reports to the CEO for a hardware upgrade is an example of the IT infrastructure-time slack that tries to ensure the flexibility in successfully reacting to any potential inconsistency between the current hardware and the added new components. The time type of IT slack can indirectly improve all of the technological (e.g., Tanriverdi 2005), integration (e.g., Barki and Pinsonneault 2005), and human IS capabilities (e.g., Wade and Hulland 2004) by creating a cushion of time that enables an organization to mobilize its technological and integration capabilities and its human resource abilities.

The previous types of IT slack were all created around the notion of IT infrastructure. However, the following IT slack types will be created at the application level.

9.4.4 Type 4 – IT Application-Artifact Slack

The IT slack created in an IT application group is fundamentally different from the IT infrastructure and its components since it is directly related to the task and is less about the technical components that support the provided services. In addition to the technological type of IT slack dedicated to IT infrastructures, managers invest in technological IT slack in applications. While the infrastructural one is indirectly related to supporting the various types of business services in general, allocating technological IT slack to application systems directly affects the task and business operations (Ranganathan and Brown 2006). Managers also invest in the application type of IT slack for directly creating options and accordingly enhancing the adaptability and survival likelihood of the firm (Sambamurthy et al. 2003). For instance, overcapacity of a bank's CRM application, underutilized functionalities of an IT application, and overinvestment in security aspects of a supply chain management system are some examples by which managers create options for future surprises and unforeseen events. As can be seen from the examples, the nature of application-based IT slack is less about the IT platform (Bharadwaj 2000) and its components and more about a specific task, process, or department in the organization (Saraf et al. 2007). Hence, managers invest in the IT application-artifact type of IT slack in order to ensure that their applications (especially strategic ones) are highly flexible for dealing with unforeseen events (Teece and Pisano 1998). The IT application-artifact slack generally enhances technological capability by improving IT application functionalities, and integration capabilities (Peppard and Ward 2004) through providing modules and functionalities that facilitate various synchronic and asynchronic (Dennis et al. 2008) handshaking between and within organizations.

9.4.5 Type 5 – IT Application-Human Resource Slack

Similar to the technological IT slack, the nature of the human resource skills and capabilities and their impacts are generally distinct between the two groups of IT assets. The knowledge, abilities, and wages of the IT human resources working on specific IT applications (e.g., office automation system, customer relationship management, supply chain management, or online payment system) are generally different from the skills of the people who need to install computer hardware, operating systems, or telecommunication equipment. Applications are generally more professional and knowledge-intensive in terms of the benefits they provide for organizations, and therefore they receive much attention from managers. Especially for more strategic applications, managers allocate various types of IT human resources to ensure quick and comprehensive system troubleshooting and even extension. For instance, an overqualified IT expert employed for an IT application, an IT expert backup for sustainability of an e-Banking system, overtraining of the staff for a CRM application, and involving more than the required stakeholders in an IT project's steering committee are some examples that show how managers allocate additional IT human resources and capabilities to act as cushions for future surprises. In general, this type of IT slack improves human resource IS capabilities through escalating both the technical and managerial IS skills.

9.4.6 Type 6 – IT Application-Time Slack

Finally, managers may dedicate more time to IT application design, development, and implementation projects because of their crucial importance (Sharfman et al. 1988). Generously dedicating additional time for implementing an ERP[4] system, giving more time to people to get acquainted with a bank's CRM system, and dedicating more time to preparing the contract for buying/outsourcing a strategic IS by being overly picky on the details are examples of allocating time cushion for an IT application's adaptability and options. Similar to the other time type of slack, this category of IT slack can indirectly improve all of the technological, integration, and human resource IS capabilities.

In the following section we apply this typology to the organizational IT impact literature and elaborate on the different impacts of these types of IT slack on organizational efficiency and effectiveness. After IT slack classification and reviewing the importance of the redeployability condition for slack consequences, in the following section we take a slack angle in order to understand the value of IT.

9.5 A Slack View Toward the Value of IT

Any IT investment requires IT slack for its sustainability and survival. From office automation to an ERP implementation project, it is hard to find any investment that is done based on the optimum amount of IT resources required for running a business operation. In fact, managers tend to keep some cushion by overinvesting beyond the optimum amount. This will create various options for the IT investment and the

[4]Enterprise Resource Planning.

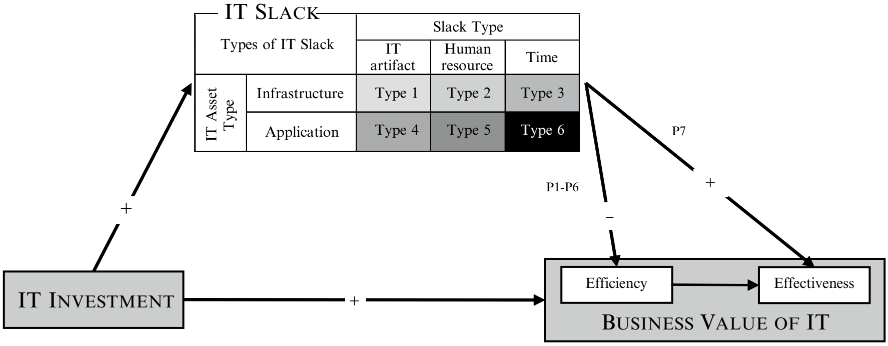

Fig. 9.1 Research model

organization for enhancing adaptability and the likelihood of survival. Therefore, understanding the value of any IT investment is incomplete and limited without an understanding of the consequences of IT slack, which is deliberately (Bourgeois 1981) or unintentionally (Cyert and March 1963) created with any IT investment. In other words, ignoring the IT slack and its consequences may affect the dependent variables and cause construct validity problems (see Shadish et al. 2002). In the following, we present a model of the business value of IT that considers IT slack construct and its consequences with regard to the dependent variables, that is, organizational efficiency and effectiveness Fig. 9.1.

Before elaborating on the details of the model, the underlying assumptions of the theory have to be clearly discussed. First, the theory assumes that organizational decision makers are considered as rationally bounded and second, that the business environment is turbulent and not perfectly predictable. These are the reasons that justify why managers tend to invest in slack resources in order to enhance their flexibility during a jolt. Building on the first assumption and considering the problems and equivocalities associated with IT, we assume that all information technology initiatives need IT slack for smooth operation without breakdowns. In other words, managers create IT slack in order to ensure IT service and/or business process sustainability (i.e., enhancing IT and/or organizational effectiveness).

9.5.1 IT Slack and Organizational Efficiency

Due to the importance of some IT services – for example, in the banking industry – high amounts of IT slack should be maintained for creating options directed at sustaining stability and survival in the case of any environmental, organizational, or IT surprise. This will significantly increase IT expenditures, while the capabilities are not necessarily utilized when they are created and therefore drastically shrink organizational efficiency. IT slack impact on organizational efficiency can occur in two ways: (1) direct influence of organizational efficiency, and (2) indirect effect on organizational efficiency through the mediating role of IT efficiency. As an example of the indirect effect, when the IT function increases its IT slack – for example, buying some additional desktops and server computers – its efficiency decreases by not necessarily utilizing all of the IT slack. Hence, as a consequence of IT efficiency decline, organizational efficiency also deteriorates. In the direct process, enhancing some IT slack – for example, time slack in implementing an accounting system in the finance department – may directly diminish organizational efficiency.

However, the degree to which organizational efficiency is sacrificed in IT slack development is not similar in different types of IT slack (Table 9.1), since they are different in terms of their redeployability. Accordingly, we argue that IT slack – absorbed or unabsorbed – influences a firm's efficiency. Unabsorbed IT slack is capable of being deployed to situations other than the ones that were initially intended. For example, computer servers that are bought as IT slack is generally among the unabsorbed IT slack resources due to their redeployability to various purposes in various departments. As a result, the CIO of a firm may buy a computer server slack initially for the customer service department for any future customer demand jump in the 2009 fiscal year. However, due to the economic recession, customer demand did not improve. In such a case, the CIO may decide to redeploy the slack computer server to be utilized in the research and development department in 2010, which is in need of the server. In this example, the unabsorbed IT slack has decreased organizational efficiency due to its one-year idle status in 2009. However, its redeployment to another purpose in 2010 has minimized this inefficiency loss for the next years.

On the other hand, the customer service department may have simultaneously developed an excessive capacity on their customer relationship management (CRM) application to provide the capacity of handling double the number of the customers as in 2009. However, in contrast to the computer server, the excess capacity of the CRM application is an absorbed IT slack that cannot be redeployed to any other situation, application, or department. In other words, this overcapacity will remain unutilized for the whole next 5 years if the economic situation does not change. In this case, the resultant organizational inefficiency is maximized due to the inability of the absorbed IT slack to be redeployed. Hence, before discussing each type of slack, it can be hypothesized that absorbed IT slack is likely to decrease organizational efficiency more than unabsorbed one.

Proposition 1 Since absorbed IT slack is typically hard or impossible to redeploy, it leads to larger organizational inefficiencies as compared with unabsorbed IT slack.

In the following, the impact of different types of IT slack is discussed according to Proposition 1 and its redeployability criterion.

9.5.1.1 Type of IT Slack and Organizational Efficiency

Proposition 1 can be applied to different IT slack types (Table 9.1). In other words, the redeployability of different IT slack types sheds light on the degree of inefficiency resulting from investing in IT slack. On the one hand, IT slack is classified based on the nature of the created slack: IT artifact, human resource, and time. We argue that the degree of flexibility and, accordingly, redeployability decreases from IT artifact to human resource, to the time type of IT slack. This can be the case in either of the two IT assets types: infrastructure or application.

Holding the IT asset type constant (e.g., within IT infrastructure assets), while the CIO can quickly redeploy an IT artifact type of slack – for example, a computer server – to other departments or processes, redeploying human resources is much harder and inefficient due to the additional costs of human socialization in new roles (Saks and Ashforth 1997; Van Maanen and Schein 1979). This cost includes various uncertainty escalation costs, social cognition costs, cognitive sense-making costs, and an increased number of unrealistic and unmet expectations at both individual and group levels (Louis 1980; Saks and Ashforth 1997). According to the asset specificity[5] notion (Williamson 1991), some productive value of the human resource is sacrificed when it is dedicated to a new use or a new user. This argument can be the case within each of the other two IT assets, IT infrastructure or IT application. Accordingly, the degree of redeployability can be argued to decrease in human IT slack. A similar argument can be made with regard to the time slack. By assigning some slack time to an IT project, the project's management practice is adapted to the new time horizon and it is rarely possible to have the extra time unused. However, in a case in which the project terminates in advance, the unused time redeployment is not as easy as the redeployment of the unused IT human resource or technological artifact slack. For instance, when a project manager considers some slack time for the debugging phase of an application development project, redeployment of this slack time is mainly possible to other activities or processes that are specifically related to completing the same task or project. That means its redeployment to other processes and projects in the IT function needs new negotiations with top management – that is, higher cost with less redeployability.

Drawing on Williamson's notion of specificity, we can conceptualize three types of redeployability for different types of IT slack. First, "redeployability to other times" is conceptualized based on Williamson's "temporal specificity." Second, "redeployability to other projects or processes" draws on the opposite notion of human-resource specificity and dedicated asset specificity. Finally, "redeployability to other departments" mainly covers the opposite notion of site specificity, physical asset specificity, and brand name capital specificity. Table 9.2 compares the three slack types specifically in terms of redeployability.

Accordingly, the IT artifact slack is the most redeployable one to other projects, processes, and departments, with the lowest technical and social costs of redistribution. If the redeployment time is not far from their purchase date and they are not obsolete, artifacts can be redeployed in other times with a minimum amount of sacrifice in their productive value. These factors are all medium in the human resource slack because human resource redeployment to other projects, processes, and departments is associated with some social costs mentioned above.

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[5]Asset specificity is considered as the flip side of the redeployability.

Table 9.2 Degree of redeployability in the three slack types of IT slack

	IT slack type		
Redeployability in slack types	IT artifact	Human resource	Time
Redeployability to other project/process	High	Medium	Low
Redeployability to other departments	High	Medium	Low
Redeployability to other times	Medium-high	Medium-low	Medium
Average	High	Medium	Low

In addition, IT human resources are more limited in terms of utilization time because postponing an individual's recruitment is associated with costs of either retaining an employee and paying all of the fix costs or firing the one currently not needed and recruiting later. These make the cost of redeployment to be higher as compared with the mere technological artifacts. Finally, the redeployability of slack time dedicated to an IT project to other departments, projects, or processes is low and sometimes impossible. In addition, as time passes, the degree of freedom in slack time redeployability to other stages of the same project also decreases.

As some clarifying examples, when a manager quotes a longer time for launching a new IT service to customers in order to help reduce debugging problems, he is only able to redeploy this amount of slack time to other activities within the boundaries of the same IT project. As a result, the time slack is less flexible for assigning to any other project or task within the boundaries of the firm. As another example, a slack time that the CIO reports to the CEO for implementing and operationalizing Internet services on the local area network (LAN) of an organization cannot be redeployed to a software development project delivery time. Therefore, compared with human resource slack, which is redeployable but with higher cost than IT artifacts, time slack is much less flexible, more expensive, or even sometimes impossible to redeploy. Again, this is also the case with other IT asset. For instance, the time slack for operationalizing a strategic CRM application of a bank, which is promised to customers for launching on a specific day, cannot be risked and redeployed to other IT projects of the firm. Therefore, time slack redeployment is either limited or impossible, and is the most expensive.

Consequently, we argue that the flexibility in reallocation and redeployability of the IT slack is the largest in IT artifacts, the lowest in time, and moderate in human resource types. According to Proposition 1, it can be hypothesized that within the same class of IT assets, organizational efficiency deterioration is the lowest in IT artifact slack, the highest in time IT slack, and moderate in human resource IT slack.

Proposition 2 Within the same class of IT assets, the negative impact of creating IT slack on organizational efficiency is likely to be the strongest in time IT slack, the weakest in IT artifact slack, and relatively moderate in human resource IT slack.

There is also another source of variation in IT slack redeployability criterion in IT slack typology. Ceteris paribus, the degree of redeployability of each slack

Table 9.3 Degree of redeployability in IT asset types of IT slack

	IT asset type	
Types of asset specificity	IT infrastructure	IT application
Redeployability to other project/process	High	Low
Redeployability to other departments	High	Low
Redeployability to other times	Medium-low	Low
Average	High	Low

type differs according to the type of IT asset. The authors argue that, keeping the slack type constant, by moving from IT infrastructures to IT applications, the degree of redeployability declines, and accordingly the organizational efficiency is more likely to deteriorate. Table 9.3 compares the two types of IT assets according to Williamson's (1991) categorization of asset specificity.

In terms of site specificity, IT infrastructures are less specific compared with IT applications. For instance, while all the departments are highly similar in desktop computers and Windows operation systems (infrastructure), they are less similar in terms of their data-gathering software applications, and significantly different in terms of their strategic, context-specific systems (e.g., an ERP module in a marketing department vs. an ERP module in an administrative department). Similar explanations can be provided for redeploying an IT resource to other projects or processes within a department. While IT infrastructures are to a low extent variant among different processes and projects, this variance is significantly higher for IT applications. For instance, the human resource skills and IT artifacts that are needed for a CRM application are fundamentally less redeployable to other projects/processes than are desktop computers, network equipment, and human experts. Finally, the degree of time slack redeployability is not that much different among the two types of IT assets.

Consequently, by averaging on the categories of asset specificity in Table 9.3, redeployability of IT slack is higher in IT infrastructure assets as compared with IT application assets. Hence, it can be hypothesized that within the same class of slack type, organizational efficiency declines more in IT applications.

Proposition 3 Within the same class of slack type, the negative impact of creating IT slack on organizational efficiency is likely to be higher in IT applications as compared with IT infrastructures.

Figure 9.2 illustrates the aggregate degree of redeployability in each type of IT slack. As a result, by integrating Propositions 2 and 3 in Fig. 9.2, it can be contended that IT Slack Type 1 has the greatest degree of redeployability. That is because both the slack type and the IT class that includes the IT slack are the greatest in the degree of redeployability. On the other hand, IT slack Type 6 is expected to have the least degree of redeployability. The reason is that the slack type and IT asset type in this IT slack type are the minimum in terms of the slack redeployability.

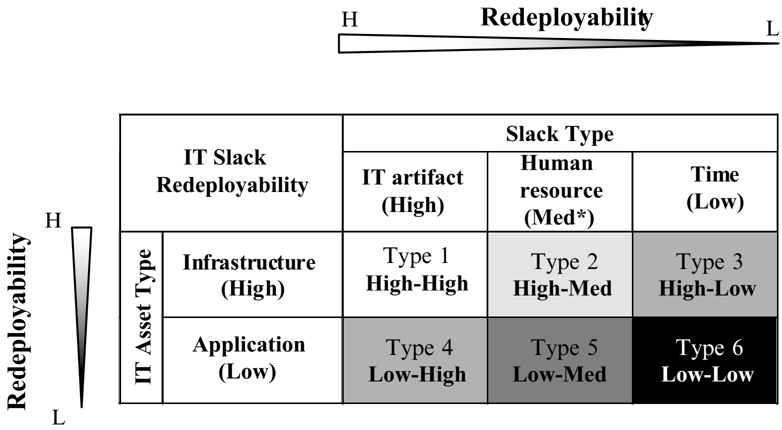

Fig. 9.2 IT slack types and redeployability

According to the direct negative relationship between redeployability and organizational inefficiency in the slack literature, the following propositions are suggested.

Proposition 4 Since the degree of redeployability of the IT slack of Type 6 is the lowest, its negative effect on organizational efficiency will be the strongest of all types.

Proposition 5 Since the degree of redeployability of the IT slack of Type 1 is the highest, its negative effect on organizational efficiency will be the weakest of all types.

As discussed earlier, while reducing organizational efficiency, IT slack aims at creating options (Ranganathan and Brown 2006; Sambamurthy et al. 2003) and improves organizational capabilities in responding to environmental jolts through the mediating role of IS capability enhancement. According to the literature (see Appendix), there are a variety of IS capabilities that can be classified in nine subcategories and three general groups: technological capabilities (i.e., related to the technological abilities of the IT artifact), human resource capabilities (i.e., related to the various abilities of human resources), and integration capabilities (i.e., related to the ability of the IS department in integrating with the internal and external stakeholders). The Appendix briefly reviews the related literature. According to this classification of the IS capabilities, each type of IT slack has potentials to enhance some specific types of IS capabilities (Table 9.4).

Type 1 is expected to enhance an organization's IT infrastructure and flexibility capabilities because it improves technical abilities of the IT platforms for faster, more adaptable, or more effective information gathering, processing, and distribution. Type 2 improves an organization's ability in human resource technical IT skills because this type of IT slack provides higher technical qualifications or a higher number of employees with the required abilities. Type 3 involves the nature of time, which gives the organization more time to develop any desired IS capability that is needed for organizational survival. In other words, to a lesser or greater extent,

Table 9.4 Types of IT slack and IS capabilities

		IT slack			IS capability								
					Technological capability			Human resource capability			Integration capability		
		IT asset type	Slack type	Degree of redeploy-ability	IT infrastruc-ture	IT application	IT flexibility	Technical IT skills	Managerial IT skills	Shared knowledge and relationship	Integration with partners	Integration with customer	Integration with internal functions
Type	1	Infra.	IT artifact	High	✓		✓						
	2	Infra.	Human	Med				✓					
	3	Infra.	Time	Med	○	○	○	○	○	○	○	○	○
	4	App.	IT artifact	Med		✓					✓	✓	✓
	5	App.	Human	Med –				✓	✓	✓			
	6	App.	Time	Low	○	○	○	○	○	○	○	○	○

Infra.: Infrastructure, App.: Application, ✓ Direct effect, ○ Indirect effect organizations are able to develop all types of IS capabilities if they are granted more time. Type 4 improves organizations' ability to have more efficient/effective IT applications and also stronger applications that better integrate with internal and external stakeholders. Type 5 can improve all technical, managerial, and relationship capabilities of the organization. Accordingly, organizations improve their ability to create better relationships between IS and business, technical, or managerial abilities through hiring more application expert human resources or recruiting ones with overqualifications beyond the mere technical requirements. Finally, Type 6 is similar to Type 3 in indirectly creating options for improving all the IS capabilities of the firm.

By making an IT investment operational, a variety of IT slack types may be needed for achieving a higher degree of stability and effectiveness. Not necessarily one, but a portfolio of IT slack types may be created simultaneously or consecutively with each IT investment. The greater the weight of the absorbed IT slack – that is, the closer to Type 6 – the greater is the resultant inefficiency. As a result, less productivity benefits from IT implementation are perceived for investments that are dominantly associated with absorbed IT slack in their created IT slack portfolio. Hence, we argue that the productivity paradox (at IT investment level)[6] can always occur depending on the dominant type of IT slack in terms of the weight. On the one hand, if the weighted average of the types of IT slack is closer to Type 6, the IT slack portfolio is dominantly absorbed and is more likely to cause productivity paradox for the IT investment. By weighted average, we mean the calculation that is weighted by the dollar amount of investment in each IT slack type. On the other hand, if the weighted average of the types of IT slack is closer to Type 1, the IT slack portfolio is predominantly unabsorbed and is less likely to cause productivity paradox.

Proposition 6 With any IT investment, absorbed and unabsorbed IT slack is created. Since highly absorbed IT slack leads to high inefficiencies, less productivity benefits are perceived if the IT slack portfolio created with an IT investment predominantly includes absorbed IT slack.

The influence of IT investment on organizational efficiency and effectiveness are considered separately. However, they are not independent of each other. In particular, effectiveness is also influenced by efficiency. In the following, the interactional effect of the efficiency and IT slack creation on the most important organizational factor – effectiveness – is analyzed.

9.5.2 IT Slack and Organizational Effectiveness

As a category of organizational slack, IT slack is generally favored because it generates excessive resources for augmenting organizational effectiveness (including

[6]By productivity paradox at IT investment level, we mean that organization's efficiency declines after an IT investment.

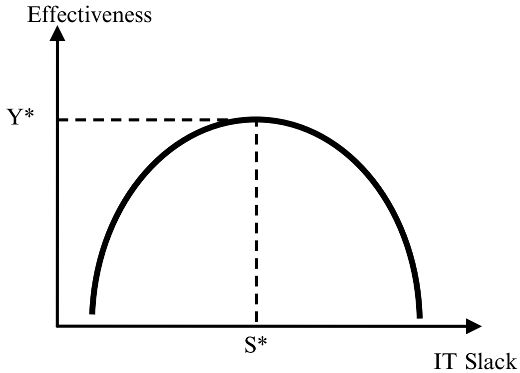

Fig. 9.3 Relationship between IT slack and organizational effectiveness

survival, adaptability, and flexibility). As a result, organizational effectiveness is enhanced through the direct IT investment and the indirect effect of IT slack. However, is this positive relationship ever-increasing? From an economic efficiency perspective, there is little reason to believe that the effect of slack on organizational effectiveness is linear (Tan and Peng 2003). There might be a threshold beyond which further slack accumulation may become negative. The relationship between organizational effectiveness and organizational efficiency is complex. In general, an organization can be inefficient but effective or efficient but ineffective. However, this does not lead to the conclusion that the two constructs are independent. While increasing the efficiency of an organization may not directly affect its effectiveness, efficiency's significant decline may deteriorate organizational effectiveness (Bourgeois 1981; Sharfman et al. 1988). Hence, on growing different types of IT slack, the declining trend of organizational efficiency can be expected to negatively affect organizational effectiveness escalation.

In the slack literature, Sharfman et al. (1988) and Bourgeois (1981) argue for an optimal level of slack and contend that while zero slack leads to breaks in firm operations, too much slack can cause organizational failure (Bourgeois 1981). Also, in an empirical study, Tan and Peng (2003) show that the relationship between organizational slack and firm performance is curvilinear. Too little or too much slack negatively affects performance and a moderate level of slack has a positive correlation with performance. Building on their idea and translating it for the context of IT, we conjecture that while increasing IT slack from zero significantly enhances organizational effectiveness (Fig. 9.3), the effectiveness acceleration is not ever-increasing and will lead to deterioration after a threshold point at (S*, Y*).

According to Fig. 9.3, while creating IT slack between zero and S* is useful and leads to higher adaptability and accordingly effectiveness, its creation beyond S* will be dysfunctional for a number of reasons. First, increased investing in IT slack after the optimum point creates the perception of resource abundance and is detrimental to innovativeness (Nohria and Gulati 1996; Tan and Peng 2003). With the perception of resource abundance, people feel less pressure to innovate and are more inclined to experimentation (Nohria and Gulati 1996) that deteriorates organizational effectiveness in the long run. For instance, with too much of IT slack, some

IT projects with high risk and low or even negative net present value may be simply funded for resource availability and abundance. Second, with too much of IT slack, top management attention to IT decreases (Nohria and Gulati 1996). As a critical success factor for IT (e.g., see Earl 1993; Lederer and Sethi 1988), lower attention to IT may deteriorate both IT and organizational effectiveness in the long term. Finally, too much of IT slack leads to lower discipline that is also detrimental to organizational effectiveness (Nohria and Gulati 1996).

Consequently, as a complement to previous assumptions regarding linear escalation in the effect of IT slack on organizational effectiveness, we hypothesize that the relationship between IT slack and organizational effectiveness is curvilinear in that too little or too much IT slack has a negative correlation with effectiveness and that a moderate level of slack has a positive correlation with effectiveness (Fig. 9.3).

Proposition 7 By investing in IT slack organizations achieve higher effectiveness at the cost of efficiency. However, too much of IT slack can be detrimental for organizational effectiveness by increasing experimentation, decreasing top management attention to IT, and deteriorating discipline in organization. Therefore, the relationship between IT slack and organizational effectiveness is inverse U-shaped.

It should be noted that the position of equilibrium point (S^*, Y^*) for each IT investment and the whole organization depends on a variety of factors such as technology, previous slack, and internal and external environments, the analysis of which is out of the scope of this study. However, we contend that this point is not predictable due to our premise of bounded rationality (Simon 1945). As the first assumption of our theory, bounded rationality, the unpredictability of technology and future market situations and demand justifies IT slack creation. If the rationality is not bounded, organizations are able to predict and plan the optimal amount of investment in all organizational resources, including IT, and therefore there is no need for any type of slack, including IT slack. As a result of the so-called bounded rationality, organizations may only be able to estimate the optimal interval based on their expertise and experience.

9.6 Implications and Contributions

Our chapter introduced the concept of IT slack and examined its relationship with operationalized IT investment and its intended impact (i.e., efficiency and effectiveness). While we specifically looked at this relationship at the organization level in our study, the IT slack construct is not limited to the firm level. By stepping back and juxtaposing the conceptualized IT slack construct with IT artifact macro- (Agarwal and Lucas 2005) and micro-level (Benbasat and Zmud 2003) nomonological network, we begin to get a glimpse of an emerging theory of IT slack. This is a multilevel theory, and it suggests that understanding the value of IT at any level of interest requires understanding the way IT slack is created and then redeployed to IT and/or business processes beside the operationalized IT investment. More specifically, this theory suggests that the value of IT at any level (e.g., individual, group, project, or organizational) emerges from the interactional effect of two parts of any IT investment: operationalized IT investment and created IT slack. On the one hand, operationalized IT investment is mainly supposed to result in intended business benefits. On the other hand, managers create IT slack in order to manage the unintended/unanticipated consequences of operationalized IT investment. However, this strategy is not costless, and the negative effects of IT slack on organizational IT investment values may outperform IT investment's intended benefits unless it is managed properly (i.e., redeployment).

At the individual level, while system adoption and usage is generally expected to lead to business values (at the individual level or other higher aggregated levels such as unit or firm performance), managers create IT slack to ensure successful implementation and smooth transition toward IT investment assimilation. A project manager of an IT application may give more than optimal time to users to catch up with the system, dedicate additional experts (or overqualified experts) to help users in becoming familiar with the applications, or grant Internet connections to users that do not need it for their tasks but in order to facilitate their relationship with the desktop and the system. At the group level, using a knowledge-management system within a group is generally expected to improve group performance after its internalization and usage. However, decision makers may need to invest in IT slack in order to guarantee system assimilation at the group level. For instance, developing the functionalities and options related to the socialization of the users and developing knowledge café in firms are some examples of deliberately creating an artifact-infrastructure type of IT slack to increase the likelihood of system adoption and internalization in group processes.

While IT slack is created with IT investments to assure stability, sustainability, and survival (i.e., effectiveness), it has some negative consequences with regard to other aspects of the firm (i.e., efficiency). Our paper examined these effects at the organizational level on both organizational efficiency and effectiveness by including the notion of redeployability as the construct that adjusts and modifies the degree of negative consequences associated with the creation of IT slack. While we apply the notion of slack at the organizational level, it can also be useful at other levels of analysis such as the individual and the group. For instance, while giving time slack to IT users to get familiar with the system generally decreases individuals' productivity, the inefficiency may be reinforced when individuals' work gets expanded without necessarily enhancing their familiarity with the new IT application.

Thus, there are three distinct sets of dynamics underlying the effects of any IT initiative on IT impact variables: (1) the direct impacts of operationalized IT investment, (2) the initial impacts of IT slack created, and (3) the updated effects of the less-absorbed IT slack after reallocation. Most of the previous research has been focused on the first mechanism (e.g., Hitt and Brynjolfsson 1996; Im et al. 2001; Ranganathan and Brown 2006; Thatcher and Pingry 2004; Venkatraman and Zaheer 1990). In contrast, our study directs attention toward the importance of the second and third mechanisms. Including the IT slack construct in the business value of IT literature and examining how the reallocation of the IT slacks lessens the inefficiencies resulting from the initial IT slack may help to explain the IT productivity paradox or not-profitable IT investments.

The negative impact of different IT slack types on organizational efficiency has some implications for the question of why some IT investments have no productivity benefits for the organization. As a plausible explanation for contradictory results in IT productivity paradox research (Brynjolfsson 1993; Brynjolfsson et al. 1994; Hitt and Brynjolfsson 1996), we contend that some necessary and effective IT investments may need parallel investments in expensive types of IT slack – for the purpose of higher stability and effectiveness – that aggregately lead to a decline in productivity benefits of the IT investment. For instance, while ERP vendors explicitly magnify the cost reduction resulting from ERP adoption, ERP module implementation needs some parallel investments in various IT infrastructures and applications from IT artifact to time types of slack – for example, excess desktops, backup experts, excessive licenses in some modules, overinvestment in security aspects of data transfer, additional implementation time for CRM module – that may finally make the ratio of output cost to input cost higher. The current literature has confounded the effect of IT investment and IT slack. Returning to our initial discussion, separating these two constructs and their distinct impact processes explains some of the variance in our dependent variable – productivity.

Another important implication of our research is the typology of IT slack and its different nature in each type. While this typology attempts to clarify and develop our understanding of IT slack and its effects on the business value of IT, it raises many new questions and opens the discussion on the IT investment and the types of IT slack that are created around it. Future research can examine the types of IT slack that are dominant in each IT asset type. This will improve our understanding of different types of IT investment and help managers better manage the created IT slack with the goal of lowering inefficiencies. Second, this study merely focused on IT infrastructure vs. IT applications in classifying IT slack. However, it would be interesting in future studies to go deep down in IT asset types and differentiate how the strategic IT applications are different from informational or transactional IT assets in creating slack. Third, another development in our paper would be to study which IS capabilities and options are more likely in each type of IT slack. This will help managers to better understand the positive sides of each type of slack and can improve their cost–benefit analysis in creating each type of IT slack. Fourth, the effect of IT slack on IT and organizational effectiveness can be separately analyzed in a model. In fact, due to the notion of consumer surplus, it might be possible for the IT slack creation to enhance one but not the other. So, it would be interesting to theorize about the relationship between these three constructs. Fifth, while the chapter was on the context of business value of IT, IT slack can be further studied in other areas such as IT outsourcing. For example, it would be interesting to investigate the relationship between IT slack and IT outsourcing.[7] As a preliminary idea, we conjecture that for technologies that are IT-slack intensive, it may be worth

[7]We thank one of the reviewers for suggesting this idea.

outsourcing the service for decreasing huge IT slack investment. Further conceptualization of the relationship and its empirical testing is an intriguing further study. Finally, research is needed to empirically test the propositions of the IT slack model. To do so, reliable and valid operationalization of the model constructs, especially IT slack, needs to be developed.

As an implication for practice, managers should be aware of the portfolio of IT slack needed in conjunction with any IT investment in order to keep the IT investment sustainable and to directly or indirectly enhance effectiveness at various levels. More specifically, managers should be mindful (Swanson and Ramiller 2004) in strategic IT investments because they are more likely to be associated with IT slack resources closer to Type 6 (most absorbed). While fundamental benefits and business values may be presented by suppliers of strategic systems – such as CRM or ERP – the costs of successful implementation and also of achieving stability and adaptability after the implementation exponentially increase. This affects the productivity and accordingly the effectiveness achieved from the IT investment. In other words, giving consideration to the type and amount of IT slack required for any IT investment will help managers develop realistic expectations regarding IT investments and their business value.

9.7 Conclusion

Drawing on the trilogy of organizational theory, strategy, and information systems literature, this paper defined IT slack as the cushion of actual or potential IT resources, which allows IT or organizational adaptation to internal and external pressures and jolts. We introduced a typology of IT slack and argued that while all types of IT slack enhance organizational effectiveness, they distinctively deteriorate organizational efficiency depending upon the degree of IT slack redeployability in each type. This speculation provided a plausible explanation for the IT productivity paradox by distinguishing between IT investment and IT slack. In essence, IT investments are inevitably associated with IT slack creation for the purpose of enhancing organizational effectiveness, IT effectiveness, or both. However, this IT slack creation will decrease organizational efficiency. As a result, the productivity of the organization may not increase as expected or may even decline after IT investment as a whole (which includes IT slack). Consideration of the IT slack construct provides some insights to show that the diverse benefits expected from IT do not necessarily occur together and that they may even in some situations be mutually exclusive. In other words, in some cases such as highly uncertain environments, organizational survival is achieved by sacrificing efficiency.

In addition, we emphasized the notion of the IT slack portfolio as the collection of different types of IT slack that are created in relation to an IT investment to enhance organizational effectiveness. This portfolio is weighted toward one of the IT slack extreme types: Type 1 as the most unabsorbed and Type 6 as the most absorbed. We argued that the closer the portfolio weight is to Type 6, the more absorbed is the IT slack and accordingly the higher is the likelihood of IT productivity paradox in IT investment.

As an update to the above conceptualization, we also urged that IT slack is a double-edged sword that can be both useful and harmful to the organization. It can be useful if management invests properly in IT slack for enhancing organizational effectiveness and survival. As a result, it is helpful especially in comparison with organizations that have no or a low amount of IT slack, which may face multiple breaks in IT and organizational operations. However, the authors conjectured that the relationship between IT slack and organizational effectiveness is not linear, but curvilinear. Thus, over-escalating IT slack will not be useful after a threshold because it will deteriorate not only organizational efficiency but also effectiveness.

In sum, we contend that the primary target of an organization is to maximize the effectiveness. In the best scenario, this goal attainment can be associated with approaching the secondary goal, organizational efficiency, as well. However, organizational efficiency does not usually enhance effectiveness maximizations. As a result, while the equilibrium point for organizational effectiveness is increased after an IT investment, the efficiency's equilibrium point may even decline vis-à-vis the pre-investment era.

No study in the past has distinguished between operationalized IT investment and IT slack and, accordingly, assumed all types of created IT slack as a part of IT investment. By addressing this threat to construct validity, we can explain some insignificant or marginally significant results in realizing business values of IT investments. In addition, failing to account for IT slack can be argued to cause model misspecification (Bentler 1990; Green 2000), which has various effects on the model statistics, fit indices, and significance levels regarding both the causal relationship significance and the model coefficients. This can be contended to be another reason that the studies on the business value of IT have produced contradictory results.

Appendix A

IS capability			
Dimensions	Subcategory	Definition	References
Technological capability	IT infrastructure	The physical IT assets that "comprise the computer and communication technologies and the shareable technical platforms and databases" (Bharadwaj 2000, p. 172)	Wade and Hulland (2004), Melville et al. (2004), Schwarz and Hirschheim (2003), Bharadwaj (2000), Zhu and Kraemer (2005), Tanriverdi (2005), Ray et al. (2005), Pavlou and El Sawy (2006)
	IT application	A piece of software functionality that is developed and installed on specific IT platform(s) to perform a set of one or more business tasks independently of other surrounding IS components (Saraf et al. 2007, p. 321)	Melville et al. (2004), Saraf et al. (2007)
	IT flexibility	"[T]he ability of an organization to incur relatively small penalties for departure from an optimal configuration of assets" (Saraf et al. 2007, p. 325)	Saraf et al. (2007), Peppard and Ward (2004), Ray et al. (2005), Clark et al. (1997)
Human resource capability	Technical IT skill	Technical abilities required for working with IT infrastructure and IT applications such as programming, system analysis, and design	Aral and Weill (2007), Wade and Hulland (2004), Melville et al. (2004), Bharadwaj (2000), Piccoli and Ives (2005), Ray et al. (2005), Pavlou and El Sawy (2006)
	Managerial IT skill	Include abilities such as the effective management of IS functions, coordination and interaction with user community, and project management and leadership skills (Bharadwaj 2000, p. 173)	Bharadwaj (2000), Piccoli and Ives (2005)
	Shared knowledge and relationship	"[C]ollaborative and harmonious relationships between IT and business managers so as to enable the sharing of knowledge and innovation risks and the joint ownership of technology-based initiatives" (Schwarz and Hirschheim 2003, p. 132)	Schwarz and Hirschheim (2003), Peppard and Ward (2004), Bharadwaj (2000), Piccoli and Ives (2005), Armstrong and Sambamurthy (1999), Ray et al. (2005), Pavlou and El Sawy (2006)

(continued)

(continued)

IS capability			
Dimensions	Subcategory	Definition	References
Integration capability	Integration with partner	"[T]he extent to which the IS applications of a focal firm work as a functional whole in conjunction with the IS applications" (Saraf et al. 2007, p. 325) of its business partners and customers	Barki and Pinsonneault (2005), Mithas et al. (2008), Wade and Hulland (2004), Schwarz and Hirschheim (2003), Saraf et al. (2007), Rai et al. (2006), Mitchell (2006), Barua et al. (2004)
	Integration with customer		Barki and Pinsonneault (2005), Saraf et al. (2007), Schwarz and Hirschheim (2003), Mitchell (2006), Bharadwaj (2000), Barua et al. (2004)
	Integration with internal functions	"[T]he extent to which the IS applications of a focal firm work as a functional whole" (Saraf et al. 2007, p. 325) between different departments	Bharadwaj et al. (2007), Tiwana (2009), Mithas et al. (2008), Wade and Hulland (2004), Schwarz and Hirschheim (2003), Rai et al. (2006), Peppard and Ward (2004), Mitchell (2006), Barua et al. (2004)

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Chapter 10
Portfolio Theory: The Contribution of Markowitz's Theory to Information System Area

Pietro Cunha Dolci and Antônio Carlos Gastaud Maçada

Abstract Portfolio theory is concerned with risk and return. However, assigning weight to the risk at least equal to the yield was the big news in the 1950s. Until then, both in academia and for the general public, the stock market was no more than a playground for speculators. So in 1952, Nobel laureate Harry Markowitz, then a young doctoral student in operations research at the University of Chicago, demonstrated mathematically, for the first time, why putting all your eggs in one basket is an unacceptable risk strategy, and that diversification is the best deal for an investor or a manager of a company. In Markowitz's analysis, the expected return and risk of several portfolios were quantified. Therefore, portfolio theory is about maximizing the benefits of investments considering risk and return. In the area of Information Systems (IS) portfolio theory has influenced two major streams regarding Information Technology Portfolio Management (ITPM): (a) analysis and classification of IT investments in different dimensions and (b) analysis and classification of IT projects. Both lines of research use Markowitz's studies as reference to evaluate the trade-off between risk and return on investments in IT projects at the organizational level of analysis. Thus, IT investments can be managed as a portfolio, combining risk and return to maximize the benefits of IT investment, and help managers to choose the best option and make the best decision.

Keywords Portfolio Theory • Information Technology Portfolio Management • Dimensions • IT project

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Abbreviations

ATM	Automatic teller machines
CAPM	Capital asset pricing model
E	Expected return
IS	Information systems
IT	Information technology
ITPM	Information technology portfolio management
ROT	Real options theory
TCO	Total cost of ownership
V	Variance of return

10.1 Introduction

> Markowitz came along, and there was light.
>
> (Burton 1998, p. 2)

That was the answer to Bill Sharpe when he asked what contribution Harry Markowitz had made toward developing financial theory with his Capital Asset Pricing Model (CAPM). According to Bernstein (2007), the work of Markowitz on portfolio selection is the foundation of everything which has been studied in finance theory and in the CAPM particularly speaking.

In antiquity and in medieval times, individuals made decisions, defended their interests, and practiced trade without a real understanding of the risk or the nature of decision making. The ability to define what may happen in the future and to choose from among several alternatives is central to contemporary societies. Currently, risk management assists in a wide range of decisions: from allocating wealth to protecting public health, from war conduct to family planning, from insurance payment to the use of seat belts, from growing corn to selling the flakes (Bernstein 2007).

Thus, before Harry Markowitz's essay, written in 1952 about portfolio selection, there was no genuine theory on the construction of portfolios – there were only practical rules and folklore. Markovitz was the one who first turned risk into the centerpiece of portfolio management, focusing on the very essence of investment: investing is to bet on an unknown future. Also according to Bernstein (2007), the prevailing investment practices before Markovitz wrote "Portfolio Selection" no longer exist. At that time investment practice was related only to tricks and traditions, rather than deep analysis of the consequences of the impacts that the investments caused to the investors. Today, Markowitz's famous observation that one must consider the risk as well as the return sounds trivial.

However, assigning weight to the risk, at least equal to that assigned to the yield, was big news in 1950s. Until then, both in academia and for the general public, the stock markets were no more than a playground for speculators (Bernstein 2005). At that time, judgments about the performance of the shares were denominated in terms of how much money the investor won or lost, where the risk had nothing to do with it. Investors were nothing but profligates in bull markets who should also have been interested in both risk and return.

In 1952, the Nobel laureate Harry Markowitz, then a young doctoral student in operations research at the University of Chicago, demonstrated mathematically why putting all your eggs in one basket is an unacceptably risky strategy, and that diversification is the best deal for an investor or a manager of a company (Bernstein 1996). He was the first to look for diversification (Rubinstein 2002) and he developed the idea that diversification is the best way to consider risk, subsequently applying this idea to the analysis of shares. Thus, investors can combine risky stocks with high expected returns or a portfolio with lower risk together with the possibility of greater returns rather than if they had done these investments individually.

This revelation triggered an intellectual movement that revolutionized Wall Street, corporate finance, and business decisions around the world, and its effects are still felt today (Bernstein 1996). Even after more than 50 years, the ideas of Markowitz are still being used as a reference for discussions, debates, as well as for the development of financial theories that are used in different subject areas, such as in Information Systems (IS).

The portfolio theory has influenced many works within the area of SI, mainly the analysis of risks and returns of IT investments. This subject so studied in the area has used the key concepts and variables of the theory to assist in studies and research to better understand and explore the subject. Thus, this chapter first presents a description of the theory explaining its fundamental concepts and afterward its relationship with the IT area, where the IT portfolio management (ITPM) is presented. Next, the links with other theories are exposed and finally the concluding comments.

10.2 Literature Review

This section presents, discusses, and reviews theories and literature related to portfolio and its use in the IS area.

10.2.1 Description of Portfolio Theory

According to Bernstein (1996), a curious fact is the omission of quoting some intellectual antecedents in Markowitz's works. His methodology is a synthesis of the ideas of Pascal, Moivre, Bayes, Laplace, Gauss, Galton, Bernoulli, Jevons, von Neumann, and Morgenstern. It is based on the concepts of probability, sampling, bell curve and dispersion around the mean, regression to the mean, and the utility theory. Rubinstein (2002) also shows these relationships between the author's seminal ideas with some of these antecedents. An important observation is that some of these ideas were not presented in the article of 1952, but later explored, like the use of the theory of probabilities (e.g., see Markowitz (1976) and Markowitz (1991)).

This section explores Markowitz's proposal (1952) presented in his seminal paper Portfolio Selection, where he analyzed not only individual investments, but considered several of them at the same time. Moreover, as mentioned before, the variable risk which was so far overlooked is examined as the variance of expected return, being placed in this context of diverse investments. So, in Markowitz's analysis the expected return and risk of several portfolios were quantified. He demonstrated how the variance of portfolio is mathematically related to the variance of each stock compared with that of every other stock and where there is a trade-off between the expected return of a portfolio and its risk (Eastham and Skitmore 1993).

According to Markowitz (1952), the investor has the choice of various combinations of expected return (E) and variance of return (V) depending on his or her choice of portfolio X1, …, Xn. Supposing the set of all obtainable (E,V) combinations (see Markowitz 1952), the E–V rule states that investor would (or should) want to select one of those portfolios which give rise to the (E,V) combinations indicated as efficient, that is, those with minimum V for given E or maximum E for given V or less.

The investor, being informed which (E,V) combinations were attainable, could state which one(s) he or she wanted. We could then find the portfolio which gave this desired combination (see Markowitz 1952). According to Bernstein (2007), an efficient portfolio is one that from the investor's point of view represents the highest expected return to a certain rate of risk or the lowest risk to a certain rate of expected return. Besides that, the efficient boundary represents a set of efficient portfolios, from the lowest risk to the highest risk, or from the lowest return to the highest expected return.

So, the key concepts related to portfolio theory are the expected return, the variance of return, and the constraints on portfolio which must be analyzed for the portfolio optimization, noting the risk–return efficient frontier to optimize the portfolio as a whole (see Fabozzi et al. 2002). It is worth emphasizing the importance of the objectives of the investor that, regardless of the area, influence the decisions on companies' investments that are purely financial or are in IT, which is the subject of the next section.

10.2.2 Markowitz's Theory and Information System Area

Initially, Modern Portfolio Theory (MPT) generated relatively little interest, but with time, the financial community strongly adopted the thesis and now, more than 50 years later, financial models based on those very same principles are constantly being reinvented to incorporate all the new findings that result from that seminal work (Fabozzi et al. 2002). Therefore, this theory have been used in different forms to optimize asset allocations: asset-liability management, bond portfolio immunization, optimal manager selection, value at risk (VaR), tracking error budgeting, hedging strategies, index funds/mutual funds, stable value/guaranteed investment contracts, long/short strategies and normal/balanced portfolios.

From the 1970s onward, portfolio theory began to be used in the area of information systems, intensifying its usage and application during the 1990s. The first studies using the MPT were more focused on operational issues of investment decisions, whose technology was used to assist in these matters, where computational power tools were used to analyze financial information online and graphically show the benefits of diversification (Bielinski et al. 1993; Rickard and Torre 1999).

Mookerjee and Mannino (2000) described an approach to support mean-risk trade-off for inductive expert system, because decision makers in many situations are risk-averse and mean-risk trade-off is important to account for the level of risk aversion. The authors developed a mean-risk that is consistent and separable, supported by empirical studies on decision making under risk. Dong et al. (2004) provide an integrated framework for portfolio selection, which is adaptable to the needs of financial organizations and individual investors, and as an organized approach of selecting efficient portfolios for investments.

These studies show that the theory began to be used in the IS area in a more complex way, where more elaborate systems are structured to measure and analyze the trade-off between risks and returns involving decision makers.

Thus, Jeffery and Leliveld (2004), based on the work of Weill and Broadbent (1998), began to enter the concept of ITPM, the theory being used not on operational matters, but in the analysis of the value of IT investments and the ways of maximizing the investments. Moreover, a concern regarding examining IT projects and how to prioritize them by selecting and maximizing the results of IT investments has come up, which results in greater interest in the processes of project portfolio management (PPM), with more and more software tools being developed to assist and automate this process (Reyck et al. 2005).

Thus, the perspective of resource management in relation to risks and returns began to gain more importance in companies using the ITPM, which will be seen in more detail in the next section.

Also it began to be a concern to ensure that these investments and projects in IT met the deadlines, resources, and stipulated time between and within companies. Thus, the need of contracts increased in order to ensure that these variables are consistent with what was determined between the parties. Thus, the need to manage these contracts grew and the portfolio theory began to be used for managing IT services to improve strategic business advantage against competitors, reducing the risk existing in this activity (Kauffman and Sougstad 2008).

Furthermore, from this concern with analyzing the environment and seeking to increase the advantages over competitors, many variables came up in time to determine the best investments and the necessary IT projects to be prioritized. So, Schumaker and Chen (2008) adapted a system to analyze: (a) investment considerations – social responsibility, diversification, and asset liquidity; and (b) factors such as risk, taxes growth, and value to make a quantitative prediction of a portfolio.

It is observed that the use of technology in the early use of MPT was more focused on determining the most operationally risky issues and return on investment. But after the increase in competition and the need to always reduce costs and increase productivity, most studies began to focus on managing scarce resources, highlighting the ITPM. So, the next section will present the main currents in the area of IS using the MPT, as regards the management of IT investments in companies.

10.2.3 Information Technology Portfolio Management (ITPM)

The portfolio theory has influenced two major streams in the area of IS with regard to ITPM: (a) analysis and classification of IT investments in different dimensions and (2) analysis and classification of IT projects. Both lines of research use Markowitz's (1952, 1959) studies as reference, performing and making the relations with the trade-off between risk and return on investment and IT projects, at a level of organizational analysis. It is noteworthy that McFarlan (1981) was the forerunner of work on IT projects and the work of Turner and Lucas (1985) was the basis for designing their IT investments in different dimensions.

The ITPM is not a new topic in research in IT, having joined the academic literature in the 1970s, when researchers began to study systems within the context of the organization as a whole (Lucas 1973). In the following decade, the term "portfolio" began to be used for the management of IT in companies taking into account the risk of projects (McFarlan 1981). From the perspective of IT management, however, few studies directly related to ITPM (Jeffery and Leliveld 2004; Weill and Aral 2006; Dolci 2009). Kumar et al. (2008) still consider the concept in development, in both academic and business worlds.

ITPM is defined as the management of IT as a portfolio of assets similar to those of a financial portfolio, with the purpose of improving the performance of the portfolio by balancing the risk and return of different investments (Jeffery and Leliveld 2004). It is a continuous process of managing IT investments, applications, and infrastructure assets, and their interdependence, to maximize benefits, minimize risks and costs, and also ensure alignment with long-term organizational strategy (Kumar et al. 2008). ITPM provides a means of monitoring and managing all IT investments in an organization so that benefits, costs, and risks of individual investments can be evaluated to determine whether or not they are contributing significantly to organizational performance (Schniederjans et al. 2004).

According to Maizlish and Handler (2005), the technique of ITPM is a framework, a language, and a tool that results in a positive correlation between the amount invested in IT and increased productivity. It is one of the alternatives to identify, analyze, and manage IT investments (Jeffery and Leliveld 2004; Maizlish and Handler 2005; Weill and Aral 2006). On the other hand, portfolio management of IT projects is a tool that helps in choosing the projects most suitable to the reality of the company, creating a link between projects and strategy of the organization, and simultaneously adopting a long-term vision. In general, management of project portfolio is the way to organize and manage multiple project environments (Elonen and Artto 2003). Below is shown the two forms of analysis and use of ITPM.

10.2.3.1 Dimensions of ITPM

The search results of Weill and Olson (1989) pointed to the need for separating the different types of IT investments and matching them to better manage the technology in various organizations. Thus, financial investments as well as IT can be designed not as a financial portfolio, but an IT portfolio that contains investments with different management objectives (Weill and Broadbent 1998; Maizlish and Handler 2005).

From the seminal studies of Turner and Lucas (1985), where the business objectives were operational, managerial control, and strategic planning, Weill (1992) investigated these goals, coming to call them: (1) transactional IT, (2) strategic IT, and (3) informational IT. Note that in the evolution of research, the operational part became IT transactional, the managerial control, IT informational, and the strategic planning, IT strategic.

These dimensions were completed in research by Mirani and Lederer (1998), where IT strategic changes the organization's products or the way the organization is responsible for providing benefits such as competitive advantage, alignment, and customer relationship. Informational IT, however, provides information and communication infrastructure for the organization, with benefits for access, quality, and flexibility of information. Besides, according to the authors, the transactional IT supports management of operations and helps cut costs, benefiting the efficiency of communications, systems development, and business. A fourth dimension, which was included later, is the IT infrastructure, which was investigated by several authors (Broadbent and Weill 1997; Broadbent et al. 1999a, b; Weill et al. 2002).

Thus, Weill and Broadbent (1998) consolidated these four different dimensions (infrastructure, transactional, informational, and strategic) where all IT investments can be allocated. These dimensions have been studied by various authors (Aral and Weill 2004; Weill and Aral 2006; Aral and Weill 2007; Dolci 2009) and are conceptualized below.

The IT infrastructure dimension is the basis of the portfolio, providing the framework for IT shared services (human and technical, e.g., personal computers, communication equipment, servers, network, laptop, database, help desk, etc.). It represents investments to provide a flexible foundation for future business initiatives. The benefits from the IT investments that comprise this dimension are: reduced IT cost, reduced IT cost in business unit, business integration, agility, and standardization.

The transactional dimension represents expenses and investments to support the daily tasks and operational organization, such as orders, requests, inventory control, cash management, accounts receivable, accounts payable, production reports, and other processing of everyday business. The benefits from the IT investments that comprise this dimension are: increase productivity, reduce costs, optimize process, and integrate data.

The informational dimension represents expenditures and investments to improve the availability of information for management and control of the company, supporting the decision making, planning, communication, accounting, and analysis.

This information comes from abstracts obtained from the systems classified in transactional dimension. The benefits from the IT investments that comprise this dimension are: increase control, improve information quality, integrate information, obtain more information, and reduce cycle time of information.

The strategic dimension is composed of investments to reposition and maintain the company's market. Investments in this dimension typically alter the nature of IT services and organizational processes in industry. Given the dynamic nature of IT, many considered strategic investments in a given time and space cease to be so over time, in a process of commoditization. This case was indentified, for example, in automatic teller machines (ATMs). When first introduced, it altered the services offered to bank customers, and guaranteed benefits for the first banks that have adopted it. Today, however, it represents investments transactional (and not strategic), as it became universally adopted. The benefits from the IT investments that comprise this dimension are: product and process innovation; deliver renewed service, obtain competitiveness, and position the company in the market.

The IT investment in these dimensions has different risk and returns. According to Weill and Broadbent (1998), the strategic dimension has high risk and huge potential for higher returns, the infrastructure dimensions has moderate risk and return, due to long life and business and technical uncertainty; the informational dimension has moderate risk and return due to difficulty of acting on information to create business value; and finally, the transactional dimension has lowest risk with solid return of 25–40%.

10.2.3.2 IT Projects Portfolio

Another stream of research concerning ITPM which is more objective and quantitative is the IT projects portfolio. Projects portfolio can be considered as a collection of projects that are conducted under the management of a unit of a private organization. Each project can be related to or be independent of the others. The IT projects share the same strategic objectives and compete for resource uses (Cooper et al. 1997). They can be managed through three distinct phases: selection, implementation, and performance evaluation (Stewart 2008). The information gained from one phase is used to support activities in each of the other two phases.

The first use of portfolio management for IT projects was a work of McFarlan (1981). The projects were managed using a four-type methodology to achieve success: external tools integration, internal integration, formal planning tools, and formal control. Furthermore, the author examined the risk elements of projects, suggesting that the risk is the consequence of failing to obtain all, even some, anticipated benefits.

From this initial study, other research has been done to analyze and measure IT projects in organizations, addressing the two variables identified as important by Markowitz (1952): the risk and expected return. Thus, there are some techniques and practices for managing the portfolio of IT projects and for managing projects to serve together as a portfolio to achieve corporate objectives (Cameron 2005). Still, according to the author, the use of IT projects portfolio creates a link between corporate strategy and IT investments. Furthermore, Phillips (2007) proposes a framework to examine the ITPM, which consists of a combination of organizational processes, structure, and technology. For such activity he proposed to use three theoretical perspectives: contingency theory, MPT, and absorptive capacity.

Regarding the process of composing an IT projects portfolio, Karhade and Shaw (2007) argue that the decision to reject and select projects are two distinct components of the composition process of the IT portfolio and are governed by different factors. The factors for the decision to reject the projects are the idea of the maturity of the project, the kind of idea, and the process of readiness. The factors for the decision to select are the technological characteristics, considerations of time, and financial characteristics. Thus, the IT projects portfolios are formed according to the organization's strategic objectives, the risks, project costs, the impact on the company's success factors and resource use (Moraes and Laurindo 2003). In addition, Archer and Ghasemzadeh (1999) propose a framework for selecting a portfolio of projects by examining each of the projects, finding an optimal selection through continual adjustments to reach successful completion.

Verhoef (2002) presents a quantitative approach for ITPM, where organizations can obtain a corporate-wide impression of the state of their total IT portfolio, how IT costs spent today project into the budgets of tomorrow, how to assess important risks residing in an IT portfolio, and to explore what-if scenarios for future IT investments. Moreover, this quantitative approach enables assessments of proposals from business units, risk calculations, cost comparisons, and estimations of total cost of ownership (TCO) of entire IT portfolios. Later, a method was proposed to quantify the yield of an IT-investment portfolio in an environment of uncertainty and risk (Peters and Verhoef 2008). A method was presented to consider IT risks and uncertainties in calculating the value of a portfolio of IT-investment proposals. Also used were various scenarios in which common sources of IT-risk such as failure, cost/time overruns, and uncertainties such as requirements creep and time compression occur.

In the same year, Wu and Ong (2008) developed a quadripartite framework and subsumed the risks within information technology projects, for managers to evaluate the potential of these IT projects. Finally, Wehrmann et al. (2006) focused on the question on how IT projects should be allocated to a risk/return balanced IT portfolio. For this propose, they developed an approach that exploits the structure of IS architectures and scenarios to identify project risks as well as dependencies between projects.

As the dimensions of ITPM, in IT projects, the central concepts of MPT (risk and return) are used on investment and spending. Thus, to implement these activities and obtain a better trade-off of these variables, IT investments can be seen as IT projects with different risks and returns and can be analyzed in global business, with the aim of prioritizing and selecting those which are more in line with the needs and goals of the organization. As explained previously, IT investments can be divided in different ways, with numerous focuses of analysis and variables to perform a classification that helps IT managers. Furthermore, ProjectIT was presented, which indicates the main activities that must be considered to better analyze IT investments by observing their risks and returns.

10.3 Links from This Theory to Other Theories

Recently, an option-based risk management framework has been proposed to control risk and maximize value in IT-investment decisions (Benaroch et al. 2006). Thus, the real options theory (ROT), using risk and return, has been identified as one way of analyzing IT investments (Mun 2006). Different studies are using the concepts of IT Portfolio and ROT to analyze the risk and return variables of IT projects, like Bardhan et al. (2004), Benaroch et al. (2006), and Peters and Verhoef (2008). Also, a few studies have combined the dimensions of ITPM with ROT (Dolci et al. 2010).

Bardhan et al. (2004) developed a nested real options model that provides an approach to incorporate project interdependencies for IT project valuation and prioritization. Another study tested empirically in a large Irish financial service organization, whether a set of normative risk-option mapping was observed in practice (Benaroch et al. 2006). Peters and Verhoef (2008) argue that the real option valuation approach is sometimes used to justify (large) investments in IT infrastructure. The basic idea of this method is that the investment is split up in a small initial investment, which should always be made, and possible follow-up investments.

Finally, Dolci et al. (2010) combine different dimensions of ITPM (transactional and strategic) with ROT. It was found that ITPM is also used to justify investments, especially when it examined the risks and returns in the case with the use of ROT to assist managers in their choices about different investments and resources in enterprises.

10.4 Concluding Comments

When Markowitz defended his thesis to get a Ph.D. in economics, a member of the Board argued that his portfolio theory was not economical (Markowitz 1991). He assumed that this comment was only partly true, since he was given his degree without a long debate. About 50 years later, Markowitz has pondered and concluded that the argument of the member of the Board had some justification. However, it may be suggested that afterward, due to its great use, acceptance, and expansion of ideas, the portfolio theory became part of the economy.

This observation was intensified when the theory began to be used in different subject areas such as administration. A theory is consolidated when other areas of knowledge start using its fundamental concepts to support different ideas and is used in various ways, such as the use of portfolio theory in IS research.

At first, the key concepts of MPT were used in research on IS in order to assist in decision making related to the more operational investments. Later, it began to be used in order to assist managers of both business and IT on the issue of asset management and IT services, highlighting the ITPM. The division of investments made in four dimensions (infrastructure, transactional, informational, and strategic) helps IT managers to better manage their IT resources, examine the risks and return, besides providing greater visibility of the area to the company as a whole. With the increase of competitiveness and volume of information available to organizations, many variables must be considered when making investments in IT. Thus, ITPM can be used to analyze these investments as IT projects contain different information, and therefore, risks and returns. Thus, activities such as analysis, prioritization, and selection of projects that are more aligned with business objectives can be realized.

Different studies use the principles of the theory in search of a better analysis: the risk and return of risk management related to outsourcing (Aubert et al. 2005), risk and return on IT investments in electronic commerce (Dewan and Ren 2007), risk related to returns on IT investments that are larger than the others (Dewan et al. 2007). These studies highlight both the academic aspects of the use of theory in analysis and risk assessment in the management of many activities related to IT with regard to its impact on return or business performance. This is related to the use of theory in practice, not the way it was conceived, but more sophisticated where IT has followed this evolution providing tools capable of assisting managers on their decisions.

From this perception that IT is constantly changing, with different technologies being released and used for companies, more and more tools to assist managers in these decisions are necessary. Thus, studies using the MPT in order to evaluate the risks and expected returns on investments on these new technologies must be developed and pursued.

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Chapter 11
The Theory of the Lemon Markets in IS Research

Jan Devos, Hendrik Van Landeghem, and Dirk Deschoolmeester

Abstract The "lemon" problem was initially posed by Nobel Prize winner Akerlof in his seminal article of 1970 and showed how a market with unbalanced information, called information asymmetry, can lead to complete disappearance or to offerings with poor quality where bad products (lemons) wipe out the good ones. Empirical evidence for Akerlof's theory came originally from the market of used cars, where the lemon is a well-known problem. However, the theoretical model of the "lemon" problem has proven also to be valid in other markets and in comparable situations like internal markets. The theory is also been used more and more in Information Systems (IS) research especially since the emerging e-Commerce initiatives and the continuous growth of e-markets and auctions. In this chapter we bring a description of the theory by presenting its nomological network and its linkages to other well-known theories in IS research. The relevance for the theory is shown to explain the phenomenon in the IS discipline. An overview is given of current and past IS articles using the Lemon Market theory (LMT) together with a bibliographical analysis of the references to the original Akerlof article.

Keywords Lemon market • Information asymmetry • Adverse selection • Moral hazard • Trust

Abbreviations

ACM	Association of computing machinery
AT	Auction theory
CACM	Communications of the ACM

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DSS	Decision systems research
EJOR	European Journal of Operational Research
ERP	Enterprise resource planning
EUT	Expected utility theory
GT	Game theory
ICT	Incomplete contract theory
IEEE	Institute of Electrical and Electronics Engineers
IS	Information systems
ISR	Information system research
ISV	Independent software vendor
IT	Information technology
I&M	Information and management
JMIS	Journal of Management Information Systems
LMT	Lemon market theory
MIS	Management information system
MISQ	MIS quarterly
PDA	Personal digital assistant
PT	Prospect theory
RFID	Radio frequency identification
SME	Small- and medium-sized enterprise
WTA	Willingness to accept
WTP	Willingness to pay

11.1 Introduction

The market for "Lemons" is a popular expression for a widespread economic theory developed by Akerlof in his seminal paper of 1970 (Akerlof 1970). According to this theory there can be incentive for sellers to market poor quality resulting in a reduction of the average quality and leading to a death spiral with eventually complete market deterioration. The phenomenon of a "lemon" market arises in markets where there is information asymmetry between buyer and seller and where the overall quality of goods and services offered is reflected on the entire group of sellers rather than on individual sellers. Lack of seller differentiation could force high-quality sellers to flee the market because their quality and reputation cannot be rewarded. Akerlof demonstrated his theory with examples from the used-car market. Most of the empirical data for bringing evidence to the theory has come from a used-car market (Bond 1982). However, the Lemon Market theory (LMT) is applied in a wide variety of similar market situations like electronics, wholesales automotive, and durable goods markets. LMT is predominantly applied in disciplines like economics, management, finance, and law. Although the LMT is well defined, its use in Information Systems (IS) research is often vague and limited to a sole citation of the seminal article of the Nobel Prize winner Akerlof. Investigated phenomena in today's digital world by which the LMT is empirically tested are rather scarce. The strong ideas and explaining mechanisms in the theory are mostly taken for granted. Although the LMT is a grand theory with a lot of explanatory and generalizing power, its falsification and validity should be tested in every different empirical situation. However, we can observe that the use of the LMT with empirical evidence in IS research is growing. The theory has surely gained attention in the strand of research on e-Commerce with research topics like e-markets and auctions (Dewan and Hsu 2004; Pavlou and Gefen 2004; Lee et al. 2010).

11.2 Dissection of the Theory: Its Nomological Network and Constructs

The nomological network is a concept developed by Lee Cronbach and Paul Meehl in 1955 and is a graphical representation of a theory by means of his constructs and their causality relations (Cronbach and Meehl 1955). It is in essence a way of showing construct validity for the measures that are used to validate the theory. The nomological network includes the theoretical framework with the constructs, an empirical framework showing how the constructs can be measured, and specification of the linkages between these two frameworks. In this work we only focus on the theoretical framework. Figure 11.1 shows our nomological theoretical network of the LMT.

The level of analysis for the LMT is a market (external or internal) where two transacting parties meet. The parties can be firms or individuals. The basic independent construct for the LMT is information asymmetry. Information asymmetry is a condition which is well understood and a very frequently occurring phenomenon in all sorts of human and organizational interactions (Stiglitz 2000). Since a situation of asymmetric information can emerge in several ways it is also well researched in a broad variety of situations. For example, insurance markets, management (shareholders vs. management) (Chiang and Venkatesh 1988), organizational activities (Aboody and Lev 2000), and professional expertises (doctor–patient, lawyer–client) (Nayyar 1990) are different sources of information asymmetry.

Information asymmetry engenders strategic possibilities that can easily be modeled. The most generic way to do so is by applying game theory. This leads to

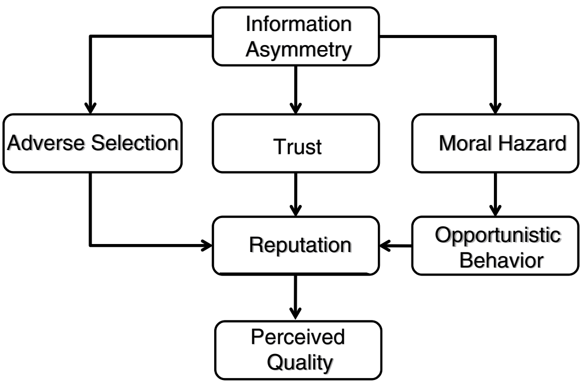

Fig. 11.1 The nomological network for the Lemon Market theory

capturing the richness of observations of real-world phenomena. However, there are some drawbacks in doing so. Milgrom and Roberts (1987) point at two serious questions on the modeling of information asymmetry environments. First is the assumption that equilibrium behavior will prevail and second, the bounded rationality of the participating parties. This leads to models with less predicting power than explanatory power.

We consider here two groups of transacting parties: buyers and sellers. The buyer is the less informed party and the seller is the most informed party. The transaction is considered to take place on an internal or external market. On a market a buyer interacts with a seller, and a contract or transaction is negotiated. Christozov et al. see information asymmetry as a natural property of any communication process between a sender and a receiver, when both actors have different backgrounds and expertise, use different "jargon" or possess different information regarding the content of the communication session (Christozov et al. 2009). When there is information asymmetry, the distribution of information between the transacting parties is unbalanced resulting in an imperfect market. Some authors refer to a situation of information asymmetry as a situation of imperfect information. This asymmetry can put one party at an advantage while placing the other at a disadvantage and makes the decision of a product risky for a prospective buyer (Afzal et al. 2009). Information asymmetry depends on the different capabilities and intellectual levels of the transacting actors and is therefore considered an independent construct for the LMT.

Dependent constructs from information asymmetry are trust, adverse selection, and moral hazard. We discuss the three dependent constructs and their dependent constructs.

The concept of trust is subtle, diffuse, and elusive. Although there is agreement on the importance of trust, there also appears disagreement on a suitable definition of the construct (Bigley and Pearce 1998). Trust is a dependent construct and can be been seen as a coordinating mechanism based on shared moral values and norm supporting collective cooperation and collaboration within uncertain environments (Reed 2001). Trust is the degree to which one party has confidence in another within the context of a given prospect, decision, or collaborative project. Blois gives a number of definitions of trust appearing in frequently quoted papers (Blois 1999). Trust/control relations between organizations can be seen as highly complex structures of social relations and processes which are needed for the generation and maintenance of collective action. The concept of trust is crucial in business interactions that are characterized by mutual dependency combined by with a lack of mutual control. Some researchers argue that trust is also reciprocal. According to Reed: "[…] the essential character of all trust relations is their reciprocal nature. Trust tends to evoke trust, distrust to evoke distrust…. As trust shrinks, distrust takes over" (Reed 2001). The notion of trust is latently present in the seminal article of Akerlof as dishonesty. Information asymmetry may result in a misunderstanding or even erode existing trust between the participating actors.

Trust is related to reputation. The concept of reputation is commonly used in social life and economy. Wilson defines reputation as: "a characteristic or attribute ascribed to one person (or organization) by another person (or organization)"

(Wilson 1985). Reputation theory indicates that uncertainty about the seller's honesty will affect the buyers' behavior (Kreps and Wilson 1982). Reputation can be formed by means of ratings by different buyers and can be seen as a measure that brings evidence a posteriori about the missed information or the hidden information and quality of the seller. When there is no proper reputation-signaling mechanism in a market, there is incentive for a lemon market where it is preferable to offer low-quality products and services (lemons) or no participation in the market at all in case of high-quality sellers. In both cases the overall perceived quality is going down. According to Yamagishi and Matsuda (2002), reputation can provide an effective solution to the lemons problem when (1) it is shared by all or most traders in the market, (2) traders in fact base their behavior on it, and (3) the market is closed such that the trader who is excluded from it cannot find an alternative market.

The adverse selection is the second dependent construct of information asymmetry and is the process of selecting the wrong seller and consequentially the least product quality. Adverse selection is a pre-contractual condition. Hidden information is sometimes used as a more practical term for the adverse selection. From the buyers point of view there is lack of knowledge on the features of the product or service and the real capabilities of the seller which may result in a wrong decision to select and leading to failure. From the seller's point of view a wrong selection may result in the buyer's dissatisfaction and eroding the reputation and consequently a drop of perceived quality.

Moral hazard as the third dependent construct is a post-contractual condition and can arise from the seller's fraud or incapacity to deliver the real quality of the offering. Hidden action or hidden intention are sometimes used as more practical terms for moral hazard, although we see these terms more as metrics for opportunistic behavior which can arise from moral hazard. We take the moral hazard construct into account because even if the problem of adverse selection is overcome by selecting a good seller with fair quality offerings, post-contractually the seller may start to shrink on quality. This can be the case in markets where service offering is traded. For IS moral hazard happens when the seller can gamble on a so-called vendor lock, in which the buyer is confronted with high switching costs and forced to use the services of the existing IS vendor. Opportunistic behavior can erode reputation, leading to a drop of perceived quality.

A lemon market must be seen as a dynamic process involving positive and negative feedback coming from closed transactions. Like a cybernetic system negative feedback can stop a market becoming a lemon market and eventually stop the death spiral. Positive feedback enforces the lemon market dynamics which drives the good ones out of the market and accelerates the death spiral. New entrants can enter the market and eventually stop the spiral. This can also be done by better informed buyers or more honest sellers. The market mechanism can eventually be regulated by exogenous triggers like governmental corrective initiatives.

For a market to become a lemon market there are constraints and an igniting condition is needed. The constraints for obtaining a lemon market are as follows: (1) information asymmetry – a condition in which not all relevant information is known to all parties involved so prospective buyers cannot accurately assess the value of a product or service before sale is made and sellers can more accurately assess the value of a product or service prior to sale, (2) sellers have no credible ways of disclosing the real quality to buyers, (3) the seller's quality is assessed by buyers acting as von Neumann–Morgenstein maximizers of expected utility. The igniting condition for a lemon market is that an incentive exists for the seller to market low-quality products and services.

All parties participating in the communication process would benefit heavily from reducing information asymmetry and avoiding a lemon market. Quantifying the amount of information asymmetry in a communication process is not easy. It is also not straightforward to derive the amount of risk of misinforming, moral hazard, and adverse selection.

11.3 Link with Other Theories

The attraction of the LMT comes from its high level of abstraction and its power to make strong generalizations. The theory is also applicable in disciplines besides economics. It may come as no surprise that LMT is also used in IS research. Since its inception in 1970, this discipline has established a new field that comprises computer science, economics, engineering, organizational science, managerial science, operational research, business, and information science. According to Gregor, all IS theories gain meaning only in an objectivity existing in an abstract world of man-made entities (Gregor 2006). We believe this holds also for the LMT. The LMT is mainly an explanatory theory, although it contains also causality and the power to make generalizations. Besides this, LMT also encompasses ideas that provide ways to think about other more or less related theories. In our research we found that Agency theory (Jensen and Meckling 1976), Prospect theory (Kahneman and Tversky 1979), and Organizational Trust theory (Reed 2001) are closely related to LMT. We already discussed the nature of trust in the previous paragraph. The research on trust in Internet-related issues like fraud, e-auctions, and e-markets, and the relation with the lemon problem is numerous (Grazioli and Jarvenpaa 2000; Ba and Pavlou 2002; Pavlou and Gefen 2004; Pavlou and Dimoka 2006; Eymann et al. 2008; Hoffman et al. 2009). We briefly discuss here Agency and Prospect theory and their relations with the LMT.

Agency theory is central to Western management thinking and one of the cornerstones for the theory of the firm (Jensen and Meckling 1976). The (positivistic) agency theory is a well-known theory, largely used in the strand of research on IS and outsourcing (Dibbern et al. 2004). According to Pavlou et al. the LMT can be seen as an extension of the principal–agent perspective to markets of imperfect information (Pavlou et al. 2007). Besides asymmetric information and goal differences, there is an important third factor in agency problems: risk behavior differences. For example, the implementation of an IS is highly risky since the outcome is not always stated in measurable outputs and only partly verifiable by organization members. The likelihood of failure looms large because of this outcome uncertainty.

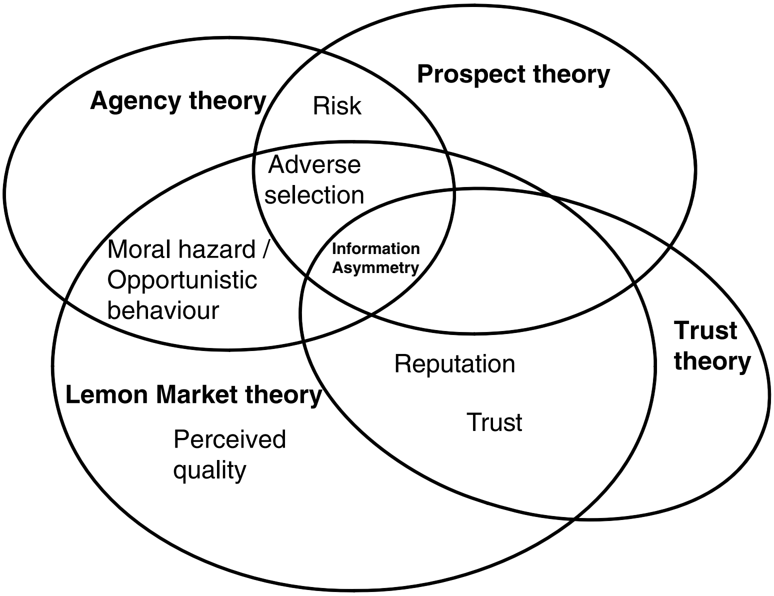

Fig. 11.2 The links of the Lemon Market theory with Agency theory, Prospect theory, and Trust theory

This gives rise to an entrepreneurial risk situated initially with the principal. The transfer of that risk to the agent is not straightforward since both parties' express risk behavior differences. The principal is assumed risk-neutral and the agent risk-averse. This assumption is based on the argument "[…] that agents are unable to diversify their employment […] and principals, who are capable of diversifying their investments, should be risk neutral" (Eisenhardt 1989). However, it is assumed that the principal is risk-averse when choosing a "buy" option (Eisenhardt 1989). When principals are faced with adverse possibilities there is an overweighting of certainty (Kahneman and Tversky 1979). This is where the prospect theory gives some explanation.

Prospect theory (PT) was developed by Tversky and Kahneman (Kahneman and Tversky 1989; Tversky and Kahneman 1986) as a falsification for the Expected Utility theory (EUT) of Von Neumann and Morgenstern (Currim and Sarin 1989). PT has also been used in IS research (Koh et al. 2004; Rose and Rose 2004). It is our belief that on the issue of risk behavior differences the prospect theory is of special interest (Devos et al. 2008). Okada (2010) investigated the link between uncertainty, risk aversion, and the seller's willingness to accept (WTA) versus the buyer's willingness to pay (WTP). They draw on prospect theory to demonstrate that the discrepancy between the WTA and WTP increases with (1) the level of uncertainty about the exchange item's value and (2) the exchange parties' level of risk aversion.

The links of the LMT with the three mentioned theories are presented in Fig. 11.2. All four theories share the construct information asymmetry. LMT and Agency theory share the constructs moral hazard, opportunistic behavior and adverse selection. Adverse selection is also shared by PT. Reputation is shared by LMT and Trust theory.

There are, however, other theories that have shared constructs with LMT like auction theory, game theory, and incomplete contract theory. Incomplete Contract theory (ICT) formalizes some ideas on opportunistic behavior in the presence of a risky investment between transacting parties. The theory was developed in the late 1980s by Hart and Moore (1988). Auction theory (AT) provides explanation for market mechanisms like methods of price formation in environments with incomplete information (Klemperer 1999). AT has gained a lot of interest in developing new auction forms like selling radio spectrum licenses and setting up new e-markets. The most generic theory which relates to LMT is probably game theory (GT). Markets can easily be simulated in well-defined economic environments (symmetric vs. asymmetric information) where they provide valuable testing grounds for GT (von Neumann and Morgenstern 1944).

11.4 Literature Overview of IS Articles Using LMT

Although a lot of IS scholars refer to the phenomenon of a lemon market in a variety of situations there is not a lot of research bringing empirical evidence of an actual lemon market as predicted by Akerlof. It is even unclear in some works to see how the theory is actually applied to explain the observations. The reference to the seminal paper of Akerlof seems to be reduced to only a citation. Some examples:

> …[]We can, therefore, defer consideration of the "lemon" problem associated with quality under asymmetric information. (Liao and Cheung 2002)

> …[]Eventually, only the lowest-quality sellers would remain, a dynamic economist George Akerlof memorialized as the "market for lemons." (Resnick et al. 2000)

Some articles have the seminal article of Akerlof only as an entry in the reference list without further use in their work (Kambil and Ginsburg 1998; de Figueiredo 2000; Sakalaki and Smaragda 2009).

The basic construct of the LMT, information asymmetry, is actually well researched. This was shown on Internet exchanges for used goods like PDAs, digital cameras, audio players, and laptops (Ghose 2009). Information asymmetry between buyer and seller creates the possibility of igniting a lemon market but is certainly not a sufficient condition. On an individual level, signs of the lemon market are mainly measured by adverse selection (Dewan and Hsu 2004). Afzal et al. (2009) showed that symmetric information highly valued a product in close proximity to the real worth of the product, while asymmetric information undervalued a product. Lee et al. (2010) showed that opportunistic behaviors in online markets can be predicted. As the risk of fraud increases, buyers underestimate the value of items in order to reduce the potential transaction risk. They conclude that this practice harms the honest and normal sellers, thus leading to a lemon market. To mitigate the lemon problem Lee and Yoo (2007) found that several auction markets have devised third-party quality grading systems and limited auctions to only relatively higher-quality products. Overby and Jap (2009) conducted an enquiry to investigate the adoption of e-channels in a market for products of uncertain quality (used vehicles). They found that quality uncertainty causes buyers to discount as a hedge against buying a lemon.

The market of IT security products and services seems to go in the direction of a lemon market. Since the security of software products is difficult to measure for users, vendors are unable to charge a premium for extra security due to the information asymmetry. Still the market for security products is very prosperous and is growing continuously (Bojanc and Jerman-Blazic 2008).

Cremonini and Nizovtsev (2009) developed a quantitative model based on game theory to understand information security practices. In their conclusions they refer to Akerlof: "This is consistent with existing theoretical research on economics of incomplete asymmetric information." It is, however, not shown how their findings are consistent with a real lemon market as described by Akerlof.

Kim et al. (2010) investigated customers' perceptions of security and trust in e-payment systems and found that posting security statements in e-payment sites are likely to increase the chances of customers' purchasing and paying over the Internet. They argue that the basis for this proposition lies in the concept of information asymmetry and the role it plays in decision-making. The risk of leading to a lemon market is recognized as one of major problems in e-payment systems.

Brydon and Vining (2006) are bringing LMT in to show the failure of internal knowledge markets. They conclude that internal knowledge suppliers must maintain their reputation to prevent suppliers of high-quality knowledge from participating in the internal knowledge market.

In a research of creating business value by virtual communities, a type of virtual community is a transaction-oriented community where sellers and buyers are brought together like eBay. According to Spaulding (2010) transaction-oriented community becomes a lemon market when trust between the parties does not exist. Without trust, risk increases and prices deflate, causing sellers with valuable goods to take their goods elsewhere. This is confirmed by a research on attacks and defense techniques for reputation systems (Hoffman et al. 2009).

Devos et al. (2009) investigated the outsourcing of IS projects in SMEs (small- and medium-sized enterprises) and found that the LMT offers an extra explanation for the adverse selection. They show that there is always incentive for adverse selection as long as the SME-principal is not willing to pay the cost to fade out the information asymmetry and thus creating an ideal environment for a lemon market. The market where SMEs buy IT is attractive for small independent software vendors (ISV) acting as business partners of top-notch ERP suppliers, like SAP, Oracle, or Microsoft Dynamics or IS/IT suppliers like IBM, Hewlett-Packard, or Apple. However, the capability maturity level of the ISVs is often inadequate to match with the demands and complex challenges of an IS implementation in an SME environment. Since SMEs are not so well informed on the correct IT/IS capabilities of the ISVs as well as on the broad functionalities of the package software together with the efforts needed to adapt the software to the specific requirements of the users, a situation of severe information asymmetry occurs. They found that this leads almost always to opportunistic or even unethical behavior on behalf of the ISV and that a lemon market occurs.

Eymann et al. (2008) apply LMT for Grid economies. Grid technologies are particular types of technological and organizational interactions within a computer network, describing supply and demand for computational and data services. Again a situation of information asymmetry occurs between the service providers having more information about availability and quality of the services they provide, and their users or clients. The asymmetrically distributed information leads to uncertainty about the optimal use of the Grid on the client side and consequently to imperfect markets.

Table 11.1 gives an overview of some IS articles using the LMT. The articles can also be found in the references. The first column lists the author(s). The second column lists the research domain. The most researched domains are e-Commerce, IT security, and IT outsourcing. The third column lists the research topic which is a refinement of the research domain. The unit of analysis is shown in the fifth column and the sixth column shows the additional theories that are used in the article.

11.5 Bibliographical Analysis of the Original Akerlof Article

It was 40 years ago that Akerlof published his seminal article in the *Quarterly Journal of Economics* (Akerlof 1970). So, reviewing and profiling the existing literature citing this article is likely to be of use to researchers and practitioners. This will help to identify the strengths and weaknesses of the existing body of research and to provide clarity in the findings. Our objective, therefore, was to identify peer-reviewed IS journals publishing articles based on the LMT. We limited our research to work published in the database provided by Thompson Scientific also known as the Web of Science.

As of the beginning of March 2010, the original Akerlof article was already cited more than 2,200 times with a monthly growth of 15–20 newly citing publications (last access of the Web of Science database was end of June 2010 and showed 2,285 citations). In Table 11.2 we show the number of citing articles by subject area. The subject areas are chosen to be most favorable to publish IS-related work; however, one cannot exclude that other areas also publish such work. It is also well known that the IS discipline is far from mature and stable and has tentacles in a wide variety of referencing disciplines like business, economics, management, and operational research. IT/IS has penetrated in almost every academic field!

The subject areas in the Web of Science are not treated as mutually exclusive attributes, so articles can be present in more than one subject area. We limited our search to articles only and excluded proceeding papers, reviews, and editorial material. This left a total of 1,613 refereed articles at the date of March 2010. We can observe in Table 11.2 that the largest area is economics, being the originating area

Table 11.1 Overview of IS articles using the Lemon Market theory

Authors	Research domain	Research topic	Unit of analysis	Used theories
Afzal et al. (2009)	Information	Product valuation	Group of students	
Bojanc and Jerman-Blazic (2008)	ICT security	Risk management	Organization	
Brydon and Vining (2006)	Knowledge management	Internal market failure	Organization	
Cremonini and Nizovtsev (2009)	ICT security	Strategic attackers	Security environment	Game theory
Devos et al. (2008)	IT outsourcing	IS failures	SME (small and medium-sized organizations)	Agency theory, Prospect theory, Trust theory, Incomplete Contract theory
Devos et al. (2009)	IT outsourcing	Outsourced project management	SME	Agency theory, Prospect theory, Trust theory, Incomplete Contract theory
Dewan and Hsu (2004)	e-Commerce	Online auction	Markets	Auction theories
Eymann et al. (2008)	IT/IS	Grid environments	Grid markets	Trust
Gopal and Sivaramakrishnan (2008)	IT outsourcing	Offshore software developing	Organizations	
Ghose (2009)	e-Commerce	Electronic trading of used goods	Market of used goods	
Hoffman et al. (2009)	ICT security	Attack and defense techniques	Organization	Trust
Kim et al. (2010)	e-Commerce	E-payment	Markets	Trust
Lee et al. (2010)	e-Commerce	Online auction fraud	Markets	Auction theories
Lee and Yoo (2007)	e-Commerce	Electronic trading of physical goods	Markets	Auction theories
Overby and Jap (2009)	e-Commerce	Adoption of e-channels	Markets	
Pavlou and Gefen (2004)	e-Commerce	Online auction and institution-based trust	Markets	Trust

(continued)

Table 11.1 (continued)

Authors	Research domain	Research topic	Unit of analysis	Used theories
Pavlou and Dimoka (2006)	e-Commerce	Online marketplaces and trust and reputation	Markets	Trust
Pavlou et al. (2007)	e-Commerce	Buyer–seller relationships	Consumers	Agency theory
Spaulding (2010)	Internet	Virtual communities	Organization	Trust
Snir and Hitt (2004)	Information economics	Contracts	Organization	Agency theory
Whang (2010)	Adoption of IT	RFID	Supply chain	Diffusion and adoption
Wilson and Zillante (2010)	e-Commerce	Institutional designs (two-sided multilateral negotiations and posted offers)	Markets	

Table 11.2 Number of articles citing the seminal Akerlof article by subject area (date of inquiry: 25 March)

Subject area	Count	Percentage
Economics	824	51.08
Business	231	14.32
Business/Finance	184	11.41
Management	176	10.91
Law	130	8.06
Agricultural, Economics, and Policy	67	4.15
Sociology	67	4,15
Planning and Development	48	2.98
Social Sciences, Mathematical Methods	47	2.91
Environmental Studies	46	2.85
Political Science	41	2.54
Public Administration	33	2.05
Information Science and Library Science	31	1.92
Environmental Science	30	1.86
Computer Sciences, Information Systems	29	1.80
Health Policy and Services	29	1.80
Health-care Sciences and Services	28	1.74
Mathematics, Interdisciplinary Applications	28	1.74
Operational Research and Management Science	26	1.61

of the seminal Akerlof article, followed by the derived disciplines business, finance, and management.

The largest area within the IS discipline is information science and library science with 1.92% of the total articles or 31 refereed articles, followed by computer science, IS with 1.80% and 29 articles. Again, it is not easy to reveal IS research articles in the Web of Science by subject area.

An alternative way to dig up IS research articles is via a search by relevant IS journals; this is shown in Table 11.3. A lot of IS scholars have their favorite IS journals, so an overview by journal title can be of interest. Again, this alternative way gives only an indication and not a complete picture of the quantity of IS research articles citing the work of Akerlof, since a lot of IS research articles also are published in typical non-IS research journals like the *Journal of Economic Perspectives*, *Management Science*, and *Organization Science*.

The IS journal with the most citing articles is the *Information Systems Research* with seven articles, followed by *Decision Support* (five articles), *Communications of the ACM* (four articles) and the *European Journal of Operational Research* together (four articles). Table 11.3 illustrates that the articles are spread over a large group of different journals. The most publishing IS journals of work using the LMT lie within the basket of "pure MIS" journals: *ISR* (#7), *DSS* (#7), *CACM* (#4), *MISQ* (#3) (Rainer and Miller 2005).

In Fig. 11.3 we show the evolution of the number of articles published per year. As can be seen, the number is incrementing every year and the growth is exponential. The last year taken into consideration, for Fig. 11.3 was 2009 with a total number of 116 articles referring to Akerlof's seminal work.

Table 11.3 Number of articles published in IS journals and citing the seminal Akerlof article

Journal title	Article count	Percentage
Information Systems Research (ISR)	7	0.61
Decision Support Systems (DSS)	5	0.44
Communications of the ACM (CACM)	4	0.35
European Journal of Operational Research (EJOR)	4	0.35
Electronic Commerce Research and Applications	3	0.26
Information & Management (I&M)	3	0.26
Journal of Management Information Systems (JMIS)	3	0.26
MIS Quarterly (MISQ)	3	0.26
Industrial Management and Data Systems	2	0.17
Journal of Information Science	2	0.17
Journal of Organizational Computing and Electronic Commerce	2	0.17
ACM Computing Surveys	1	0.09
Concurrency and Computation-Practice and Experience	1	0.09
IEEE Transactions on Knowledge and Data Engineering	1	0.09
Information Processing and Management	1	0.09
Information Research and Resource Reports	1	0.09
Information Sciences	1	0.09
International Journal of Information Management	1	0.09
International Journal on Semantic Web and Information Systems	1	0.09
Journal of Experimental and Theoretical Artificial Intelligence	1	0.09
Journal of Grid Computing	1	0.09
Online Information Review	1	0.09

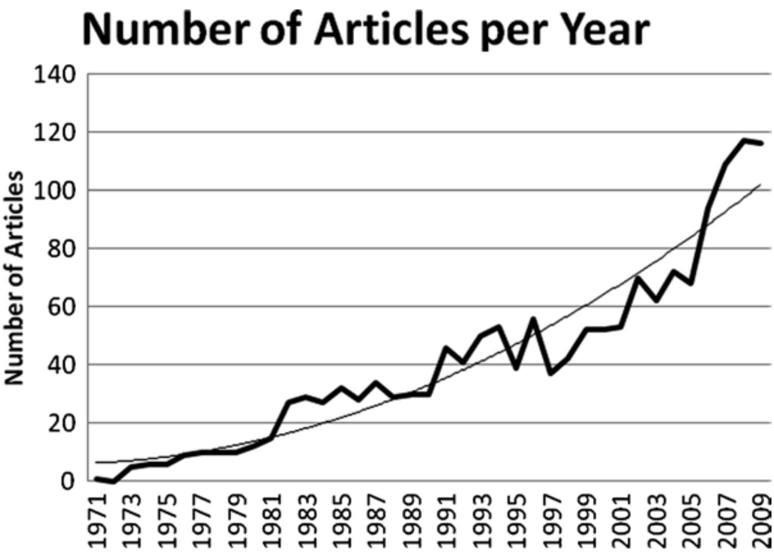

Fig. 11.3 Number of articles published per year and referring to Akerlof's seminal work

11.6 Conclusion

We have shown that the work of Akerlof has been acknowledged in a variety of disciplines including IS research. The lemon market is indeed a frequently occurring phenomenon and has been applied by many scholars from different academic perspectives. The theory goes back to the essence of markets and human interactions. The emerging e-markets since the end of the last century have given a boost to the application of the theory. We have also shown that the theory has a much broader application domain than e-Commerce.

Since the LMT is a meta-theory with a very high level of abstraction, it provides ways of thinking about other theories and has also links to other theories. We show that Agency theory is one of them with probably the same strength and authority as the LMT. Prospect theory and the theory of organizational trust are also very strongly linked and can provide measures for constructs of the LMT.

The scarcity of empirical evidence of the LMT in IS research is probably the major drawback. Although the theory has strong explanatory power, every empirical situation has its own specific nature which should be carefully and rigorously investigated. The relevance of the LMT lies in its nomological power to make strong generalizing laws.

Finally, we think that this chapter can help researchers to find adequate information on the LMT and we hope that it can be of use to new research initiatives in domains as described in this chapter.

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Chapter 12
The Technology–Organization–Environment Framework

Jeff Baker

Abstract This chapter describes the Technology–Organization–Environment (TOE) framework. It begins by presenting a description of the TOE framework and its constructs. Next, a brief review of studies that have used the TOE framework is provided. In this review, an emphasis is placed on noting the type of innovation that is being adopted in each study. Also, the different ways in which the framework has been adapted for various adoption contexts are highlighted. Finally, directions for future research with the TOE framework are described. In spite of this framework's stability since its initial development, many avenues for evolution and development appear promising.

Keywords Adoption of innovations, • Diffusion of innovations • Technology-Organization-Environment framework • Technology adoption

Abbreviations

CRT	Cathode ray tube
DOI Theory	Diffusion of innovations theory
EDI	Electronic data interchange
ERP	Enterprise resource planning
IOS	Interorganizational systems
IS	Information systems
RBV	Resource-based view
RFID	Radio-frequency identification
SCM	Supply chain management

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TAM	Technology acceptance model
TAM2	Technology acceptance model version 2
TOE	Technology–organization–environment framework
TPB	Theory of planned behavior
UTAUT	Unified theory of acceptance and use of technology

12.1 Introduction

The technology–organization–environment (TOE) framework is described in Tornatzky and Fleischer's *The Processes of Technological Innovation* (1990). The book describes the entire process of innovation – stretching from the development of innovations by engineers and entrepreneurs to the adoption and implementation of those innovations by users within the context of a firm. The TOE framework represents one segment of this process – how the firm context influences the adoption and implementation of innovations.

The TOE framework is an organization-level theory that explains that three different elements of a firm's context influence adoption decisions. These three elements are the *technological context*, the *organizational context*, and the *environmental context*. All three are posited to influence *technological innovation*.

12.1.1 The Technological Context

The technological context includes all of the technologies that are relevant to the firm – both technologies that are already in use at the firm as well as those that are available in the marketplace but not currently in use. A firm's existing technologies are important in the adoption process because they set a broad limit on the scope and pace of technological change that a firm can undertake (Collins et al. 1988). Innovations that exist but are not yet in use at the firm also influence innovation – both by demarcating the limits of what is possible as well as by showing firms ways in which technology can enable them to evolve and adapt.

Within the group of innovations that exists outside the firm are innovations of three types, those that create incremental, synthetic, or discontinuous changes (Tushman and Nadler 1986). Innovations that produce incremental change introduce new features or new versions of existing technologies. These incremental innovations represent the least amount of risk and change for the adopting organization. Examples include the transition from cathode ray tube (CRT) computer monitors to liquid crystal display (LCD) monitors, or an upgrade from one version of enterprise resource planning (ERP) system to a newer version of the same system. Innovations producing synthetic change represent a middle point of moderate change, where existing ideas or technologies are combined in a novel manner. An example is universities' delivery of course content via the Internet. No new technologies – in recording, storage, or transmission are used – neither is there necessarily an innovation in course content. Thus, existing technologies are combined in a novel way to innovate. Innovations that produce a discontinuous change – which have been referred to as “radical” innovations (Ettlie et al. 1984) – represent significant departures from current technology or processes. Examples include the adoption of bar-code scanning in the grocery industry in the 1970s and 1980s, the change from mainframes to PCs at many corporations in the 1980s, or the shift to cloud computing that began in the early 2000s.

Industries that are characterized by technological innovations that cause incremental and even synthetic change allow a measured pace of adoption. In contrast, industries that are characterized by technological innovations that produce discontinuous change require firms to make quick and decisive adoption decisions to maintain and enhance competitive standing. When evaluating technologies that will cause discontinuous change, firms must also consider whether these technologies are “competence-enhancing” or “competence-destroying” (Tushman and Anderson 1986). Competence-enhancing innovations enable firms to gradually change as they build upon their expertise, while competence-destroying innovations render many existing technologies and many types of expertise obsolete. These discontinuous, competence-destroying innovations often cause major shifts in industries. For instance, the shift to cloud computing may ultimately prove to be a competence-destroying technology. Firms that have achieved a high level of expertise within their IT function may find that such a competency is no longer needed and no longer a source of competitive advantage. In contrast, the adoption of RFID technology appears to be competence-enhancing. Firms that have a demonstrated skill in tracking assets and resources – a skill that most likely relies on bar-coding technology – can build upon this competency. As they replace bar codes and optical scanners with RFID tags and digital RFID scanners, they can use the same databases to store item data and can find new efficiencies in business processes as manual scanning of bar codes becomes unnecessary.

In sum, organizations must carefully consider the type of organizational changes that will be created by adopting a new innovation. Some innovations will have a dramatic impact on the firm and the industry in which it competes, while others will have a relatively small impact.

12.1.2 The Organizational Context

The organizational context refers to the characteristics and resources of the firm, including linking structures between employees, intra-firm communication processes, firm size, and the amount of slack resources. There are several ways in which this context affects adoption and implementation decisions. First, mechanisms that link internal subunits of the organization or span internal boundaries promote innovation (Galbraith 1973; Tushman and Nadler 1986). The presence of informal linking agents – such as product champions, boundary spanners, and gatekeepers – is associated with adoption. Cross-functional teams and employees that have formal or informal links to other departments or to other value chain partners are additional examples of such mechanisms.

More broadly, organizational structure has been studied to identify its relationship to the innovation adoption process. Organic and decentralized organizational structures are associated with adoption (Burns and Stalker 1962; Daft and Becker 1978). Organizations with these types of structures emphasize teams, have a degree of fluidity in responsibilities for employees, and promote lateral communication in addition to communication along reporting lines. Other research on organizational structure indicates that while organic and decentralized structures may be best-suited to the *adoption* phase of the innovation process, mechanistic (rather than organic) structures, with their emphasis on formal reporting relationships, centralized decision-making, and clearly defined roles for employees, may be best-suited to the *implementation* phase of the innovation process (Zaltman et al. 1973).

Communication processes within the organizational context can also promote or inhibit innovation. Top management can foster innovation by creating an organizational context that welcomes change and is supportive of innovations that further the firm's core mission and vision (Tushman and Nadler 1986). Top management leadership behaviors and communication processes include describing the role of innovation within the organization's overall strategy, indicating the importance of innovation to subordinates, rewarding innovation both formally and informally, emphasizing the history of innovation within a firm, and building a skilled executive team that is able to cast a compelling vision of the firm's future.

Among the most frequently discussed factors within the organizational context that affect innovation, however, are slack and size. While much research indicates that slack promotes adoption (March and Simon 1958; Rogers 1995), additional work indicates that innovation can take place in the absence of this factor and that the presence of slack may not necessarily lead to technological innovation (Tornatzky et al. 1983). Thus, while slack is desirable and helpful, it is "neither necessary nor sufficient for innovation to occur" (Tornatzky and Fleischer 1990, p. 161).

Size is also widely studied, but a conclusive link between this factor and innovation does not exist. Larger organizations are generally more likely to adopt innovations (Cyert and March 1963; Kamien and Schwartz 1982; Scherer 1980), but much of this research has been criticized on the grounds that size is often a crude proxy for more specific and more meaningful underlying organizational factors such as the availability of specific resources (Kimberly 1976). Thus, a link between size and innovation cannot be conclusively established, and researchers argue for the use of more specific measures of organizational variables than simply the generic measure "size."

An example of a firm that was able to cultivate an organizational context that was receptive to the adoption of innovation is the motorcycle-maker, Harley-Davidson Motor Company (Austin et al. 2003). When the company was considering implementing a new supply chain management (SCM) system in the late 1990s, they deliberately assembled a project team that included key employees from different sites and different functions in the firm. They benefitted from a company structure where rigidly divided functional silos do not exist, but interlocking functional teams collaborate to make decisions and define strategy. Furthermore, the company values self-directed teams rather than formal hierarchy. And finally, a champion for the innovation, the CIO of the firm, was instrumental in the adoption of a new SCM system. This example illustrates one specific setting where the organizational context was particularly well-structured to promote the adoption of an innovation.

12.1.3 The Environmental Context

The environmental context includes the structure of the industry, the presence or absence of technology service providers, and the regulatory environment. Industry structure has been investigated in several ways. For instance, intense competition stimulates the adoption of innovation (Mansfield 1968; Mansfield et al. 1977). Also, dominant firms within the value chain can influence other value chain partners to innovate (Kamath and Liker 1994).

With regard to industry life cycle, it is argued that firms in rapidly growing industries tend to innovate more rapidly. In mature or declining industries, however, innovation practices are not clear-cut (Tornatzky and Fleischer 1990). Some firms use the decline of an industry to innovate through efficiency initiatives or by expanding into new lines of business. Other firms may avoid investment in innovation in an effort to minimize costs. Empirical work validating these assertions about the relationship between industry life cycle and the adoption of innovation remains to be carried out.

The support infrastructure for technology also impacts innovation. Firms that must pay high wages for skilled labor are often compelled to innovate through labor-saving innovations (Globerman 1975; Levin et al. 1987). The availability of skilled labor and the availability of consultants or other suppliers of technology services also fosters innovation (Rees et al. 1984).

Finally, government regulation can have either a beneficial or a detrimental effect on innovation. When governments impose new constraints on industry, such as requiring pollution-control devices for energy firms, innovation is essentially mandated for those firms. Similarly, stringent safety and testing requirements can retard innovation in numerous industries. For instance, in construction, where new materials must be extensively tested before they can be used, or in agriculture, where new varieties of crops must be patented and licensed, the cost of innovation can be quite high. Another example exists in banking, where privacy requirements may prevent banks from introducing new ways for customers to access their account information. Thus, government regulation can either encourage or discourage innovation.

In sum, these three elements – the technological, organizational, and environmental contexts – present "both constraints and opportunities for technological innovation" (Tornatzky and Fleischer 1990, p. 154). These elements influence the firm's level of technological innovation. Figure 12.1 depicts this framework visually.

12.2 The Technology–Organization–Environment Framework in Research

Extant research has demonstrated that the TOE model has broad applicability and possesses explanatory power across a number of technological, industrial, and national/cultural contexts. The TOE model has been used to explain the adoption of interorganizational systems (Grover 1993; Mishra et al. 2007), e-business (Zhu et al. 2003; Zhu

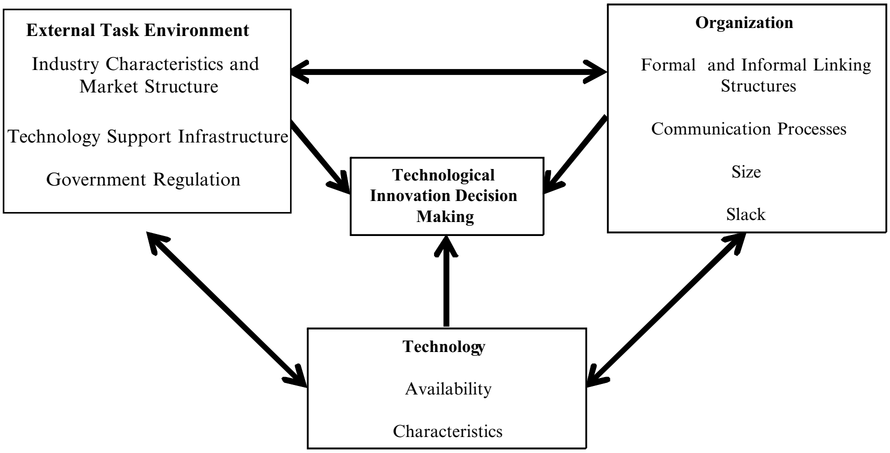

Fig. 12.1 The technology–organization–environment framework

and Kraemer 2005; Zhu et al. 2006b; Zhu et al. 2004), electronic data interchange (EDI) (Kuan and Chau 2001), open systems (Chau and Tam 1997), enterprise systems (Ramdani et al. 2009), and a broad spectrum of general IS applications (Thong 1999). The TOE model has been utilized to explain the adoption of innovations in a host of industries, including manufacturing (Mishra et al. 2007; Zhu et al. 2006b), health care (Lee and Shim 2007), retail, wholesale, and financial services (Zhu et al. 2006b). Furthermore, the TOE model has been tested in European, American, and Asian contexts, as well as in both developed as well as developing countries (Zhu et al. 2003; Zhu and Kraemer 2005; Zhu et al. 2006b, 2004). In each study, the three elements of technology, organization, and environment have been shown to influence the way a firm identifies the need for, searches for, and adopts new technology.

In each of the empirical studies that test the TOE framework, researchers have used slightly different factors for the technological, organizational, and environmental contexts. In essence, researchers have concurred with Tornatzky and Fleischer (1990) that the three TOE contexts influence adoption, but these researchers have then assumed that for each specific technology or context that is being studied, there is a unique set of factors or measures. For instance, in Zhu et al. (2004), the authors argue that one pertinent factor in the technological context that affects the adoption of e-business is "technology readiness." Similarly, these authors argue that "firm size," "global scope," and "financial resources" are the pertinent factors that should be studied to understand how the organizational context affects the adoption of e-business. Finally, the "regulatory environment" and "competition intensity" are relevant when researchers wish to understand how the environmental context influences the adoption of e-business. Different types of innovations have different factors that influence their adoption. Similarly, different national/cultural contexts and different industries will have differing factors as well. Thus, other research studies use different factors for the technological, organizational, and environmental contexts.

Table 12.1 lists these factors that compose the technological, organizational, and environmental context elements in each of the extant empirical studies. In this table, asterisks denote factors that were statistically significant predictors of adoption; plain text denotes a factor for which partial support was found, and italics denote that the factor was not statistically significant. This table also identifies the type of innovation that is being studied.

12.3 The Technology–Organization–Environment Framework in Future Research

To this point, the majority of the theoretical development that has taken place related to the TOE framework has been limited to enumerating the different factors that are relevant in various adoption contexts. No new constructs have been added to the framework. Little theoretical synthesis has occurred. Scant critique has been offered. Thus, the TOE framework has evolved very little since its original development. In this section, reasons for this lack of theoretical development will be presented, followed by directions for future research.

12.3.1 Reasons for Lack of Development

There may be multiple reasons for the relative lack of evolution and change in the TOE framework since its initial development. First, the TOE framework has been described as a "generic" theory (Zhu and Kraemer 2005, p. 63). This assessment seems appropriate considering that the theory has come to be used as a framework within which a host of various factors can be placed (as has been demonstrated in Table 12.1). The freedom to vary the factors or measures for each new research context makes the TOE framework highly adaptable. Thus, scholars have seen little need to adjust or refine the theory itself.

Second, the TOE framework may have seen relatively little evolution because it has been viewed as aligned with other explanations of innovation adoption – rather than offering a competing explanation to them. Tension between the TOE framework and other theories has been seen as slight, and this tension has, at this point, to be resolved by allowing the TOE framework to subsume competing ideas, rather than respond to them. For instance, it has been noted that the TOE framework is consistent with the theory of the diffusion of innovations (DOI) (Rogers 1995). The DOI adoption predictors, *individual leader characteristics* and *internal characteristics of organizational structure* are said to be comparable to the TOE's *organizational context* element. A similar renaming equates DOI's *external characteristics of the organization* with TOE's *environmental context*. Finally, Rogers's implicit emphasis on technological characteristics of the innovation has been said to equate with the TOE's *technological context*

Table 12.1 Summary of prior studies using the TOE framework

Reference and innovation	Technological context factors	Organizational context factors	Environmental context factors
Chau and Tam (1997)	Perceived barriers*	Satisfaction with existing systems*	*Environmental uncertainty*
	Perceived benefits	*Complexity of IT infrastructure*	
Open systems	*Perceived importance of compliance to standards, interoperability, and interconnectivity*	*Formalization on system development and management*	
Grover (1993)	Compatibility*	Size*	Role of IT*
	Complexity*	Strategic planning*	Management risk position*
Customer-based IOS	*Relative advantage*	Infrastructure*	Adaptable innovations*
		Top management support*	Technology policy
		Championship*	Customer interaction
		Centralization	Competitor scanning
		Formalization	Competition intensity
		Integration	Information intensity
		Implementation planning	Power
			Generic strategy
			Maturity
			Vertical coordination
Kuan and Chau (2001)	Perceived direct benefits*	Perceived financial cost*	Perceived industry pressure*
EDI	*Perceived indirect benefits*	Perceived technical competence*	Perceived government pressure*
Lee and Shim (2007)	Perceived benefits*	Presence of champions*	Performance gap*
RFID	Vendor pressure		Market uncertainty*
Mishra et al. (2007)	Procurement process digitization*	Diversity of organizational procurement knowledge	Suppliers' sales-process digitization*
Internet in procurement		Organizational perceptions of technological uncertainty	

Ramdani et al. (2009)	Relative advantage*	Top management support*	*Industry*
	Compatibility		*Market scope*
	Complexity	Organizational readiness*	*Competitive pressure*
Enterprise systems	Trialability*		*External IS support*
	Observability	*IS experience*	
		Size*	
Thong (1999)	Relative advantage of IS	Business size*	*Competition*
	Compatibility of IS	Employees' IS knowledge*	
IS	Complexity of IS	Information intensity	
		CEO's innovativeness	
		CEO's IS knowledge	
Zhu et al. (2003)	Technology competence (second-order construct composed of IT infrastructure, Internet skills, e-business know-how)*	Firm size*	Competitive Pressure*
E-business		Firm scope*	Consumer readiness (interactive construct composed of consumer willingness, Internet penetration)
			Lack of trading partner readiness
Zhu et al. (2004)	Technology readiness*	Firm size*	Regulatory environment*
		Global scope*	*Competition intensity*
e-business		Financial resources*	
Zhu and Kraemer (2005)	Technology competence*	Size*	Regulatory support*
e-business		Financial commitment*	Competitive pressure
		International scope	
(Zhu et al. 2006b)	Technology integration*	Firm size	Competition intensity
e-business	Technology readiness	Global scope	Regulatory environment
		Managerial obstacles	

(Zhu et al. 2003, 2006a). Because these theories are described as markedly similar, the TOE framework has not been altered in response to DOI. Instead, researchers explain them as being closely related.

An example of the TOE framework subsuming a similar theoretical approach is seen in the blending of the TOE with a model of EDI adoption (Iacovou et al. 1995). The EDI adoption model was developed in a multiple case-study research program and explains that *perceived benefits*, *organizational readiness*, and *external pressure* predict the adoption of EDI. One study "integrates" the EDI adoption model of Iacovou et al. (1995) with the TOE framework (Kuan and Chau 2001, p. 509), another cites these models alongside each other as though they have the same predictors (Lee and Shim 2007), and others go even farther, stating that "following Tornatzky and Fleischer (1990), Iacovou et al., developed a model formulating three aspects of EDI adoption – *technological* factor, *organizational* factor, and *environmental* factor…" (Zhu et al. 2003, p. 253, emphasis in original – see also Zhu et al. 2004, p. 20). This is a particularly striking statement given that the EDI adoption model was developed independently of the TOE framework, with Iacovou et al. never referencing or citing TOE research. It is also striking in that Zhu et al. have described the EDI adoption model constructs in a way that makes them appear identical to the TOE elements. Similar statements about Iacovou et al.'s research supporting the TOE framework can be found elsewhere (Zhu and Kraemer 2005; Zhu et al. 2006b). Thus, the EDI adoption model of Iacovou et al. (1995) – rather than being recognized as an independent theoretical development, and rather than being acknowledged as having different drivers of the adoption process – is gradually becoming subsumed into the body of TOE research. This reality also prevents the theoretical evolution of the TOE framework. The TOE framework's elements of *technological context*, *organizational context*, and *environmental context* have not been contrasted with the EDI adoption model predictors of *perceived benefits*, *organizational readiness*, and *external pressure.*

Third and finally, other theories do exist in the area of adoption and DOI. The TOE framework is not the only option researchers have available to explain organizational adoption. Arguably the most similar explanation to TOE is DOI theory (Rogers 1995), with the aforementioned EDI adoption model of Iacovou et al. (1995), also somewhat related. Furthermore, network externalities have been put forward as an explanation for the adoption of certain types of innovations (Zhu et al. 2006a). Other theories of the adoption of innovations include task-technology fit theory (Cooper and Zmud 1990), institutional theory (Teo et al. 2003), the theory of organizational design (Swanson and Beath 1990), and social contagion theory (Angst et al. 2010). These theories can and have been utilized as alternatives to the TOE framework. These alternatives mean that the TOE framework need not be adapted or changed to apply in more varied contexts. Other theories exist that may fit the particular research context better.

A closely related point is that researchers have argued that perhaps it is not possible to have a single theory that applies to all types of innovations. Because innovations are of different types (Damanpour and Evan 1984; Robey 1986; Swanson 1994; Zmud 1982), it seems unlikely that a single theoretical explanation can be developed to describe the adoption and diffusion of all types of innovations (Kimberly and Evanisko 1981; Lai and Guynes 1997; Lee and Shim 2007; Thong 1999; Zhu et al. 2006b). While these arguments are well-founded, they have the potential to limit the comparison of theories with one another. By avoiding comparison and critique of the various theories of adoption of innovation, the refinement of these theories is restricted.

12.3.2 Future Directions for TOE Research

Future research with the TOE framework can take a number of directions. Perhaps the most obvious is that the TOE framework can continue to be used for empirical research. As long as new technologies are developed, and as long as novel contexts for adoption can be identified, the need to understand the adoption of innovation in organizations indicates that the TOE framework is capable of providing insights for researchers and practitioners. Thus, continued empirical work is one future direction for TOE research.

Other possibilities exist as well. For instance, one area of interest to researchers is interorganizational adoption. The TOE framework has been used to study the adoption of interorganizational systems, but only from the perspective of a single focal firm. Extant research does not examine how decisions are made when multiple firms must collectively reach a decision about a new system. How do the multiple firms' multiple technological contexts influence adoption? How do the multiple firms' multiple organizational contexts influence adoption? Is the environmental context viewed differently by different firms? Does the position of a firm in the value chain cause it to view new technologies differently than its value chain partners view those same technologies? Exploration and investigation of each of these questions would allow researchers to extend the TOE framework in ways that would increase its explanatory power or possibly reveal its limits. Such research would also provide actionable insights for practitioners in an age of increasing organizational interconnectedness.

Additionally, theoretical synthesis may extend and enrich the TOE framework. For instance, one explanation for the organizational adoption of many types of technology – an explanation that has slightly different emphases than the TOE framework – is that of network externalities. When the value of an innovation depends on the number of other users or other firms who adopt that innovation, positive adoption externalities, also known as network effects or *network externalities*, are said to exist (Katz and Shapiro 1985, 1986). Network effects can be either direct network effects, which are the physical effects of being able to exchange information, or indirect network effects, which arise from the interdependencies with other organizations in the use of complementary goods (Katz and Shapiro 1985, 1986; Weitzel et al. 2006). Numerous types of technologies are said to generate network effects, including computer networks for academic research (Gurbaxani 1990), EDI (Chwelos et al. 2001), and open-standard interorganizational systems (Au and Kauffman 2001; Riggins et al. 1994; Zhu et al. 2006a). In each case, the value of being a member of the network of adopters increases with each additional adoption decision. Thus, these researchers argue that network externalities are one of the primary reasons for adoption.

Where do network externalities fit within the TOE framework? Can they be understood as a characteristic of some specific types of technologies – and thus included as part of the technological context? Or are externalities something entirely different that the present TOE framework does not truly account for? It remains to be seen how the TOE framework will evolve and change in response to this theory.

Theoretical synthesis can take additional routes. Researchers have already included other theories and typologies in TOE-based research studies. Some researchers explain how the TOE factors predict use of an innovation, and then appeal to the resource-based view (RBV) of the firm to explain how use of an innovation creates value or improves performance (Mishra et al. 2007; Zhu and Kraemer 2005). Such research indicates that the dependent construct in the TOE model, technological innovation, might possibly be enlarged to include an element of organizational performance. Furthermore, TOE framework research has also included typologies of innovations such as Swanson's Type I, II, and III innovations (Chau and Tam 1997; Swanson 1994; Zhu et al. 2003; Zhu and Kraemer 2005; Zhu et al. 2004). If conditional statements could be made about how the technological, organizational, and environmental contexts influence the adoption of Type I, II, or III innovations, the TOE framework would be enlarged.

Yet another route for theoretical evolution involves exploring ways in which theories of individual behavior and individual adoption can influence the TOE framework's explanation of organizational adoption. Researchers have suggested that not only should the technological, organizational, and environmental contexts be considered, but also that task characteristics and individual factors should be included in studies of adoption (Premkumar 2003). In adoption research, some of the most widely used theories include the theory of planned behavior (TPB) (Ajzen 1985, 1991), the technology acceptance model (TAM) (Davis 1989; Davis et al. 1989), a more recent version of TAM known as TAM2 (Venkatesh and Davis 2000), and the unified theory of acceptance and use of technology (UTAUT) (Venkatesh et al. 2003). Perhaps a synthesis can be achieved that combines the strengths of these theories in explaining individual behavior with the strength of the TOE framework in explaining organizational behavior.

In sum, each of the ideas for future research listed above allows scholars to develop or critique the TOE framework and the research that supports it. Definitions of the three elements of a firm's context could be refined. Also, as noted above, the definition of the dependent construct could be perhaps enlarged. Furthermore, the ways that the TOE elements influence the various types of innovations could be discussed. And finally, theories of individual behavior can be examined for ways to enrich the TOE framework. The potential exists for much fruitful work to be done.

12.4 Conclusions

The adoption of innovations is clearly affected by the technological, organizational, and environmental contexts within a firm. Given this reality, it appears that the TOE framework will continue to provide useful guidance for researchers and practitioners. However, a variety of other ideas exist alongside the TOE framework. Competing theories will need to be addressed and the ideas within those theories will need to be incorporated into the TOE framework – or else critiqued by it. The challenge for researchers and theorists will be to comprehensively address these competing ideas and to craft a refined version of the TOE framework that is at the same time parsimonious and broadly applicable.

Fortunately, researchers know considerably more about the adoption of innovations than they did when the TOE framework was initially developed. The TOE model has been shown to be useful in the investigation of a wide range of innovations and contexts. Furthermore, it has been broadly supported in empirical work. It remains among the most prominent and widely utilized theories of organizational adoption since its development. The work of researchers in the coming decades will reveal how the TOE framework can continue to shape work on the adoption of innovations.

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Chapter 13
Contingency Theory in Information Systems Research

Jeff Reinking

Abstract Contingency theory, which originated in organizational theory, has been utilized in information systems (IS) research for the past 25 years. This theory is based on two central findings: First, there is not one best way to organize or manage a firm. Second, each specific method a firm could choose to organize or manage is not equally effective (Galbraith 1973). IS researchers have utilized the primary contingency theory variables of environment; technology, structure, and management effectiveness in their study of important topics; which include systems planning, systems design, systems implementation, performance, user involvement, and Internet adoption. This chapter describes the main contingency theory constructs which are used in IS research and the seminal work in organizational theory; the primary research methods; and lastly, the limitations of contingency theory.

Keywords Contingency Theory • IT • IS

Abbreviations

AIS	Accounting information systems
EDP	Electronic data processing
IS	Information systems
IT	Information technology
MIS	Management information systems
SEM	Structural equation modeling
SME	Small/medium enterprise

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13.1 Introduction

The contingency view in information technologies (IT) and information systems (IS) is based on the principle that no single information system can be universally applied to all firms in all situations (Otley 1980). Contingency theory has been utilized in IS research to explain how organizational and individual traits are interrelated to produce effective systems. The contingency approach is based on two central findings from several large-scale empirical studies. The first finding is that there is not "one best way" for a firm to organize or manage. A firm's organization is defined as the structure (centralized or decentralized) and the hierarchy of the firm. Secondly, each specific method of organizing or managing is not equally effective (Galbraith 1973). Accordingly, contingency theory is based on not one way, but several best ways to construct an effective IS; and these best ways are contingent upon a specific number of common characteristics of the individual and organization. Contingency theory can be viewed as a middle point between one best way and everything is completely situational, since the number of "best ways" is not an unlimited proposition. Moreover, Feidler (1964) was convinced that for a contingency theory to be successful, it needed to be able to predict the "best way" in a large percentage of the cases in a given context. This contingency view of the firm is viewed as a rejection of the classical organizational theory's long-held universal principle of "the one best way" to manage in exchange for "it all depends" on the conditions contained in the organization (Kast and Rosenzweig 1979).

For much of the past half century, contingency theory has been used by researchers to help explain how differing conditions affect a multitude of organizational functions. Contingency theory explains how various organizations can utilize different methods to accomplish the same goals (Kast and Rosenzweig 1979; Lawrence and Lorsch 1986). Fundamentally, contingency theory is able to predict based on the prescriptive guidelines that are outlined and substantiated by empirical research. These prescriptive guidelines are stated in the form of logic. If the situation is A, then B should be the most effective technique or organizational form. However, if the situation is C, then D should be utilized (Kast and Rosenzweig 1979).

The initial contingency theory research, which began in the 1950s and 1960s, originated in organizational theory. The early organizational researchers were primarily concerned with defining a single management style and organizational form that would offer the best fit and be most effective in all situations and environments. Essentially, organizational theory was utilizing a "one size fits all" approach. However, the empirical research in the field did not support this theory. Wetherbe and Whitehead (1977) summed up the early contingency research succinctly as the need for "fit" between the styles of management along with their structures and the circumstances facing the organization to produce goods and/or services. If the fit between the organization, its environment, and internal organizational design was appropriate, that fit should lead to increased efficiency, effectiveness, and satisfaction (Kast and Rosenzweig 1979). By 1970, the use of contingency theory dominated organizational theory research (Child 1977).

Kast and Rosenzweig (1979) further define the contingency view as somewhere on a continuum between the unsophisticated, universal principal of "one best way" and the complicated, not easily defined notion of "it all depends." The authors further explain that contingency theory is a mid-range theory that identifies the complexities of the modern organization, which utilizes patterns of interrelations in an effort to improve organizational effectiveness. Umanath (2003) sees the contingency approach as a method for organizing knowledge in a particular discipline. It allows researchers to methodologically investigate factors in order to predict or explain organizational events.

Although contingency theory originated from organization theory, it is also an extension of the earlier research on systems concepts. Systems concepts are based on the notion that organizations are comprised of a multitude of subsystems whose interrelationships have to be recognized. Organizations are open systems with multiple interactive parts, consequently, they cannot be thought of in unsophisticated one-dimensional terms. Even though contingency models are grounded in the systems concepts, they tend to be more concrete, emphasize more precise features of organizations, and depend upon the patterns of relationships among subsystems. Additionally, contingency models recognize that an individual organization's environment and subsystems are unique and they offer a basis for establishing management styles and organizational form. Systems concepts tend to be broad models for understanding all organizations (Kast and Rosenzweig 1979). Over the last 3 decades, the early frameworks for contingency theory have been extended into the IS field by narrowing the context into the following specialized areas: systems planning, systems design, systems implementation, performance, user involvement, and the Internet.

The remainder of the chapter will present a literature review of the seminal and IS research in Sect. 13.2, 13.4 will discuss the limitations of contingency theory and Sect. 13.5 is the Conclusion.

13.2 Literature Review

This literature review section discusses the origins of contingency theory and its current use in IS literature.

13.2.1 Seminal Literature

The seminal research that led to the development of contingency theory began in organizational research during the early 1950s and continued into the 1960s. This seminal research was completed in an effort to model the multiple relations found between three main contingent variables: environment, technology, and leadership traits. Environment is defined as the factors and entities that are external to an organization or the subunit of an organization, including customers, competitors, or government regulation (Wetherbe and Whitehead 1977). Technology is defined as the human and production methods which an organization utilizes to produce their goods and/or services. These variables were studied in relation to organizational effectiveness. Most of the seminal contingency research was conducted utilizing comparative analysis based on data collected from multiple case studies. Comparative analysis is defined as the constant comparison of the main variables under review in order to discover the range of differences or variation in the subject variables. In contingency theory research, the constant comparative method is extended by also investigating the interrelations of the variables. The first area to be reviewed in this literature is environment.

13.2.1.1 Environment

The environment in which an organization exists is an important contingent variable, which influences the organization's effectiveness. Burns and Stalker (1961) conducted a study to better understand the relationship between an organization and its environment. They found that the management techniques and internal procedures differed greatly between firms and were contingent upon the industry studied. These divergent management methods and procedures were classified as either mechanistic or organic, and were designed by the firm in response to the environment in which it operated. The research method utilized in this study was conducted by interviewing key personnel in approximately 20 industrial firms in the UK. The main contingent variable in this seminal study was the organization's environment (Burns and Stalker 1961).

Lawrence and Lorsch (1986) studied the "fit" between an organization and its environment. However, their study focused on the differentiation and integration that occurs as an organization grows and changes in response to its environment. Differentiation occurs when an organization becomes segmented into units, such as the marketing department or the production department, in order to more effectively interact with its environment. Integration is how well these segmented units work together to accomplish the overall purpose or mission of the firm. The study found that "different external conditions might require different organizational characteristics and behavior patterns within the effective organization." (Lawrence and Lorsch 1986, p. 14). This study's research methods included questionnaires and interviews. The main contingent variables were the level of differentiation and integration in relation to an organization's environment.

13.2.1.2 Technology

During this mid-century time frame, classical management theory research focused on the discovery and confirmation of one best method of management practice and organizational form that could be utilized by all organizations to improve their effectiveness. To that end, Woodward's (1958) study set out to confirm whether the current normative management theories of the day correlated with business success when the management principles were put into practice. However, early in Woodward's research, conflicting results pointed to a lack of correlation between an organization's actual management practices and its efficiency. Woodward wrote "The widely accepted assumption that there are principles of management valid for all types of production systems seemed very doubtful." (Woodward 1958, p. 52). The study eventually revealed that management practices were similar in firms that utilized comparable types of production and technical complexities (technologies). The research methodology in this study utilized surveys and longitudinal case studies from 1953 to 1957; 100 firms from South Essex, England participated in the case study. Each firm employed more than 100 employees and accounted for 91% of the manufacturing firms within the geographical area of South Essex. The main contingent variable in this study was production technology.

13.2.1.3 Leadership Traits

Lastly, effective leadership and the identification of personality traits that led to their effectiveness was an ongoing stream of research during this early time frame. Fiedler began conducting research in this area in the early 1950s and wrote an article that developed a generalized model of the interrelations between a leader's attributes and their group's performance in an organizational setting. Fiedler essentially found that "the effectiveness of a group is contingent upon the relationship between leadership style and the degree to which the group situation enables the leader to exert influence" (Fiedler 1967, p. 15). Fiedler's research was the first organizational study to define the interrelations of their model as a "contingency model" and he was convinced that in order for a contingency model to be meaningful, it needed to be able to reasonably predict a high percentage of the cases in each situation (Feidler 1964). The primary contingent variable in his research was an individual's personality traits. The research method involved review of prior literature, questionnaires, experiments, and case studies involving the US armed forces.

In general, these organizational researchers in the mid-century were concerned with discrediting classical management theory's "one size fits all" and demonstrating that the appropriate and effective organization is contingent upon several factors, which included environment, technology, and management effectiveness (Wood 1979). The primary research method employed during this time frame was comparative analysis conducted via case study, survey, or questionnaire; and the main units of analysis were either the organization or the individual.

13.2.2 Contingency Research in IS

IS entry into contingency research did not emerge in the literature until the late 1970s. IS researchers were beginning to investigate the primary organizational contingent variables in relation to the IS areas of discipline that were being studied at the time. These discipline areas of IS research are outlined by the following categories: systems development, which includes systems planning, systems design, and systems implementation; system performance; user involvement; and the Internet. These research categories were found to be the most prominent focus areas in the IS literature that utilized contingency theory to predict or map their results. The literature revealed other topics that were examined using the contingency approach, such as office productivity, management style, data management, outsourcing business processes, knowledge management, and software development; however, these were not the primary research categories at the time. Additionally, it is important to understand that the early literature in IS contingency theory developed in other disciplines such as accounting information systems (AIS) and management information systems (MIS), which were eventually consumed under the IS umbrella.[1]

The temporal development of IS research utilizing contingency theory loosely follows the ordering of the prominent IS categories listed above. During the 1970s, IS research was primarily focused on systems development; and as a result, this line of research was the first area to transition into utilizing contingency theory. Additionally, the initial IS contingency researchers relied upon on organizational research to inform their studies concerning firm traits and classifications. For example, Gordon and Miller's (1976) IS "design" study specified the most effective system design components based on the contingent archetypal firms revealed by Miller's (1975) organizational contingency research.

Systems performance and effectiveness was the next category that received considerable attention by IS contingency researchers. Otley (1980) emphasized the importance of system performance as a variable in AIS contingency research and critiqued previous research for not using system performance as a variable. Otley (1980) was one of the initial authors to include performance as an integral variable in his contingency model.

User involvement in systems development was the next major category of IS research that utilized contingency theory in the 1980s. Franz (1985) developed a contingency model that recommended the roles users should assume during the systems development life cycle to reduce risk and uncertainty. Lastly, in the early 2000s contingency research in IS examined Internet-based issues such as electronic marketplaces and business Internet adoption. Overall, the temporal development of contingency theory research in IS paralleled the topics that were studied in mainstream IS research. Contingency theory was utilized by the researchers to provide an additional lens to examine the important topics of the time frame.

The ensuing sections will review the influential research conducted in each category of IS research utilizing contingency theory.

[1]The early literature was not referred to as IS. The research concentrated on the topics that were pertinent during the time frame: Management Information Systems, Accounting Information Systems, and Electronic Data Processing. These items still remain separate areas of study today, except EDP; however, they all were subsumed under the umbrella of IS.

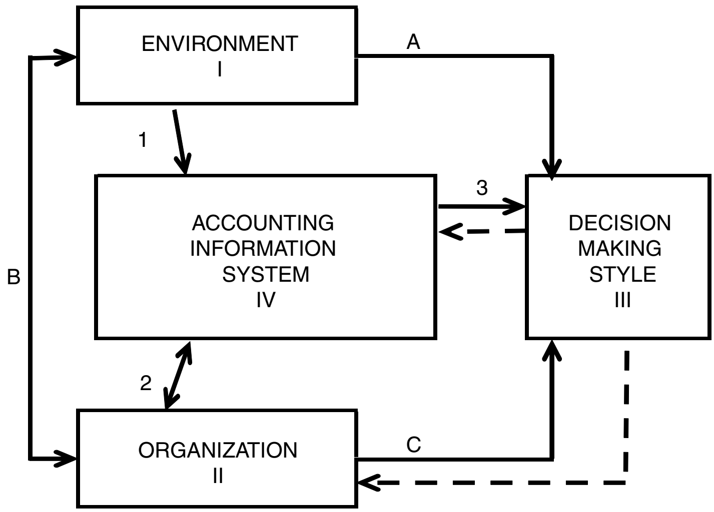

Fig. 13.1 Contingency framework for the design of AIS (Reprinted from Accounting, Organizations and Society, 1(1), Gordon, L. A., and Miller, D. (1976). A contingency framework for the designs of accounting information systems, 59–69, with permission from Elsevier)

13.2.2.1 Systems Design

The initial IS research developed contingency models for the design of AIS and MIS. These early contingency models were based on theoretical propositions that used organizational theory, management policy, and accounting in order to distinguish the variables vital to effective systems design. Gordon and Miller (1976) developed a contingency framework in this manner that is shown in Fig. 13.1. The specific relationships are shown by the solid lines.

The model in Fig. 13.1 made use of the environment, the organization, and decision-making style to predict the type of AIS needed and its level of success. The variables included in environment are environmental dynamism, environmental heterogeneity, and environmental hostility. Organizational variables include decentralization, differentiation, integration, bureaucratization, and resources. Lastly, decision-making style consists of analysis of decisions, decision time horizons, multiplex decision making, adaptiveness, proactivity, and consciousness of strategies. The study demonstrates how AIS should be designed based on all of these contextual variables. However, Otley (1980) argues that this model is too simplistic and that it is based more on common sense than on explicit theoretical underpinnings. Additionally, it does not include system or organizational effectiveness as a measure of the fit between the contingent variables. Otley (1980) presents an alternate model in response to this model, which includes effectiveness and is detailed in the "Performance" section below.

Alternatively, Edström (1977) develops a theoretical model for systems design by examining varying degrees of MIS design success. The MIS design success is related to the following contingent variables: the influence of various users; when the influence will be exerted; which phase of development process; how effective is the process of communication; the task environment, which are the characteristics the system is designed to support; and lastly, the existing system environment or existing computer-based systems. The above factors are found to be important contingencies between user influence and the success of MIS projects; and Edström provides a model to show the proposed relations of these variables (Edström 1977).

After 25 years of IS design research defining the interrelations of the contingent variables, Zhu (2002) extended the contingency view one step further by identifying the contingent variable of "when" the design methodology was chosen during the design process. Zhu found three contingency approaches were used in the field to select the appropriate time during the design process to designate the design methodology. These approaches include selecting the design methodology at the outset, which establishes the design approach before the process begins. The second approach is based on establishing a fixed pattern or schedule when methodologies are to be selected. This fixed pattern is predicated on a linear design sequence that denotes when a methodology needs to be specified for each stage of the project. Lastly, the design approach can be selected on the basis of developmental dynamics, which allows for the methodologies to be chosen as the complexity of the system design unfolds. The article then investigates how these contingency approaches fit with the environment of the IT organization.

13.2.2.2 Implementation

Ginzberg (1980) developed a systems implementation framework based on the impact that eight organizational characteristics had on the implementation of different types of accounting and information systems. Ginzberg found that an organization's information system is intimately connected with the specific attributes of that organization and the individuals within the organization. Therefore, not every system will be effective for every organization. The study shows how each of the characteristics are interrelated to produce a successful system implementation. Ginzberg's framework of accounting and information system implementation is shown in Fig. 13.2. This figure identifies four groups of characteristics: system designers, system users, the actual system, and the organization. All of the characteristics and their interactions essentially determine the effectiveness of the system implementation.

Khazanchi (2005) answers the question concerning when small and medium size business entities (SME) should consider new IT implementations. The study found that there were four contingent factors that predicted whether new IT implementations would improve organizational performance. These factors are "the internal/external business and technological environment; organizational readiness and trading partner support; financial impact; and workflow productivity (Khazanchi 2005)."

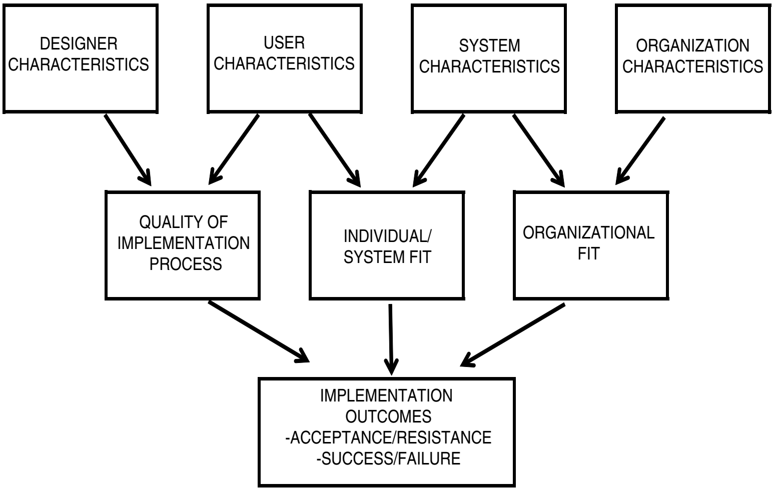

Fig. 13.2 General model of AIS implementation (Reprinted from Accounting, Organizations and Society, 5(4), Ginzberg, M. J. (1980). An organizational contingencies view of accounting information and information systems implementations, 369–382, with permission from Elsevier)

13.2.2.3 Performance[2]

Performance is a primary variable in most contingency models, including those in IS. IS research has included both organizational performance and system performance as measures of successful designs and implementations. According to Otley (1980), it is imperative to include a measure of performance to allow for an appropriate form of contingency theory to emerge. If no measure of performance is utilized, the contingency theory will merely contain what is observed in the field and will not be a predictor of success. Weill and Olson (1989) state that there is an assumed fit between system performance and firm performance; and either can be used interchangeably in IS research. According to Umanath (2003), there must be an appropriate fit between organization context and structure in order for an organization to perform well. However, providing a reliable measurement for effectiveness is one of the primary difficulties in contingency research.

Sugumaran and Arogyaswamy (2003–2004) attempt to build an IT effectiveness model based on the relations of the contingent variables external environment, strategy, structure, and culture between the mode of IT deployment (i.e., Cost, Service, or Investment Center). The model identifies the appropriate measure of effectiveness for each form of deployment. Seliem et al. (2003) examine the effectiveness of IS in a different cultural setting: Egypt. Their research explores top

[2] Performance and effectiveness are used interchangeably throughout the paper as a measurement of success at the systems level or the organizational level.

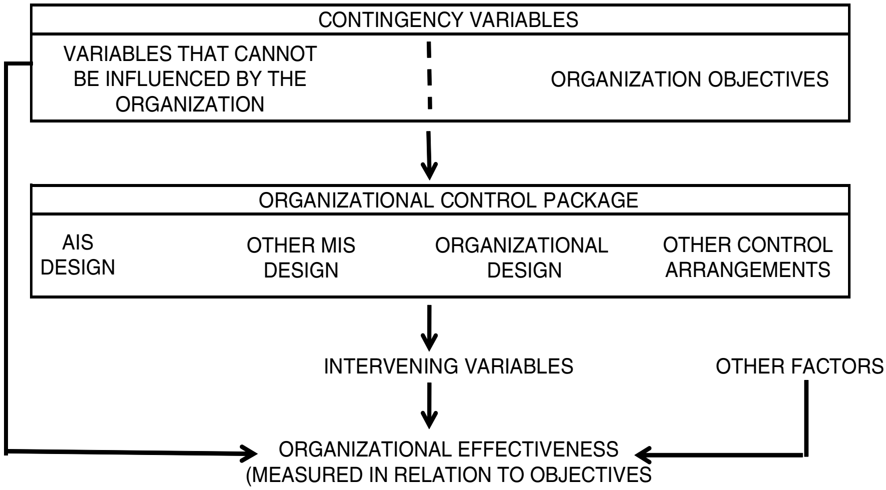

Fig. 13.3 The minimum necessary contingency framework (Reprinted from Accounting, Organizations and Society, 5(4), Otley, D. T. (1980). The contingency theory of management accounting: Achievement and prognosis, 413–428, with permission from Elsevier)

management support, user involvement, and the maturity of the IS function. These three contingency variables were found to be positively associated with systems effectiveness.

Lastly, Otley (1980) argues that AIS design must be predicated on the effectiveness of the organization as well as the interrelation of the typical contingency variables: technology, environment, and organizational form. He contends that the systems design models are weak when they simply relate which AIS designs are associated with specific contingent variables, regardless of the effectiveness of the system. The mere existence of a system design does not automatically confer that it is a successful design. In order for a particular design to be deemed appropriate, an evaluation of effectiveness needs to be included. In order to solve this dilemma, Otley (1980) offers the following model, which includes effectiveness in the framework and shows the minimum variables that are necessary to conduct contingency research. This model is shown as Fig. 13.3.

13.2.2.4 User Involvement

The examination of the impact of IS users in contingency research has been extensive. The research has concentrated on the amount of time a user is involved in the design process, the type of user involved, and whether their involvement achieves the best results. The inclusion of a user's participation in the development process is predicted to increase a user's satisfaction. Likewise, the utilization of the correct individual, either specialist or user, at the proper time in the development process is also predicted to increase the success of an IS development project.

Schonberger (1980) develops six MIS design approaches that are based on varying levels of manager/user involvement in the design. The level of manager/user involvement is predicated on the task characteristics involved with each level of managerial function incorporated in the IS and the type of decision related to these functions. Schonberger's (1980) contingency model includes three levels of management function as well as either structured or unstructured decision types for each level. The managerial function levels are operational control (lower level functions), managerial control (mid-manager functions), and strategic planning (top executive and stakeholder). Additionally, Schonberger discusses further contingency variables that are important to consider in MIS design: size, cost, urgency, and expectation of technology change. The author gives prescriptions for all of these variables based on their fit with the environment and decision-making style to provide the most effective system (Schonberger 1980).

McKeen et al. (1994) and McKeen and Guimaraes (1997) concentrated on building contingency theories revolving around user participation concepts, including user satisfaction and system success. The contingent variables in these two studies are task complexity, system complexity, user influence, and user developer communication. Lin and Shao (2000) also investigated the relations between user participation and information system success; however, this study included different contingent variables, which were user attitudes, system impact, system complexity, and development strategy. Franz (1985) used a contingency approach to examine the timing of when a specialist or user should assume control of the system development life cycle. Franz showed that the control of the process should be assumed by the user or specialist at different times during the process based on the interrelations of the contingent variables, which are IS complexity, IS department experience, and the users past experience in systems development. The research methodology utilized in the above user involvement studies was surveys, except Franz (1985), which used case study data.

13.2.2.5 Internet

The widespread adoption of the Internet by organizations in the 1990s permanently changed the business models of most firms. The established brick-and-mortar businesses were forced to compete with Internet businesses; and consequently, the brick-and-mortar businesses adopted the use of the Internet as a sales channel for their organization. This adoption of the Internet has led to substantial changes in IS and IT in today's firm. However, the IS/IT research involving both contingency theory and business Internet adoption has been minimal. Two studies in this area involving Internet adoption are Teo and Pian (2003) and Giaglis et al. (2002). Teo and Pian (2003) conducted a survey in order to decipher the interrelations between an organization's level of Internet adoption and their competitive advantage. Contingent variables included business technology strategy, technology, and level of top management support. Giaglis et al. (2002) investigated the level of involvement of business intermediaries in varying electronic market place environments.

Giaglis developed four premises of intermediary involvement by analyzing prior literature. Teo and Pian (2003) relied on survey data collection and SEM statistical testing to develop their contingency theory.

13.2.2.6 Additional Constructs

IS contingency research has examined additional constructs over the years in addition to those listed above; however, these constructs have not benefited from in-depth research. A listing of these additional constructs and a short description of the studies follows. The constructs are size, office productivity, management style, software development, and data management. Weill and Olson (1989) state that organizational *size* has been included as a contingency variable in numerous empirical studies and it is purported to have a moderating influence. Danziger (1979) studied governmental office *productivity* as a measure of performance which was attributable to the level of computer technology employed by the office. The contingent variables were office size, political framework, technology, and user–technician interface. The research method utilized 42 intensive case studies of municipal government agencies.

Wetherbe and Whitehead (1977) sought to understand how different *management styles* impact a manager's effectiveness in an organization's electronic data processing (EDP) function. The authors found that the management style developed by an individual while working in EDP's production section or the development section did not make them an effective manager of the overall department. This research concentrated on the style of management that was developed at the section level based on the contingent variables of environment and technology. The production activities of EDP were labeled as Closed/Stable/Mechanistic (centralized and bureaucratic) and the development activities as Open/Adaptive/Organic (decentralized and unusual). The study found that EDP managers that were previously employed in the production activities of data processing were not effective in managing the development activities and vice versa. Andres and Zmud (2002) examined *software development* from a contingent perspective that included the following constructs: task interdependence, goal conflict, coordinating strategies, productivity, and software design satisfaction. Goodhue et al. (1988) studied *data management* and found that the contingent variables relating to business objective, organizational scope, planning methods, and the type of product delivered were all interrelated with the success of the data management process.

13.3 Research Methods

Contingency theory was developed at the time when researchers were utilizing comparative analysis case studies to investigate organizational issues. In the earlier organizational research, the majority of the contingency research was conducted via case study, which enabled the researcher to get up close and personal to the issues they were studying. This closeness to the data allowed the researcher to intensively view the interrelations in order to produce an appropriate contingency framework and map their relations. Contingency research can be accomplished by collecting survey data; however, the closeness to and the unique understanding of the variable's relations are lost in this method. According to Otley (1980), case studies performed in contingency research should involve a small number of organizations that have been carefully chosen so that the contingent variables full range of values can be viewed while controlling for other variables (Otley 1980).

The more recent IS contingency research has utilized more advanced statistical analyses including ANOVA, Path Analysis, Factorial Analysis, and Structured Equation Modeling (SEM). While these methods produce quality results in validation studies, they only validate a single "one best solution" model. Therefore, these methods are not entirely appropriate for contingency studies where several interrelated contextual models need to be developed. In contingency approaches, the researcher is not seeking the "one best solution" for the relations of the contingent variables in an organization. This "one best solution" was shown to be ineffective in earlier organizational research; therefore, it should not be utilized in IS research merely as a result of the availability and ease of use of new statistical methods. Overall, Path Analysis and SEM should be used with caution, and typically for the validation of a portion of an existing contingency model.

True contingency theory produces a predictive mapping of the interrelationships among the variables, based on multiple best solutions for the contexts and variables studied. Otley (1980) continues this line of thinking by stating that "it is unrealistic to expect purely statistical methods of analysis to unravel a complex pattern of interaction; the researcher must have a closer involvement and develop hypotheses as to likely relationships as he explores the organizations he is investigating." (Otley 1980, p. 424). Additionally, since causal relationships can be much more insightful than mere associations, longitudinal studies allow the researcher to see these causal relationships versus a snap shot offered by cross-sectional studies. Longitudinal studies also show the processes by which an information system develops and actually operates in the field as well as how it changes over time in relation to organizational pressures (Otley 1980).

Overall, contingency theory research is best served by conducting case studies that are longitudinal. Surveys that are cross-sectional and contain multiple points of data to allow comparative analysis is the next best research method. Lastly, path analysis or SEM can be used as a verification method for a single part of an established contingency model; however, this statistical method produces the one best model, so it cannot show all of the interrelations required for true contingency models.

The unit of study in contingency theory research focuses on the individual and the organization. The different constructs utilized to explain the unit of analysis are varied as evidenced by the extensive number of contingent variables described in the previous sections of the paper. The variables associated with the individual unit of analysis include: management styles/traits; user time spent assisting the design process; which individual assisted the design process – user, manager, or programmer; decision-making types; and level of communication. The variables associated with the organizational unit of analysis include: organizational form, environment, technology employed, strategy, structure, culture, system complexity, and task complexity.

13.4 Contingency Theory Limitations

Contingency theory has been very productive in expanding and classifying our knowledge base over the last 4 decades; however, it does have some inherent weaknesses that need to be taken into consideration before it is utilized. First, it seems as if organizational theory and subsequently IS research moved away from the "one best way" panacea to a new panacea where everything is situational (Wood 1979). Instead of one best answer to a situation, you may have multiple solutions that are not easy to interpret or apply to the situation at hand. The idea that "it all depends" can give managers the leeway to avoid solving issues rather than addressing them (Otley 1980). The limitations regarding performance measurement, contingency variables, and culture are reviewed in more detail below.

13.4.1 Performance

Performance is a key variable in most contingency theory models; however, it usually is the weakest variable studied due to the lack of adequate measure. There are considerable difficulties in the measurement of effectiveness; and most of the measures are self-reported by individuals, which tend to be biased and unreliable. Moreover, IS research assumes that if the study reveals effective organizational performance then IS performance is assumed to be good also, although the relation is never proven. The reverse situation is also true if IS effectiveness is measured and found to be good (Weill and Olson 1989).

According to Otley (1980), researchers need to be content measuring intervening variables or variables which are thought to lead an organization toward effective versus ineffective performance because of the difficulty in actually measuring effectiveness. Weill and Olson (1989) believe that there is an inability to explain organizational performance. Lastly, Child (1977) states that when organizational designs are connected to prevailing contingencies, there is a lack of conclusive verification that the prevailing contingencies "contribute *importantly* to performance" (Child 1977, p. 165).

13.4.2 Contingency Variables

Otley (1980) contends that contingent variables are not properly defined and vary considerably from study to study. In essence, a contingent model may work based on one study, but may not be generalizable due to the lack of true definition for the variables. Additionally, in the more recent contingency research, the variables chosen to explain either IS effectiveness or organizational performance only account for a small portion of the variance in performance (Weill and Olson 1989).

13.4.3 Culture

Fiedler (1967) found that contingency models produced in one culture or geographic location may not be generalizable to another.

13.5 Conclusion

Ultimately, the IS body of knowledge will always contain contingencies since there are no absolutes in social organizations and there are no guarantees of success (Kast and Rosenzweig 1979). With that said, true IS organizational contingency models provide a more thorough understanding of the variables involved in complex environments and increase the likelihood that appropriate action will be taken by the individuals involved. Managers' that utilize the contingency approach need to have considerable conceptual skills and a practical approach to analyzing different situations (Kast and Rosenzweig 1979).

The use of contingency theory in research has declined in recent years when compared to its introduction in the 1970s and 1980s; however, the theory still provides important opportunities for IS researchers. Some of the most recent IS contingency research includes both the extension of previous study areas and new topic areas. Sharma and Yetton's (2007) study extends the research in systems implementation to include the variable of training and its relation to the implementation of IS innovations. Jiang et al. (2006) continued the research into software development by examining the contingent variables of nonsupportive users, partnering, residual performance risk, and project performance. Lastly, Cerruti (2008) looks at a new topic for IS contingency research: offshoring IS management and its impact on firm competeiveness.

Suggestions for future IS research include the examination of the dramatic changes to business processes as a result of the Internet and electronic commerce. The changes to business processes include major changes in a firm's ability to manage their supply chain and outsource. These topics are well suited to the predictive aspect of contingency theory and would benefit from research into the primary contingent variables: organization form, environment, and technology in relation to firm performance and/or when to develop a supply chain or outsource. Specific outsourcing topics include IS management, business processes, and software development.

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Chapter 14
IT and Porter's Competitive Forces Model and Strategies

Sanjay Mohapatra

Abstract Information Technology (IT) has revolutionized our economy and no organization can escape its impact. Using IT, new business models are being developed which could not be thought of earlier. As IT makes inroads into every aspect of organization, it is clear that strategies can be successful and have the competitive edge if they are integrated with IT. This is primarily because there have been reduction of operative cost and increase in productivity through technology adoption. As a result, IT cannot remain exclusive territory of IT/Electronic Data Processing/Computer department. Business managers now see the need to get directly involved in IT investment decisions and integration of IT with business processes and managing technological trends. Michael Porter's theory of five forces, which defines the framework for formulating strategies through five forces, has to be integrated with technological capabilities of a firm to maintain competitive advantage. To make these integrations happen, managers need to understand IT in a holistic manner which will integrate business with IT. This chapter addresses the role of technology on the organizations' strategies, how these five forces that Porter described are impacted by technology and how managers should plan to cope with the changing times with technology.

Keywords Porter's five forces • IT and porter's five forces • IT and Porter

Abbreviations

CRDI	Common rail Diesel injection
CSR	Corporate social responsibility
ERP	Enterprise resource planning

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FI	Financial institution
IT	Information technology
KM	Knowledge management
MPFI	Multi-point fuel injection
SaS	Software as service
SWOT	Strength, weakness, opportunity, and threat

14.1 Introduction

In the knowledge economy, technology has become the de facto strategic tool. From being a business aid, it has changed its role to being a business enabler to being a strategic tool. No sector can exist without technology today. Using technology, organizations are able to improve their competitive advantage. Because of rapid growth in research activities in technology area, its adoption and usage has increased many folds in all organizations. Furthermore, due to advances in research, the cost of acquiring, transferring, and adopting technology has gone down drastically. This has resulted in multifold benefits for organizations in the form of increased productivity, decreased cost of operations, optimized resource utilization, etc. These have been well described in Michael Porter's (1979) model of competitive forces. In Porter's (1979) theory of competitive forces model, he has indicated five factors to determine the competitive edge of any organization: entry barrier, bargaining power of buyers and suppliers, availability of substitute products, and competitors' adoption of new products. In this chapter, we examine the role of technology in becoming a catalyst in Porter's model.

Thus, the learning objectives of the chapter are:

- To understand Porter's (1979) model
- To understand linkage of technology with Porter's model
- To understand how technology will change industry characteristics
- To understand how managers need to plan to cope with the changes that technology impacted forces will bring about

14.2 Understanding Porter's Model

Porter (1979) developed a model for describing competitive advantage for organizations. As per the model, there are two competitive threats to any organizations. The first one is threats from external sources, such as competition from macro environment (government policy changes, competitors with products and services that offer similar value for money to the customers). The second threat constitutes threats from buyers' and suppliers' bargaining power, easy adoption of products and services (easy entry barrier). Thus, Porter's model has the following five factors.

14.2.1 Supplier's Bargaining Power

Here, the word "suppliers" indicates all the sources of inputs that are required to produce the company's product or to deliver a service. The supplier power can get higher when the supplier market is monopolistic in nature. This happens when one or very few suppliers or the customers have limited bargaining power because of inequality in supply-and-demand conditions. Also suppliers' bargaining power can be higher when the costs of changing to a new supplier are high or the suppliers have a cartel and exercise monopoly in pricing decisions (Porter 1979; Falnney et al. 2009).

14.2.2 Bargaining Power of Buyers

Buyers have become more demanding. With more information available on products and services, they can pick and choose the service provider after making a thorough comparison of available information (Porter 1979). Also, buyers are better placed compared to suppliers or vendors when the buyers can buy in large volume and have several options to either substitute the product or vendor[1] (Porter 1979). When the products are not critical for customer's business model, some of the buyers also can integrate backward to manufacture products themselves and as a result be better placed to negotiate with present manufacturers. Car manufacturers such as Maruti Suzuki[2] have started manufacturing floor mats and other accessories, which were earlier supplied by other manufacturers, often at a higher cost. As a result, Maruti Suzuki is better placed to negotiate with these manufacturers on price and quality.

14.2.3 Threats of New Entrant

Higher the potential of a product or service, higher are the chances that many companies will try to gain a portion of the pie of the market. In any sunrise industry we have witnessed a plethora of companies offering similar products and services till the markets gets flooded with "me too" products. However, deterrents for companies to join the bandwagon are many, and many times we witness a few players in a niche market. The conditions acting as deterrent for a new entrant are (1) limited access to raw materials for new entrants, (2) high brand loyalty with existing suppliers, (3) long-serving contract for existing suppliers which make it legally difficult for customers to switch to others, (4) intellectual property rights owned by existing players for existing products, and (5) high investment cost (Porter 1979). A new retail bank has to invest in infrastructure related to technology and hire technical resources before planning to start its retail operations. This is because, in the new

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[1] https://www.mckinseyquarterly.com/Enduring_Ideas_The_three_horizons_of_growth_2485

[2] http://www. http://marutisuzuki.com/owners.aspx

information age, all banks have become technology savvy and integrated technology at operation and strategy levels. This investment is in addition to that required for banking operations and hence can become a deterrent for new entrants.

14.2.4 Threat of Substitutes

Sometimes a product or service performs similar functions as that of an already established product. The established product, for example, when plastic bags are replaced by bags made out of jute, has a direct threat from the substitutes and its market potential reduces drastically. In the automobile industry, when engine blocks made out of cast iron was substituted by aluminum-alloy-based engines, many ancillary industries dealing in making cast iron faced closure. Travel industry lost some of its market potential when video conference could reduce the geographical distance through technology. Sometimes the substitutes come in different forms and are difficult to recognize. Such substitutes can threaten market potential of existing established products. To counter the threat of substitutes, existing products need to create Unique Selling Propositions (USPs) and provide features which will offer value to the customers compared to substitutes. In recent years goods manufactured by India and China have been at costs much lower than that of developed countries and have substantially eroded market share of existing players in almost all sectors (pharmaceutical, construction, household, electronics, automobiles, to name a few). These cost savings have been attributed to adoption of technology in many sectors (Martin 1998).

14.2.5 Threats of Rivalry Among Existing Players in Present Market

There are situations when, it would be expensive to exit the present market. High cost of exit, rivalry among existing players, too many players without much product differentiation, existing monopoly, operating in a niche market and lack of core capabilities to expand in other sectors lead to these conditions (Porter 1979). These rivalries exist in the form of price war, features available in rival products and services and time taken to introduce new competitive products in the market. The time taken to introduce products would make the products top-of-mind recall products and help the organization to gain market share. When Common Rail Diesel Injection (CRDI) was introduced for diesel vehicles in India, Hyundai took the market lead as it took quite some time for its competitors to introduce a similar vehicle. Similarly, Dominos advertisement for its pizza was catchy in a “not so differentiated” pizza market. This increased sale of pizzas for Dominos as reported.[3]

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[3] http://www.fcamin.nic.in/

In summary, Porter's (1979) model explains behavior of the organizations in a competitive market/in a specific industry and how they maintain their sources of competitive advantages. There are several challenges that managers face in such organizations to maintain and improve their market position. In the subsequent section, we analyze how technology can help managers to overcome these challenges by helping them to set their priorities in business decisions by acquiring and processing required strategic information. The subsequent section will also discuss the strategy that these managers need to formulate to get the maximum benefit from technology. These strategies should not only help them align business goals with benefits obtained from technology investment, but also should help in addressing issues with respect to five strategic forces that determine competitive advantage for a firm. In the next section, we will examine the role of technology vis-à-vis Porter's five forces.

14.3 Strategic Significance of Information Technology

A manager in any organization has to worry about how information technology (IT) will affect his competitive advantage vis-a-vis other players in the market (Joachim et al. 2007). He or she has to look into the impact of technological investment in terms of change in organization culture, work-life balance, and attitude toward change management, besides business benefits and return on investment from technology adoption (Rockart et al. 1984). Since resources are limited, the manager needs to prioritize investment decisions, and convince all stakeholders that his or her strategies will meet their long-term objectives as well. To achieve all these through effective utilization of technology, he or she has to understand the meaning of IT in a holistic manner (Combe Collin 2008).

As per Mclean and Turban (2005), IT is more than just computer boxes or hardware as they are known, but design and usage of information system that the organization will require to use for delivering value to all stakeholders. Smith (2006) says that information should be convergent with each tactical or department goal and will drill down to monitoring at transaction level as well. By using a holistic IT concept, different technologies and information systems that are used in the organization will be convergent and will result in coherent decision-making process (Nolan 2001). Thus, a holistic IT will mean hardware, software, design of information system that will capture data at transaction, tactical and strategy levels, process these data, and will help in the decision-making process for managers. IT will also help in automating key business processes that will improve consistency and predictability in outputs and deliverables. In addition, it will help in designing communication protocol for effective communication during regular and exceptional situations as well.

IT will, thus, help maintain competitive advantage by changing organization structure so that it will be aligned toward communication protocol. The changed structure will help in bringing in new ideas and new style of working that will help the firm to outperform its competitors (Parsons 1983). These ideas sometimes bring in new business models (Dell[4] online booking system, Internet banking system) from a company's existing operations of creating its products. It also helps in reshaping the existing products and services and creates more value for customers.

14.4 Technology-Enabled Strategy

Porter (2001) stated that the important concept that IT has brought in is "providing value to stakeholders (customers, investors, employees, suppliers and environment". This concept has helped to distinctly identify business processes and transactions and implementation of technologies that will enable these business processes. This distinction has helped first to determine needs of the business, decide business goals and then fix key performance indicators (KPIs) for each employee (Bansal 2009). This helps business to run as usual while creating value for all stakeholders. The value that is created for customers is determined by the amount of money they are willing to pay for the goods and services of the firm (Porter 1996). The value for investors is determined by the amount of investment they are willing to do with the firm. This value is also indicated by their period of association with the firm; a longer association means continuous faith in the value delivered by the firm to its investors. As per Spitz et al. (2005), the employees perceive value as they can understand what is expected from them in terms of deliverables and deliver their services while managing "work-life balance". Similarly, the suppliers are part of the entire "value chain" as the firm is transparent in their dealings and also jointly determine strategy to outperform their competitors. Finally, environment is also part of the "value chain" as KPIs related to corporate social responsibilities (CSR) help attain a sustainable growth.

To outperform their competitors, a firm must perform all the above business processes which are part of value chain at lower cost in a consistent and predictable manner. Mckinsey (2009), in one research paper, indicated that all these business processes are designed to produce goods and services and providing after-sales support services also. All these processes are linked with each other and output of one process becomes input for the other. These integrated processes not only require resources and infrastructure, but also need to be effective so that other dependent processes can be cost effective. The entire integration then impacts the cost-effectiveness of the business, which in turn determines competitiveness of the organization. Effective integration results in less cost, better on-time delivery, better supplier management and customer delight, and growth of the organization (Gregory 2006).

In knowledge economy, implementations of technologies have permeated at every stage of this value chain. It has transformed each and every value chain linkage improving productivity, reducing cost of operation through less rework (as consistency and predictability increases, cost of rework goes down and so also cost of operations

[4] www.dell.com

(Joseph and Sanjay 2008)). Each of the business processes generates information which is acquired through IT, then processed through different channels created by organization structure and consolidated at tactical and strategy level to aid in decision-making process. With the evolution of IT, the cost of data collection, data storage, manipulation and channelization through different organizational structural levels, and finally transmitting the consolidated information simultaneously to different persons located at different geographical locations has become cheaper and faster. This technological-aided revolution has expanded the limits that the organization could do with IT. Making the decision process faster has helped managers to be agile, be able to tackle different forces that dynamically impact business and maintain the competitive advantage (Mohapatra 2009; Smith and Fingar 2003).

IT revolution has taken over manual human effort and paperwork has been replaced by computers. Illegibility, incorrect data entry, inconsistency, delay in processing, manipulation, and delay in publishing information generated from these collected data, which are associated with manual data processing, have been substituted by IT. As pointed out by Robert et al. (2009), Whittle and Myrick (2004) and Wieringa (2004), at strategic level, information is transparent, is simultaneously published at different places, is accurate and consistent, and above all is available to managers at the shortest possible of time. This makes decisions effective as immediate corrective actions can be taken by managers. Information about any changes in the external conditions such as raw material availability, threats from suppliers, threat from launch of new products, threat from entry and exit barrier will be noticed, data recorded and processed, and information splashed to take preventive action. Using IT, publication of information can be controlled and relevant information can be shared with relevant managers only.[5] The technique uses "role based security" system which allows all the benefits of IT while still maintaining confidentiality (Robert et al. 2009).

In summary, IT enables managers to develop strategy to tackle different forces such as competitors, entry and exit barrier, for managing suppliers and customers and still be compliant with environmental policies. With adoption technology, the managers can detect signs of any change in these forces by processing available information and take preventive action before it is too late. This means technology not only supports and enables Porter's theory of competitive forces, but also helps in managing any changes that are required to bring back stability in the business model.

14.5 How Five Forces Help Formulate Strategy

Porter's five forces have been used for benchmarking an organization's relative strength and weaknesses. Executives carry out a Strength, Weakness, Opportunity, and Threat (SWOT) analysis for their organizations vis-à-vis competitors in their

[5] http://www.tdan.com/view-articles/4430

industry. These forces also help executives to look for threats in the form of substitutes in other industries as well. In recent times, with advancement of technology, automation has played a major role at the strategic level. IT-enabled strategy has now given to IT-led strategy for many organizations. Using IT evolution, Indian Railways[6] formulated its strategy for booking online tickets in 1990s. But now it has used core strength of technology to formulate its strategy. It has gone ahead and started offering "rail tourism" by using existing IT capability. Similarly, Future Group[7] initially used IT to enable its existing strategy to scale up its operations. Future Group has crossed $1 billion turnover in 2007, own 16 million square feet of retail space in 73 cities and 65 rural locations in India. The entire operation is backed by IT-enabled strategy, by which the vision, mission, and values of the group are well shared and understood by its more than a million employees. After tasting success with IT-enabled strategy, Future Group has used its existing IT capabilities to offer a variety of online products and services to its customers. Using online portals, customers can buy products from different categories such as apparels, insurance, groceries etc., which could not have been imagined otherwise. Thus, we find examples of IT influencing already established five forces.

From the above discussion, it is seen that the influence of five forces is impacted by factors such as adoption of IT. Similarly, Knowledge Management (KM)[8] based strategy has helped organizations to create "competitive edge." Strategy, social discourses, innovations, etc., use factors as knowledge to define their future. Earlier KM was found and guarded within a certain boundary. But today, with the help of the Internet, KM has become a forceful factor everywhere. While formulating strategies for marketing strategy, financial management, increasing service level to the customers, increasing productivity, etc. KM has become a strong influencing factor. As an extension of Porter's five forces, strategists need to think about KM as a strong impacting factor.

From the discussions, we find that even though Porter's five forces have strong influence on strategy formulation, with time other factors such as IT and KM have become important in addition to these five forces. In the subsequent section, we discuss the impact of IT on the five forces.

14.6 IT Research and Porter's Five Forces

Research in IT area has shown that organizations exhibit different characteristics based on factors related to IT adoptions. The competitive advantages of these organizations are dependent on different factors. IT research by Thong et al. (1994) has indicated that success of IT implementation largely depends on execution issues

[6] www.irctc.co.in

[7] www.futuregroup.in

[8] www.ssrc.org/blogs/knowledgerules, 2008

such as change management, defining critical success factors, etc. Research indicates that these implementation issues impact degrees of success for large and small organizations differently. Organizations also differ from each other in terms of process maturity, meaning level of compliance to defined benchmarked processes. Larger organizations are found to be following defined processes and exhibit high level of compliance (Prananto et al. 2003). These large organizations have implemented IT systems and have been able to align their business goals to IT. This has resulted in higher business benefits and consistent results. Cragg and King (1993) have indicated in their research that IT has become a good strategy enabler and has improved competitive advantage only if the computer applications have been implemented well and there is a high degree of motivation to use these applications at all levels, particularly at end-user levels. The findings from this research state that initially there would be lot of inhibitions to adopt new IT systems. However, if the employees are motivated through rewards and recognition system, which can be both monetary and non-monetary-based recognition schemes, then effective utilization of IT will increase and this will result in reaping benefits from automation. In a similar research, Lacovou et al. (1995) have mentioned that it is important that all stakeholders accept the new IT systems as business needs and their implementation will help improve the competitive advantage of their organization. Acceptance by stakeholders would mean that, through appropriate communication, stakeholders are made aware of the benefits and impacts that these new systems will make on the existing business model (Igbaria et al. 1997) and corresponding roles and responsibilities that the stakeholders have to shoulder for their day-to-day activities. The business impacts need to be correctly categorized as qualitative and quantitative and then communicated to these stakeholders. Accepting the IT systems and correct assessment of business value that would be created by these new IT systems will improve the USP of these organizations and will be in addition to the five forces model that Porter has created.

Every success needs to be celebrated; this is true even for IT systems being implemented. For successful IT systems implementation, results need to be published all over the place which will lead to self-satisfaction and an urge among other colleagues to implement these systems at their place and be part of the celebrations (DeLone 1988). To achieve this, the organizations can implement the IT applications and systems in some parts of the organizations in a pilot model. These success celebrations will encourage employees to implement and use IT systems which will simplify processes, integrate applications, and improve productivity of the organizations while satisfying customers. Customer satisfaction will lead to further business orders (repeat business) and increased market share. Hence, this factor can be an additional consideration which will determine competitive position for an organization.

With the adoption of IT, organizations have been able to innovate and become more competitive (Lefebvre and Lefebvre 1993). In the research paper it has been reported that innovation has become a key strategy for many organizations to beat competition. Organizations in all industries use innovations to bring new products and services that would provide value for money to customers. Using IT, innovations and "product to market" cycle time has reduced. In the same paper it has been argued that IT has helped to integrate customers' explicit and implicit requirements with design stage. This has resulted in transferring even changes in customers' needs to design specifications within no time. As a result the development time required for these products has reduced and the organization is able to maintain its market position with new products. In related work by Quale and Christiansen (2004) and Beckinsale et al. (2006), the research has concluded that there need to be business drivers for using IT as strategy enabler. These drivers or extended factors are over and above the five forces that Porter has described in his study. These factors are dependent on need to remain competitive in the industry by reducing cost of operations and passing the resultant benefits to customers. This will increase value for money for customers. These factors reduce cost of production, increase productivity and increase service-level agreement with customers. With enhanced value for money being provided by these factors, organizations adopt IT to fulfill the needs of these business drivers. These factors coupled with the need to reduce overhead cost and be able to service customers faster also impact decisions to adopt IT (Tse and Soufani 2003). As we move toward knowledge economy, relationships between several factors related to environment become influencing factors for investment in IT (Bharati and Chaudhury 2008).

14.7 IT and Porter's Five Forces

IT is changing the rules of business and competition in three ways. Firstly, because of new technology, business models are changing. This, in turn, is changing the industry characteristics. Secondly, using IT, new strategies are being formulated to service not only the customers, but also to meet objectives for all stakeholders. An early adoption of technology helps the firm to maintain its competitive advantage and remains as top-of-mind recall for potential customers. This forces competitors to devise similar technology-enabled strategies and become "me too" in the process (Grover et al. 2001; Porter 2001). And lastly, because of technology, new business models are being created, which would not have been possible otherwise. In the subsequent paragraphs, these three impacts are discussed in detail.

According to Porter (1979), a firm is influenced by five forces, which also affect its sustainable growth and profitability. As mentioned in Sect. 14.1, these forces are suppliers' bargaining power, customers' bargaining power, threat of new entrant (meaning how difficult it is for a new player to enter the industry), threat of new products/services that can substitute existing products/services at cheaper rate and threat/barrier of exiting the industry (meaning how difficult it is to leave the present industry). However, it is seen that these five forces have different degrees of impact in different industries. Even individual force has a different level of impact on different firms in different industries. Over a period of time the individual forces and their collective impact will change as the government policies and macroeconomic and environment conditions change. These changes can affect attractiveness of the industry.

14.7.1 IT and Buying Power

With IT these forces can be controlled and monitored, which can become a big factor in maintaining industry characteristics. For example, with technology-enabled systems, purchase orders can be automated, vendor selection can be faster, and inventory management can be automated. These features along with automated billing capability will help an organization engaged in engineering projects such as Larsen & Toubro,[9] to reduce lead time for procurement, improve vendor relationship, and be able to meet service-level agreements made with different stakeholders. Thus the power of buyers has increased tremendously.

14.7.2 IT and Entry Barrier

Banks and Financial institutions (FI) have been providing services to customers through traditional manual systems for a long time. Customers had to be physically available at the bank counters and in financial service providers' offices for carrying out business transactions. With the introduction of technology, online banking system has become a de facto feature. Similarly, FI provide online and mobile investment facilities for customers, which allow them to take investment decisions from any part of the world without physical presence in banks and FI offices. However, these features require complex software and a high degree of computer networking for cloud computing. All these need to be managed and maintained by skilled personnel. Training the skilled personnel is a must as they need to constantly update themselves with the latest in technology (such as cloud computing, software as service, green technology). Also the end users of these online systems need to be trained so that they can use the systems and increase their productivity. These require heavy amount of investment in technology, training, and human resources. The heavy investment has increased the barrier to enter this industry.

14.7.3 IT and Threat of Substitutes

In automobile industry, there is a constant need to introduce new models and better quality vehicles to meet the changing taste of customers. Introduction of MPFI (Multi-Point Fuel Injection), CRDI (Common Rail Diesel Injection) engines have increased product life cycles of many models. Also, there is a constant need to upgrade features of existing products to induce existing customers to upgrade their vehicles. These require rapid changes in design, ability to manufacture new as well as modified vehicles as per the changed design specifications.

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[9] www.larsentoubro.com

Traditional manufacturing systems will not be able to cope with the demand for meeting high quality with reduction in manufacturing cycle time. Introduction of flexible manufacturing system made design easier while shortening manufacturing cycle. Thus, with the help of technology the organizations can manufacture new products with shorter lead time and reduce threat of substitutes.

14.7.4 IT and Industry Rivalry

In service industries such as Airlines, Railways, Banking services, the pricing strategies and service levels are almost similar. There is little to differentiate between two service organizations and this makes competition in the industry fierce to get the share of the pie. With technology adoption, each organization has been trying consciously to reduce the operation time with respect to servicing a customer request, delivering the service with service-level agreement, and finally preparing invoice. Each time a firm introduces technology to get an edge with respect to its competitors other players immediately invest in similar technologies to remain competitive. Thus, technology has increased the level of competition among players in the same industry to get a portion of the pie.

14.7.5 IT and Selling Power

Gone are the days, when suppliers and buyers were not well informed about a firm's products, services and its strategies. With the help of the Internet, buyers, suppliers, financial analysts, customers are able to know details about the firm's strategies and quality of products and services. Several blogs sites and review sites are available to comment on the value delivered by the firm. This not only makes the entire business process transparent to buyers and sellers, but also has impact relationship with buyers and sellers as well as with linkages throughout the supply channel. For example, for Maruti,[10] introduction of ERP (enterprise resource planning) has changed relationship with its buyers and suppliers. Earlier, even though there was enough trust, still the buyers and suppliers did not have much insight into the production planning process of Maruti. With ERP, Maruti has become more transparent, which has helped buyers and sellers to plan accordingly. As a result, Maruti could demand raw materials at a competitive price and buyers could meet customer demands for new vehicles. A similar example is Nano,[11] a vehicle manufactured by Tata Motors, where bargaining power of buyers and sellers has dramatically changed because of ERP. Buyers (in this case vehicle retail outlets) are able to predict accurately the

[10] www.marutisuzuki.com

[11] http://tatanano.inservices.tatamotors.com/tatamotors/, May 2010

delivery time for their customers, and sellers have been able to renegotiate the prices of raw materials because of increased volume of production.

14.8 Changing Times with IT

Many of the core business activities are now performed with lesser lead time with reduced cost and increased transparency as information is being published and shared immediately. This has resulted in greater customization capability for the organizations and has resulted in being able to address needs of small and niche markets. Thus, with reduced cost of operation, higher flexibility in designing and subsequently manufacturing those in shorter lead time have affected rivalry among players and also industry dynamics. On the flip side, technology also has the capability to change or damage existing industry structure. For example, in hotel industry, depending on demand, the room tariffs keep on changing. A customer traveling to a particular city can check through the Internet, different tariffs in different hotels, and can opt for the most suitable one. This has kept the hotel industry on their toes as they need to constantly evaluate demand-and-supply conditions and then come up with discounts and different off-season packages to attract tourists to their hotels. They also provide details of their rooms, a three-dimension view of their rooms and customers' comments (those who used their hotels earlier) to attract potential customers. Travel agencies who used to get commission for providing customers to these hotels are no longer in the business as the hotels have passed on their commission to customers directly. Thus, with passage of time, usage of technology has changed the industry dynamics by giving more value to the customers while wiping the travel agents out of their business.

There are many organizations that have linked buyers with suppliers. For example, Amazon.com allows buyers to see the availability of books and inventory positions with the suppliers so that they can estimate the probable date of delivery. Online suppliers such as Indiaplaza.com in India supply books, electronic items, music CDs to their registered users. While ordering the buyers/customers are integrated with suppliers through the Internet which allow them to see the availability of stocks and order accordingly. Such systems that have integrated buyers and suppliers have used technology as a strategy to change the bargaining power of buyers and suppliers.

With technology becoming the backbone in many industries, the entry barrier has been redefined. Process industries depend largely on automation and every manufacturing activity has been integrated and automated. In steel industry, Chorus,[12] Tata,[13] Mittal[14] have used technology to reduce cost of operation, upgrade their capacity as

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[12] http://www.corusgroup.com/en/

[13] http://www.tatasteel.com/

[14] http://www.mittal-steel.com/

well as to increase productivity. Instead of plant and machineries, investment in technology has become high in these process industries, raising entry barriers.

Industry rivalry has greatly been affected through technology. We have seen in earlier sections how technology has transformed industry characteristics. This creates differentiation. While technology creates differentiation, the competitors are quick to adopt the same technology-based strategy to bridge the differentiation. For example, while DELL is given the credit for online assembly and delivery model of laptops and desktops, its competitors were quick to adopt the same technology and offer similar services. So while technology helped to create differentiation and shake up the rivalry, the same could be adopted immediately (as these technologies are available with open source) to bridge the gap. This is possible because these technologies are available in the open and with passage of time become cheaper to adopt. With concepts like "SaS" (Software as Service) and cloud computing, there are specialized firms that offer these technologies to their customers. Thus, while ICICI bank[15] decided to use cloud computing for its core banking operations, the same has been immediately adopted by its competitors. This has resulted in cost reduction and predictability in service.

IT has also improved collaboration among organizations across industries which would have been almost impossible in the past. In the telecom industries, Bharati telecom[16] collaborated with Satyam[17] (now called Mahindra Satyam) to carry out research for its telecom products. In this collaboration, role of CIO was created, who used new technology to automate business processes to get maximum benefits. Similarly, Apple[18] has used iPhone to enter into lucrative mobile handset business. Using IT, Apple integrated its famous music business with the latest in mobile technology to create iPhone. Similar usage of IT can be seen in Google Maps, where they have used technology with search engine capabilities to provide geographical information to all its users. Traffic to Google Web sites has increased manyfolds from there on. Thus, with IT, new business avenues have opened up for many organizations and have widened competitive scope. Monitoring business transactions are being done through IT-enabled decision support systems.

14.9 Role of Managers in IT-Enabled Strategy

In the last section we have seen the trends that are being set by adopting technology. In this section, we will explore how managers can best use the technology for maintaining competitive strategy. Firstly, the managers need to understand industry characteristics and impact of IT on them. They should be able to predict the role

[15] www.icicibank.com

[16] www.bharti.com

[17] www.mahindrasatyam.com

[18] http://www.apple.com/

of IT in their industry and the way it might affect industry characteristics in future (Peer et al. 2009). IT might change each force separately and also the combined effect of all these five forces. Even the boundaries of business models in the industry might change. Thought leaders in industries will be able to see the foreseeable changes and become ready for that. They even might use IT to change the characteristics so that their competitors are forced to follow the same. ICICI bank with its online trading system through ICICIdirect.com[19] created a revolution in India. Similarly, Dell forced its competitors to adopt online ordering system for laptops and desktops.

Secondly, managers think of changes in the business models through collaboration with organizations within as well as outside the industry (White and Bruton 2007). For example, railway reservation portal[20] has collaborated with hotels to provide holiday packages – an offer unheard of earlier. Amazon.com collaborated with UPS for delivery of their books using technology to provide different options to its readers. Unless managers foresee these changes in business boundaries, they would not be able to take full advantage of technology. In many of the recent benchmarking exercises in IT industry, competitors have collaborated with each other through online forums to share best practices with each other and gain customers confidence.

Thirdly, managers should manage the change (Heeks 2002) that will be necessitated because of technology adoption. They should devise a plan that will prioritize technology investment in different departments/functions, develop business case for investment and prepare a roadmap for implementing new technology. Business managers should work with IT managers to decide architecture, integration of applications, and choice of right technology so that business alignment is achieved while maintaining competitive advantage. Finally, managers should use IT to create a learning organization. A technology-enabled learning organization should use technology to capture learning from business transactions, create a knowledge repository, and then share these best practices throughout the organization.

14.10 Conclusion

IT has become important in all industries and has revolutionized the way different forces impact characteristics of business models. The question is not the degree of impact, but when and how IT will change these characteristics. The managers who can anticipate these impacts will emerge as winners. Those who cannot foresee these changes will have to follow leaders and will find themselves at a competitive disadvantage. Hence, firms need to plan and get ready for these changing times.

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[19] www.icicidirect.com

[20] www.irctc.gov.in

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Chapter 15
Information Technology and Organisational Performance: Reviewing the Business Value of IT Literature

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Abstract Managing Information Technology (IT) investments continues to be a challenge for firms due to the difficulty associated with demonstrating IT contributions to organisational performance. Many IT contributions are not accounted for because they cannot be easily quantified. Linking IT to organisational performance is a complex problem that is informed by insights from multiple theoretical paradigms. The aim of this chapter is to comprehensively review work done by both academic and practitioners, and to explore why new approaches to managing IT investments are needed. To achieve this aim, we will start by defining IT assets and business value and exploring the different dimensions used to measure the business value of IT. Then, we will look at the early research on IT business value and the emergence of the *Productivity Paradox*. After that, we will delve into the three current theoretical paradigms: economics, management and sociology. The theoretical lenses and models used in these paradigms will also be discussed. Finally, future research directions are suggested.

Keywords Business value • Information technology • IT business value • Performance

Abbreviations

BVI	Business value index
CobiT	Control objectives for information and related technology
EDI	Electronic data interchange
IRR	Internal rate of return

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ISACA	Information systems audit and control association
IT	Information technology
ITGI	IT Governance Institute
NPV	Net present value
OPMs	Option pricing models
ROI	Return on investment
TEI	Total economic impact

15.1 Introduction

As the global business environment has become more dynamic and complex, competition among firms has accelerated to unprecedented levels amid tighter budget constraints (Chanopas et al. 2006). IT is today a critical tool in attaining desired levels of growth and competitiveness, often constituting a major portion of an organisation's capital investment (Huang et al. 2006; Kumar 2004; Alshawi et al. 2003). Compared to the 1990s, organisations today are carefully scrutinising IT investments and questioning their value (Carr 2003).

According to a recent survey, 60% of executives do not know the size of the their core software assets, more than half of them feel that the financial value of the organisation's core software assets were poorly assessed compared to other corporate assets such as brands and intellectual property, and only 10% rate their team's efforts to communicate the business value of their core software assets to their boards (Dutta 2007).

Firms do not appropriate all of the value they generate from IT, because they cannot capture many of the qualitative and intangible benefits (Farbey et al. 1992). Despite evidence of a positive relationship between IT investments and organisational performance, firms have managed their IT as an expense item to be minimised rather than an asset for value creation (Dutta 2007). Findings are not conclusive and still vary across firms and performance measures (Aral and Weill 2007). Before we look at the business value of IT research, we will clarify what is meant by IT assets and business value.

15.1.1 IT Assets

IT infrastructure is a long-term asset, impacts long-term shareholder value and represents the long-term options for an organisation (Weill and Broadbent 1998). Organisations are increasingly recognising the critical importance of the effective management of their IT infrastructure (Kumar 2004; Byrd and Turner 2000; Broadbent and Weill 1997). One of the top strategic goals for firms is reported to be associated to IT infrastructure (Eastwood 2008).

A number of typologies have been adopted to conceptualise IT resources (e.g. Aral and Weill 2007; Melville et al. 2004). Ross et al. (1996) provide a good classification of IT assets:

Human assets: IT employees are valuable in solving business problems and addressing business opportunities through their accumulated firm-level IT knowledge and competence. Technical skills, business understanding and problem-solving orientation are three dimensions of human assets.

Technology assets: They consist of sharable platforms and databases. A technology asset is valuable for integrating systems and making IT applications cost effective in their operations and support. The characteristics of the technology assets are: well-defined technology architecture, and standards for data and platforms.

Relationship assets: The relationship between business and IT is valuable when risks and responsibilities are shared for the effective application of IT. Strong relationship assets include business partner ownership of, and accountability for, all IT projects; and top management leadership in establishing IT priorities.

15.1.2 IT Business Value

Melville et al. (2004) define the business value of IT as 'the organisational performance impacts of information technology at both the intermediate process level and organisation-wide level, and comprising both efficiency impacts and competitive impacts' (p. 287). From reviewing the IT business value literature, they claim that 'IT is valuable, offering an extensive menu of potential benefits ranging from flexibility and quality improvement to cost reduction and productivity enhancement' (p. 381).

A generic list of benefits that may be expected from IT investments has been suggested by Farbey, et al. (1993). This list includes strategic benefits (e.g. provide customers with unique value proposition), management benefits (e.g. increase agility), operational benefits (e.g. improved quality at reduced cost), and functional benefits (e.g. improved communication and collaboration opportunities).

Davern and Kauffman (2000) distinguish between two types of IT value: *potential value*, which represents the maximum value opportunity available to the investor if the IT is implemented successfully, and *realised value*, which is the measurable value that can be identified after the implementation. Chircu and Kauffman (2000) explain why not all of the potential value is realised after implementation. They argue that *valuation barriers* (industry barriers and organisational barriers) and *conversion barriers* (resource barriers, knowledge barriers and usage barriers) are a series of specific value discounting factors.

According to Aral and Weill (2007), different types of IT assets (transactional, informational, strategic and infrastructure) are implemented to achieve different management objectives. They argue that one explanation of why two firms with the same amount of IT capital perform differently is that they are investing in different types of technology with different goals. They also found that IT investments deliver high performance only along dimensions consistent with the strategic purpose of that asset. They explained that while investments in transactional IT applications are associated with lower costs but not with more firm-level product innovation, investments in strategic IT applications are associated with more product innovation but not with lower costs.

15.1.3 IT Business Value Dimensions

Several dimensions exist in assessing the business value generated from IT. Stratopolous and Dehning (2000) classify financial performance variables into profitability measures such as returns on assets and gross profit margin, and efficiency measures such as fixed assets turnover and inventory turnover. A comprehensive review by Dehning and Richardson (2002) classifies measures into IT measures (e.g. spending, strategy, management or capability), process measures (e.g. gross margin, inventory turnover, customer service, quality and efficiency), firm performance measures (e.g. Tobin's q, market value) and accounting measures (e.g. return on asset, market share).

Murphy and Simon (2002) claim that classical quantitative techniques, such as cost-benefit analysis, are not adequate for the evaluation of IT, except when dealing with cost avoidance issues. They argue that many projects deliver benefits that cannot easily be quantified. These benefits may include information access, improved workflow and interdepartmental co-ordination, and increased customer satisfaction (Emigh 1999). Tallon et al. (2000) argue that economic and financial measures fail to assess accurately the payoff of IT projects and suggest that one mean of determining value is through the perception of executives.

Intangible benefits of IT investment include internal improvement, customer service, foresight and adaptability (Hares and Royle 1994). Murphy and Simon (2002) argue that intangible benefits are more difficult to measure as the time horizon over which they are being evaluated becomes longer. They also add that externally oriented factors such as customer perceptions or market forces are more difficult to assess than internal factors.

Based on work done by Harris (1996), Irani and Love (2000) propose a framework that categorises benefits into operational, tactical and strategic. As one moves from operationally oriented projects through tactical to strategically oriented projects, the benefits move from those that are generally tangible and quantitative in nature to intangible and non-quantitative ones. IT business value measures seem to fall into one of these three dimensions as illustrated in Table 15.1.

15.2 Early Research on IT Business Value

There has been a long-running debate over whether IT contributes to productivity. Research has attempted to untangle the relationship between IT, productivity and firm's performance for more than 2 decades. Early studies found no relationship between IT investment and productivity at the level of the firm, industry or the

Table 15.1 Dimensions of IT business value

Dimensions	Value measures	Studies
Strategic	Sustainable competitive advantage	Clemons (1991)
	Effectiveness	Melville et al. (2004)
Tactical	Customer service	Lucas et al. (1993)
	Consumer surplus	Hitt and Brynjolfsson (1996)
	Improve relationship with trading partners	Bakos and Brynjolfsson (1993), Srinivasan et al. (1994), Brynjolfsson and Hitt (1998)
	Return on asset	Rai et al. (1997)
	Sales growth	Strassman (1997)
	Sales, total assets, shareholders' equity, spending on IS staff and staff training	Sircar et al. (2000)
	Stock returns on days	Subramani and Walden (2001), Hayes et al. (2001)
Operational	Business process performance	Melville et al. (2004)
	Efficiency	Srinivasan et al. (1994)
	Productivity	Brynjolfsson (1993), Diewert and Smith (1994), Hitt and Brynjolfsson (1996), Dewan and Min (1997), Shin (1997), Rai et al. (1997), Strassman (1997), Francalanci and Galal (1998), Menon et al. (2000)
	Productivity and quality	Mukhopadhyay et al. (1997), Devaraj and Kohli (2003)
	Plant performance (cost and quality)	Bardhan et al. (2006)
	Cost saving	Lucas et al. (1993), Mukhopadhyay et al. (1995), Barua et al. (1995), Shin (1997)
	Capacity to utilisation	Barua et al. (1995)
	Inventory turnover	
	Order entry	Strassman (1997)
	Back-office operations	Strassman (1997)

economy as a whole (e.g. Loveman 1994; Strassman 1990). This has been referred to as the *Productivity Paradox*.

The paradox in the relationship between IT and productivity has been explained by pointing out that heavy IT investments have occurred parallel with the US productivity slowdown that began in 1973. Brynjolfsson (1993) identified four possible explanations:

- *Mismeasurement*: The benefits of IT investments are quite large, but a proper index of its true impact has yet to be analysed.
- *Time lags*: The benefits take a long time to be realised.
- *Redistribution*: There are private benefits, but they come at the expense of others, so no net benefits can be realised at the aggregate level.
- *Mismanagement*: There are no benefits because of poor investment decisions, misallocation or misuse.

This has not deterred researchers from demonstrating IT contributions by undertaking research which used larger datasets, more refined research methods and precise measurements (e.g. Bharadwaj et al. 1999a; Dewan and Min 1997; Brynjolfsson and Hitt 1996). These studies revealed a convincing positive relationship between IT investments, economic productivity and business value.

15.3 Current Theoretical Paradigms

Having resolved the productivity paradox, the complex problem of linking IT to organisational performance has been informed by insights from multiple theoretical paradigms: economics, management and sociobiology. Several theoretical lenses and models have been used to assess IT contributions to organisational performance (Table 15.2).

15.3.1 Economics-Based IT Business Value Research

Econometric techniques are used to study how financial measures of organisational performance depend on measures of IT investments (for a review see Kohli and Devaraj 2003). There are mixed results on the financial benefits due to IT investments. Hitt and Brynjolfsson (1996) found evidence that IT may be increasing productivity and consumer surplus, but not necessarily leading to firm profitability. Basing their econometric models on IT usage, Devaraj and Kohli (2003) present evidence of improved financial performance as a result of IT investments.

Practically, managers responsible for forecasting return from projects have experienced a growing awareness of the relevance of success metrics that elude financial quantification (Murphy and Simon 2002). Forrester Research suggests that financial measures such as ROI (Return on Investment), NPV (Net Present Value) and IRR (Internal Rate of Return) are not enough because using financial measures has serious flaws: too many to choose from; imply a precision that does not exist; fail to account for intangible benefits; do not account for future opportunities; and fail to incorporate risk (Symons 2006). Kumar (2004) argues that it is essential to consider IT usage in measuring the business value from IT since value does not only depend on investments, but also on IT usage.

According to Fichman et al. (2005), real options are similar to financial trading options and they can be valued similarly using option pricing models (or OPMs). OPMs were originally developed to assist in the valuation of tangible assets (Amran and Kulatilaka 1999), but have increasingly been applied to more intangible investments, such as those related to IT (Benaroch and Kauffman 1999).

This stream of research highlights the limitations of the traditional financial evaluation methods. Real options theory has been used to account for inherent risks and uncertainties (Melville et al. 2004). It has been applied to the evaluation

Table 15.2 Theories used in IT business value research

Paradigms	Theory	Notes	References
Economics-based IT business value research	Theory of production	This theory has been particularly useful in conceptualising the process of production and providing empirical specifications and enabling estimation of the economic impact of IT (Melville et al. 2004).	Brynjolfsson and Hitt (1995), Dewan and Min (1997), Lichtenberg (1995)
	Data development analysis	This theory assesses IT productivity and efficiency with multiple specifications, estimation techniques, behavioural assumptions and capitalisation methods (Lee and Barua 1999).	Lee and Barua (1999)
	Transaction cost theory	(*TCE*) *is concerned with the allocation of economic activity across alternative modes of organisation* (*markets, firms, bureaus, etc.*), *employs discrete structural analysis, and describes the firm as a governance structure* (Williamson 2005, p. 41).	Clemons and Row (1991), Gurbaxani and Whang (1991)
	Consumer theory	This theory has been used to estimate the total benefits that a given purchase confer to consumers (Hitt and Brynjolfsson 1996).	Brynjolfsson (1996), Hitt and Brynjolfsson (1996)
	Incomplete construct theory	This theory has been used to study the relationship between ownership structure of an electronic network and incentives to invest in network-specific assets (Bakos and Nault 1997).	Bakos and Nault (1997)
	Game theory	This theory has been used to examine in which circumstances firms prefer to invest in product differentiating rather than in cost-reducing technologies (Belleflamme 2001).	Belleflamme (2001)
	Theory of real options		
	Option pricing model	This theory has been used to account for inherent risks and uncertainties in IT investments (Melville et al. 2004), attempting to value a particular aspect of IT infrastructure: *upgradeability* (Balasubramanian et al. 2000; Taudes et al. 2000; Panayi and Trigeorgis 1998)	Benaroch and Kauffman (1999)
	Financial asset valuation	This theory is indirectly related to information systems' literature on real options. It has been recognised that traditional financial evaluation techniques undervalue IT infrastructure investments (Taudes et al. 2000; Panayi and Trigeorgis 1998), since they do not account for intangible benefits such as flexibility (Kumar 2004).	Kumar (2004)
	Agency theory	A bargaining model of firm's choices for inter-organisational IT has been used to analyse the efficiency and the likelihood of cooperative investment in IT among several firms (Clemons and Kleindorfer 1992).	Clemons and Kleindorfer (1992)

(continued)

Table 15.2 (continued)

Paradigms	Theory	Notes	References
Management-based IT business value Research	Resource-based view (RBV)	This theory has been used to examine the efficiency and effectiveness of specific firm resources (Melville et al. 2004).	Aral and Weill (2007), Bharadwaj (2000), Santhanam and Hartono (2003)
Sociology-based IT business value research	Theory of embeddedness	*Embeddedness is a logic of exchange that promotes economies of time, integrative agreements, Pareto improvements in allocative efficiency, and complex adaptation* (Uzzi 1997, p. 35).	Chatfield and Yetton (2000)
	Socio-political perspective	Instead of this perspective focusing on politics and conflict as the primary interaction mode, it focuses on collaboration and cooperation as the key to understanding interaction processes (Kumar et al. 1998).	Hoogeveen and Oppelland (2002), Kumar et al. (1998)

of several IT investments including automated teller machine networks (Benaroch and Kauffman 1999), decision support systems (Kumar 1999), enterprise resource planning software (Taudes et al. 2000), IT infrastructure in banks (Panayi and Trigeorgis 1998), software upgrades (Taudes 1998) and object-oriented middleware (Dai et al. 1999).

According to Kumar (2004), although real options research stream presents a promising conceptual framework for IT projects evaluation, its limitations include: assumptions regarding uncertainty modelling, tradability and risk neutrality; estimating the expiry time of an option (Benaroch and Kauffman 2000; Benaroch and Kauffman 1999); the absence of contracts to enforce exercise of options (Taudes et al. 2000); and difficulties in modelling multiple types of uncertainty in options (Trigeorgis 1996).

15.3.2 Management-Based IT Business Value Research

In order to justify new IT investments, managers are required to make decisions about what and where to invest today taking into account future strategic choices. These investments are often shared across several business units, multiple business initiatives and many applications. This sharing requires negotiation about how much is needed, who pays for it, where it should be placed and who owns it. IT infrastructure decisions are complicated and confuse managers with questions such as: are we spending too much or too little on IT? Are we spending on the right areas? Are we getting the best value from our IT investment? These are business decisions and business managers typically lack frameworks to assist in their choices (Weill et al. 2002).

This paradigm focuses on the organisational value of IT infrastructure flexibility, which includes both technical as well as human IT infrastructure flexibility (Byrd and Turner 2000; Broadbent and Weill 1997; Duncan 1995; Henderson and Venkatraman 1994). IT infrastructure flexibility is multidimensional and includes: the ability to easily upgrade the infrastructure to network different parts; to integrate disparate data sources through the use of middleware; to resist systems failure due to redundant components; and to easily add new applications (Byrd and Turner 2000; Fan et al. 2000; Kapinski 1999; Wagner 1998). IT infrastructure flexibility is a complex and multidimensional concept that represents the ability of the technical and managerial parts of the infrastructure to effectively respond to multiple types of uncertainties including user requirement changes, technology changes and system usage changes (Kumar 2004).

Some suggest that many of the derived benefits from IT are not accounted for because of the models used to assess IT contributions (e.g. Cline and Guynes 2001; Thatcher and Oliver 2001). Waterhouse (2008) argues that communicating the business value of IT has never been more critical. He stresses that adopting a strategic approach to measuring IT performance supported by advanced IT management models enables IT to better demonstrate how it is contributing to business growth and success. By adopting this approach, firms can benefit from the following:

- Stopping the endless cycle of IT cost reductions that can ultimately damage the business;
- Providing IT and the business with a common language and framework upon which to identify and derive strategic improvements; and
- Increase business agility and IT responsiveness to changing conditions (Waterhouse 2008).

15.3.2.1 Value Creation Models

These models focus mainly on depicting the process of how organisations can realise business value from IT. They have been developed by academics to explain the phases organisations have to go through to improve their organisational performance from deploying IT.

'How IT Creates Business Value' Model

Based on a synthesis of previous literature (Beath et al. 1994; Sambamurthy and Zmud 1994; Grabowski and Lee 1993; Lucas 1993; Markus and Soh 1993), Soh and Markus (1995) theoretical model explains the steps involved in creating value from IT. The model identifies three processes: the first is conversion of purchased IT assets into assets that can be used by the firm; the second is the appropriate use of these assets by the firm; and the third is the transformation of effective use into meaningful organisational performance. This framework is one of the earliest syntheses of literature. Although, it is a useful starting point to conceptualise the process of value creation, it is very much a simplistic view that focuses mainly on IT usage. Also, this model has not been popular among business managers.

IT Value Creation Process

Expanding on prior models of IT value (Lucas 1999; Soh and Markus 1995; Markus and Soh 1993), and rather than starting with the cost of an investment in IT, the conceptualisation of Davern and Kauffman's framework begins with the potential value of an IT investment. Conversion contingencies act as intervening and moderating factors in the process by which potential value is transformed, or fails to be transformed, into realised value (Davern and Kauffman 2000). Like Soh and Markus's framework, this model explains the phases of transforming potential into realised benefits. It also fails to be popular among business managers.

IT Business Value Model

Melville et al. (2004) developed a model of IT business value that integrates the various strands of research into a single framework. Their principle finding is that 'IT is valuable, but the extent and dimensions are dependent upon internal and external factors, including complementary organisational resources of the firm and its trading partners, as well as the competitive and macro environment' (p. 283).

The derived integrative model comprises three domains: focal firm, competitive environment and macro environment. Melville et al. (2004) argue that the locus of IT business generation is the organisation that invests in and deploys IT resources, which is referred to as the focal firm. Also, external factors are claimed to play a role in shaping the extent to which IT business value can be generated and captured. This model integrates previous models and shows both the process of value creation and the forces that affect organisational performance. Although, this is a conceptual model that highlights the 'big picture' of what entails the creation of IT business value, this model has not gained widespread use.

15.3.2.2 Performance Measurement Models

Unlike the value creation models, performance measurement models are practitioner-oriented models. Firms are more familiar with these models because they are used to measure the entire organisational performance. The balanced scorecard for IT and Six Sigma will be considered for this section.

Balanced Scorecard for IT

Kaplan and Norton (1992) developed a model that suggests organisations should not only be evaluated against one set of criteria, but rather they should be evaluated against a set of goals and measures. The original four perspectives in a balanced scorecard are financial, customer, internal business and innovation and learning. Although initially developed at an enterprise level, the balanced scorecard can be applied to IT as an instrument to measure IT performance (Bon and Verheijen 2006). Although it is relatively easy to tailor balanced scorecard framework to the specific needs of IT, there are no generic IT measures that fit all organisations and the IT perspective might be too narrow (Willcocks and Lester 1994).

Six Sigma

Unlike other frameworks, Six Sigma is not owned and maintained by any specific community (Harris et al. 2008). It was originally developed by Motorola in the 1980s. Its roots are in Total Quality Management. The process model is abbreviated as DMAIC, which stands for the phases of a Six Sigma project: define; measure;

analyse; improve; and control. If a firm already uses Six Sigma, it can be a tool that provides a common language between IT and the business. Although Six Sigma has proven to be a powerful approach to improve performance by eliminating defects, its ‘rigid’ nature makes it vulnerable when it comes to organisational innovation.

15.3.2.3 IT Investment Models

Benefits Dependency Network

This is one of the few models developed by academics at Cranfield School of Management for practitioners use. This framework explicitly links the overall investment objectives and the required benefits with business changes necessary to deliver those benefits and the essential IT capabilities that enable these changes (Peppard et al. 2007). This model can be used to engage with senior managers because it clearly communicates the business benefits. Although this model specifies both tangible and intangible benefits, it does not quantify them.

Business Value Index (BVI)

Developed by Intel – one of the most technology-intensive organisations in the world where IT plays a critical role in its success (Symons 2006). BVI helped Intel to prioritise investment options, make data-driven decisions and monitor progress (Baldwin and Curley 2007). The BVI was mainly developed by practitioners and has been used since 2002. According to Symons (2006), the BVI method goes beyond the financial measures to account for both tangible and intangible benefits. He argues that Intel used the BVI internally as part of its portfolio management process, to document the business value of IT in its annual performance report.

Total Economic Impact (TEI)

Developed by an independent technology and market research company Forrester Research for valuing IT investments. This model includes four elements:

- Cost – Impact on IT: the changes to IT spending which can be positive, when money is saved, or negative, when money is spent
- Benefit – Impact on IT: capturing the quantified data relating to changes in the non-IT departments (e.g. the impact of training on the long-term productivity gain)
- Flexibility – Future options: the value of the options to take a second or third action in the future
- Risk: risk analysis translates the initial estimates for cost and benefits into a range of potential benefits

While containing a number of aspects that BVI touches upon such as valuing intangibles and calculating financial returns, TEI adds a method for quantifying risk and valuing flexibility (Symons 2006).

15.3.2.4 IT Governance Models

Most firms under-manage their core software assets (Dutta 2007). According to Weill and Ross (2004), IT governance is the most important factor in generating business value form IT. They define IT governance as 'specifying the decision rights and accountability framework to encourage desirable behavior in the use of IT' (p. 8). They argue that effective IT governance must address the following three questions: What decisions must be made to ensure effective management and use of IT? Who should make these decisions? How will these decisions be made and monitored?

Weill and Ross (2004) claim that IT governance is essential because good IT governance pays off; IT is expensive; IT is pervasive; new information technologies bombard enterprises with new business opportunities, firms need to learn about IT value, IT value depends on more than a good technology, senior management has limited bandwidth, and leading enterprises govern IT differently. CobiT and Val IT will be considered in this section.

CobiT

The Control Objectives for Information and Related Technology (or CobiT) has been developed by the Information Systems Audit and Control Association (ISACA), and the IT Governance Institute (ITGI) in 1996. CobiT is an IT governance framework that allows managers to bridge the gap between control requirements, technical issues and business risks (ISACA 2008). It provides managers with a set of best practices to help them maximise IT benefits through the development of IT governance and control. CobiT 4.1 consists of 34 high-level processes that cover 210 control objectives categorised in four domains: Planning and Organisation, Acquisition and Implementation, Delivery and Support, and Monitoring and Evaluation. One of the major criticisms of CobiT is that it describes what needs to be done but it fails to assist managers to meet these needs.

Val IT

Val IT framework is closely aligned with CobiT components (ITGI 2008). While CobiT sets good practices for the means of contributing to the process of value creation, Val IT sets good practices for the ends, by providing enterprises with the structure they require to measure, monitor and optimise the realisation of business value from their IT investment. Val IT consists of three major domains: Value Governance, Portfolio Management and Investment Management. While CobiT focuses on the execution – 'are we doing them the right way, and are we getting them done well?' – Val IT focuses on the investment decision – 'are we doing the right things?' – and the realisation of benefits – 'are we getting the benefits?' (ISACA 2008).

15.3.3 Sociology-Based IT Business Value Research

Compared to the other two paradigms, sociology-based business value research seems to have had less attention. Sociological theory of embeddedness (Uzzi 1997) advocates that the structure and quality of social ties between firms shape their economic action. Economic action here includes joint action undertaken by two or more firms collaboratively, such as joint ventures and strategic alliances, as well as economic behaviour unilaterally decided by the focal firm or by a trading partner. Uzzi identifies three characteristics of embedded inter-firm relationships: exchange of sensitive information, joint problem-solving arrangements and trust. Uzzi claims that a cooperative relationship shapes economic action differently and hence has differential strategic implications for performance. This theory can be used to inform our understanding of how firms realise more IT contributions through inter-organisational relationships, and it has been applied in the context of EDI (Chatfield and Yetton 2000).

The socio-political perspective has been used to study the relationship between IT investment and firm performance (Hoogeveen and Oppelland 2002). Instead of this perspective focusing on politics and conflict as the primary interaction mode, it focuses on collaboration and cooperation as the key to understanding interaction processes. This perspective introduces a third rationality of information systems in which trust, social capital and collaborative relationships become the key concepts for interpretation (Kumar et al. 1998).

15.4 Conclusion and Future Research

Having reviewed the work done by both academic and practitioners in this area, it is clear that new approaches to managing IT investments are needed. Moreover, the questions of how do firms transform or fail to transform the potential value of IT remain under-studied.

Although a great deal of research has examined the business value of IT, several aspects remain relatively under-studied (Melville et al. 2004). Because the majority of firm-level analysis measures IT in the aggregate, we know a little about the relative performance contributions of different types of IT investments and whether different IT assets affect different aspects of firm performance (Aral and Weill 2007). We need to explore the evolving role of IT and the changing nature of its contribution to organisational value creation *unless we can identify how and where*

IT is contributing to value creation, we cannot measure it; unless we can measure it, we cannot demonstrate value, thus failing to dispel the prophecies of diminishing IT value (Kohli and Grover 2008, p. 28). Some of the research questions that can be explored further are:

- Do different types of IT resources drive performance differences?
- Are IT resources associated with improved operational efficiencies or competitive advantage?
- How do IT resources generate operational efficiencies and competitive advantage?
- How firms allocate aggregate IT investments?
- What type of organisational factors and management practices contribute to a firm's ability to generate value through IT?

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Chapter 16
Applying "Business Case" Construct Using the "Diffusion of Innovations" Theory Framework: Empirical Case Study in the Higher Education

Francisco Chia Cua

Abstract Real-world cases have highlighted the need for better understanding of the process by which risk-averse organizations introduce new enterprise systems. There is a particular need to focus on the "business case document" which comprehensively outlines the pros and cons of adopting the new system. This chapter describes the complex innovation and diffusion process of enterprise systems as not described before. It asks questions about how information on a new system is communicated to potential stakeholders. Taking the specific case of a large public sector university, it examines all the processes involved in evaluating whether a new system is right for an organization and convincing both end-users and upper management to approve the change. Accordingly, any document that drives this change must be as credible as possible. And so, this paper looks at the possible sources of credibility for both the document and the sponsor who writes it.

Keywords Business case • Diffusion of Innovations • Financial management information systems • Executive sponsor • Upper management • Perceived attributes of the innovation

Abbreviation

BCDoI Business Case, Diffusion of Innovations

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16.1 Introduction

Business process innovation increases outputs, efficiency, and performance. Process is a dimension of innovation, which is simply the introduction of a new idea. It can be Smith's reordering and sequencing of tasks in a familiar process (Smith [1776] 2009) or the complete replacement of an organization's financial management information systems. Briefly, innovation equals the perceived newness plus the innovation process (Roberts 2007; Rogers [1962] 2003).

The innovation requires an awareness of its existence and value, followed by a more detailed exploration of the latter. Finally, exploitation takes place, as the innovation is accepted and adopted. The innovation process[1] consists of being aware of an idea, forming an attitude toward it, making an accept decision, implementing the innovation, and evaluating the decision (Rogers [1962] 2003).

Tightly intertwined with this innovation process is another process called diffusion. During the innovation process, people interact and communicate with each other. Their words, images, or actions make up the diffusion process, theoretically distinct from the innovation process. Diffusion is also distinct from the common communication process because of the special message in the communication, the uncertainty of the innovation process, and the intention that the target audience will make a favorable adoption decision.[2]

One conception of the "business case" construct is the "business case" document, considered a product of the innovation process. This document is something that addresses, at a high level, the business need that an innovation seeks to solve. This formal document contains evidence of research and due diligence (McLaughlin 2004). The other conceptions of the business case are: the business

[1] The exploration and exploitation phases of the innovation process in turn consist of several stages, namely, knowledge (agenda-setting), persuasion (matchmaking), decision, adoption, and confirmation (feedback and assessments process). See Rogers ([1962] 2003) for detailed descriptions of these stages.

[2] One conception of diffusion is diffusion as a special message or as the special characters in the message (Rogers ([1962] 2003). The message of the diffusion constitutes other conceptions such as diffusion as uncertainty or unexpected undesirable consequences (Borge 2001; Burrell and Morgan 2005; Dettmer 2003; Green 2004; Larsen and Myers 1999; Trompenaars and Prud'homme 2004); diffusion as creating awareness and/or mitigation of risks (e.g., Katz 2004; Leifer et al. 2004); diffusion as reaching a mutual understanding among the participants of the diffusion-innovation process (e.g., vision and expected consequences; Katz 2004; Polak 1973; Rogers [1962] 2003); diffusion as potent trigger of the innovation process; diffusion as expected consequences of selling an innovation with an emphasis on benefits, costs, risks, and controls; diffusion as a deliberate process of selling something new to the target audience; and diffusion as the source's (e.g., executive sponsor's) intention that the target audience (e.g., upper management) will be responsive to the message and will make a favorable adoption decision (Katz 2004; Polak 1973; Rogers [1962] 2003).

case as a diffusion[3] from the executive sponsor to the upper management, and the business case as a coping mechanism.[4]

For a better understanding and application of the "business case" construct using the Diffusion of Innovations theory (DoI) framework, the following three questions can provide a way of thinking "perceptibly" (Heidegger [1954] 2010, p. 100). *What kind of diffusion is the business case? What are its ends? What are the means used to achieve these ends?* Four other constructs can help to answer these questions, namely, the innovation, the innovation process, the diffusion process, and the perceived attributes (or "perceived characteristics") of the innovation.

Why should the practitioners and academic care? This empirical case study highlights the real-life practices in a neglected business case area. The real-world cases, such as those of FoxMeyer (Caldwell 1998; O'Leary 2000; Stein 1998; "SAP and Deloitte Sued by FoxMeyer," 27 Aug 1998) and Fonterra (Ferrier 2004; Howell et al. 2004), are evidence of the need to understand the process of radical innovation with respect to enterprise systems and the business case in the same innovation process. To the best of the researcher's knowledge, there is no diffusion research that has focused on the "business case" construct. The last scan on 4 June 2009 from *Science Direct*, *ProQuest*, and *Emerald* corroborates this,[5] while a paper in *ProQuest* reveals the *absence* of the business case in studies of diffusion and adoption of innovations (Siu et al. 2009). Finally, this paper also illustrates a unique case study methodology, which includes multiple-level instruments to triangulate and analyze a case.

[3] Using the parlance of Diffusion of Innovations theory, a second conception is that of the business case as diffusion. This communication to the upper management conveys the executive sponsor's agenda (the innovation), clarifies how it will yield benefits to the organization, and justifies why they should support it (e.g., "Building a business case" 2008; Clarke 2007; Dimick et al. 2006; Fang et al. 2004; Karat et al. 2005; King and Sapnas 2007; Maklan et al. 2005; McLaughlin 2004; Salzmann et al. 2005; State Services Commission 2007; State Services Commission and the Treasury 2001; Wheeler and Sillanpaa 1998; Willard 2005; Unerman and O'Dwyer 2007).

[4] A third conception of the business case is that of a coping mechanism occurring at a later stage (the coping stage) of the innovation process. It consists of reasoned actions, such as developing and presenting an agenda (Beaudry and Pinsonneault 2005; Mintzberg et al. 1976).

[5] In the first round, the search of each database used the term "business case." In the second round, "diffusion" was added to the first term to narrow down the list. However, the search generated noise. One of the two papers from *ScienceDirect* expressed that "[m]ore research is needed to examine the quality of care associated with these models and to establish the business case for managers faced with small female patient caseloads" (Yano et al. 2006). More noise came from a paper by Amesse and Cohendet (2001) about the "diffusion of technology," in which they refer to knowledge transfer and knowledge management. There was similar noise in the *ProQuest*. A paper revealed an absence of the "business case" construct for the diffusion and adoption of innovations, in the context of chronic care (Siu et al. 2009). *Emerald* missed half a mark since its paper lacked the DoI lens. However, it is the only paper that concerns winning project approval and writing a convincing business case for project funding (McLaughlin 2004).

But, *why is this particular process innovation an appropriate context for understanding the business case of the DoI theory*? *Why analyze the innovation and its adoption as opposed to the organizational buying decision*? First, the innovation process, as previously explained, consists of being aware of the innovation, forming a positive or negative attitude toward it, and making the buying decision. The "business case" construction can represent this process, its outcome, its intention, the parallel diffusion process, or a thinking tool for understanding all these elements. Thus, it can be used to tell a complete story of the process innovation, of which the buying decision makes up only one part. Secondly, a story that truthfully recounts a phenomenon involving a business process should have a beginning, middle, and an ending. Such a structure is already in the thinking framework of the business case. A third reason is that the buying decision alone cannot tell the story, also called the Explanation[6] (Hart and Honoré 1985; Hume 2004; Passmore 1962; Scarre 1998), the elements of which must be arranged like a chain of events (i.e., a process) or a chain of reasoning. This chain is reflected in the reasoned actions of the key characters, which reach their climax in the accept-reject-delay decision. An organizational buying decision alone does not provide the wider context. Nor does it have a comparable chain of reasoning. This could be Wolf's (1994) reason for saying that diffusion research that focuses on analyzing the buying decision is "weak" (p. 417).

16.1.1 Critical Reflective Lenses

The paper uses the self as the first reflective lens, inasmuch as personal experience provided the primary perspective for this diffusion research. Yet reflection as a function of the mind can be both instinctive and biased. The details and characteristics of the single-case study examined differ from those of the researcher's personal experiences; their tensions, however, remain essentially the same. Like a double-edged sword, this first lens both cuts the target and hurts the wielder. Thus, two other reflective lenses are necessary to cross-examine the case study.

A second lens is the DoI theory. Although a single theory normally cannot adequately account for a complex phenomenon, at least the DoI theory enables the researcher to see both the forest for the trees and the trees for the forest. In this model, "business case" construct connects with other constructs and tells a story.

The third reflective lens is the empirical evidence derived from the single-case study of a complex phenomenon. The deployment of enterprise systems by a large public sector University of Australasia (all names of the case disguised) helps to

[6] In explanation, the story must be (a) correct, (b) adequate, and (c) intelligible (Passmore 1962), its elements arranged like a chain of events (i.e., a process) or a chain of reasoning. A fourth criterion is (d) completeness from the point of view of a philosopher (Hume 2004; Scarre 1998) or relevance from the perspective of a layman (Hart and Honoré 1985).

uncover the intricate aspects of diffusion and the business case (Meyer and Goes 1988; Zaltman et al. 1973) and makes a complex process easier to understand over time (Baskerville and Pries-Heje 2001).

16.1.2 Outline

The next section briefly introduces the DoI theory. It highlights the philosophical assumptions embedded in a technological radical innovation. The same section also discusses the five key constructs related to the three research questions. A brief overview of the methodology follows. Next, is a narration of the case study. The discussion in the fifth section presents the argumentation of four a posteriori propositions which collectively act as the premises and lead to the conclusion (the sixth section) of what the business case is. This is important for practitioners in order to improve their business operations. The last (sixth) section also points to a set of questions to direct future research on diffusion.

16.2 The "Diffusion of Innovations" (DoI) Theory

The Diffusion of Innovations (DoI) theory is a theory of how, why, and at what rate new ideas, technology, and process innovation spread through an organization, a society, or a country (Rogers [1962] 2003). The *how* concerns the innovation process. The *why* is the justification for adopting or rejecting the innovation, referring specifically to the perceived attributes of the innovation.

The earliest resources on innovation and adoption date from the sixteenth century. In 1516, an English lawyer published a book about an ideal island nation with a seemingly perfect socio-politico-legal system, called Utopia[7] (More 2003); 200 years later, the French philosopher Nicolas de Condorcet declared that human vision and ability can actually harness technology to create such a Utopia (Avery 1997; Bell 1996; Bottomore and Nisbet 1978). In the nineteen century, Marx and Engels[8] (1973) defined *technology* as a force that triggers social change for the good of society and *society* as a force that drives innovation. In this deterministic view, social systems lead to innovation, which leads in turn to social change. In opposition is the instrumentalist view, which sees technology as a means to a definite end. An organization's vision provides a real rationale for either adopting or rejecting an innovation (Durlabhji 1993; Tönnies 2001).

[7] Sir Thomas More (7 February 1478–6 July 1535) coined the word "utopia" for this fictional perfect island nation.

[8] Karl Heinrich Marx (5 May 1818–14 March 1883) and Friedrich Engels (28 November 1820–5 August 1895) were German philosophers who collaborated on The Communist Manifesto published in 1848.

At the beginning of the twentieth century, French sociologist Gabriel Tarde (1903, p. 140) asked why, "given one hundred different innovations conceived at the same time … ten will spread *abroad* [italics emphasized], while ninety will be forgotten." After observing a stranger (the innovator) introducing an innovation to early adopters, who then influenced other people to follow their lead, he concluded that human interactions (that is, relationships) are the "magic" element. Factoring in the elements of space and time, he expressed diffusion as a rate (Kinnunen 1996; Mahajan and Peterson 1985; Mohr 1987). Bass (1969) later applied a differential equation to this rate that would let one predict the number of future adopters of an innovation.

Toward the mid-twentieth century, the concept of adopter categories was established. Ryan and Gross (1943) introduced the early majority, late majority, and laggards. Coleman et al. (1957), focusing on opinion leaders, examined diffusion as a social process originating with the media. His theory parallels a two-step diffusion process model of Lazarsfeld and Merton (1949) and of Lazarsfeld and Menzel (1963): first the source transmits the innovation to the opinion leader and then the opinion leader diffuses it to friends or acquaintances (or "opinion followers"). Transmission can involve either a mass medium or interpersonal interactions.

Tarde also identified important constructs[9] which suggest that interactions (relationships) at the micro (individual) levels drive diffusion at the macro (societal) level. Yet older work by Durkheim (1938), Giddens (1987, 1990) contradicts this, stating that it is societal factors which influence individual adoption. However, even when an entire society embraces innovation, a cultural lag affects its adoption by individuals (Ogburn 2007).

If Tarde was the father of diffusion research, then Rogers was the "opinion leader" who promoted the DoI theory in a book of the same title, which confirms diffusion as a social process (Rogers 1962). Their books are properly considered together at the beginning and end of every review of diffusion research. Rogers' book, now in its 5th edition, is one of the most cited references in the social sciences, thanks to its combination of solid academic insights and interesting anecdotes.

Since its introduction, the DoI theory has been extended by the Actor-Network Theory (Latour 2004), the Theory of Social Change (Ogburn 1964), Theory of Cultural Lag (Ogburn 1964), and Technological Acceptance Model (Davis 1986, 1989; Davis et al. 1989). Being grounded not only in innovation and diffusion, but also in the web of interactions among people, organizations, and technology (Pennings and Buitendam 1987), its diffusion paradigm is a good interdisciplinary model for understanding a complex phenomenon.

[9] The important constructs, identified by Tarde (1903), include: the innovation; the innovator (or the stranger); the location (space) where the innovator emigrated to; the opinion leader (the early adopter); his or her networks of friends and acquaintances (the social systems); the receptiveness of these friends and acquaintances; their beliefs, desires, and motives; the later adopters; the time it takes them to adopt the innovation; the adoption rate in the S-shape curve; and the imitative rays.

Yet the strengths of DoI are only the flip sides of its weaknesses. For instance, those solid academic insights can be misleading, as in the case of one farmer who refused to adopt any new herbicides which killed earthworms and birds on his farm. Now that agricultural trends favor organic farming, Rogers’ alleged laggard has turned out to be a super-innovator. Even the interesting anecdotes come at a price: dependence upon self-reported *recall data* from respondents. Due to faulty recollection or poor hindsight in tracer studies (Rogers [1962] 2003; Waterson 2005), serendipitous and accidental aspects of the innovation process were unlikely to be fully reported. Moreover, the limited data alone could not reveal much about the innovation process and there was not much research to publish in the end. Thirdly, Rogers ([1962] 2003) identified time as an important methodological enemy in diffusion research because hundreds of years can pass before an innovation can be accepted. On the other hand, this fact can be studied in the light of the diffusion rate (popularly known as the S-curve), the adopter categories, and cultural lag.

The S-curve contains a positive bias. It assumes that a new idea, product, or service is favorable and should be and would be adopted, although this is not always the case in real life. Only 16% of the population has such a favorable attitude toward innovation (Brown and Venkatesh 2003): the innovators (2.5%), and the early adopters or opinion leaders (13.5%). Although the remaining 84% are negatively biased, 34% (misleadingly called the “early majorities”) can still be convinced to reduce their innovation resistance, while the remaining 50% (so-called late majorities and laggards) remain non-adopters to the end. Note the inappropriateness of Rogers’ terms for the last two groups. There is nothing “early” about the 34% majority, and the late majorities and laggards will actually never become adopters. Such a positive bias, coupled with the instrumentalist view, creates a perceived optimism and a perceived value for the innovation (MacKenzie and Wajcman 1999).

16.2.1 Perceived Attributes of the Innovation

The five important constructs of this research are: the innovation, the diffusion process, the innovation process, the business case, and the perceived attributes of the innovation. The first four constructs introduced in the first section provide the foundation for the fifth construct. The diffusion intends to sell the innovation as a means to an end (e.g., Jasanoff et al. 1995; Luftman and Koeller 2003; Ogburn 2007; Surry and Farquhar 1997; Toffler 1970; Tönnies 2001). The innovation process depends on the success of the diffusion process, which in turn relies on the perceived attributes of the innovation (Ahuja and Thatcher 2005; Bock et al. 2005; Valente 1996) contained in the “business case” document.

These perceived attributes of the innovation (Hurt and Hubbard 1987; Kwon and Zmud 1987; Moore and Benbasat 1991; Rogers [1962] 2003; Tornatzky and Klein 1982) are either real or imaginary strengths or weaknesses. The key is *perception*.

Since reality can be objective or subjective (Burrell and Morgan 2005), it is not clear which between awareness or perception precedes the other in the first stage of the innovation process. Either way, people fill up the details of their reality in their mind with the help of their awareness (e.g., Bryman 2001; Heidegger 1962; Kant 1934; Weber 2004), their perceptions, and their feelings (Gilbert 2006). What this leads to is personal bias. In short, the perceived attributes of an innovation result in favorable or unfavorable biases, whether the strengths and/or weaknesses are real or imaginary.

Perceived attributes of an innovation can be classified into three sets. Set 1 consists primarily of classical perceived characteristics of the innovation, ultimately encompassing a total of nine (Moore and Benbasat 1991; Rogers 1962, 1983, 1995, [1962] 2003; Rogers and Shoemaker 1971): relative advantage (or perceived usefulness), compatibility, ease of use, complexity, ability to be tested (trialability), demonstrability (observability), image, visibility (somewhat similar to observability), and voluntariness. Set 2 concerns positive acceptance and usage of technological innovation (e.g., the Technology Acceptance Model or TAM; Davis 1986). These characteristics are perceived usefulness (similar to relative advantage) and perceived ease of use (the opposite of complexity). Set 3 is about value, specifically the economic value, benefits, and costs, such as Total Cost of Ownership (TCO), and when it comes to technological innovation, network externalities.

The latter concept states that the value of something, such as a software package, increases with the number sold or used (e.g., Eom 2005; Katz and Shapiro 1985, 1986, 1994; Liebowitz and Margolis n.d.). Thus, the success of a software product depends in part on the size of its installed base (Brynjolfsson and Kemerer 1996; Jongseok et al. 2003), because this affects consumer expectations and compatibility (Farrell and Saloner 1986). The basic premise is: *increase of installed base equals increase of expectations plus increase of compatibility*.

The perceived attributes of innovation are critical throughout the exploration phase of the innovation process, not just the matchmaking stage indicated by the process models of Rogers (1962, 1983, 1995, [1962] 2003) and Rogers and Shoemaker (1971). In the business case, they represent the consensual true evidence presented to the upper management.

All the three sets of perceived attributes enhance the belief that the expected desirable consequences articulated in the business case are achievable. Thus, a critical examination of the business case implicitly relies on the credibility of the justifications, of the evidence presented, and of the executive sponsor.

16.3 Methodology

This single-case study examined the exploration phase in the deployment of new enterprise systems by the University of Australasia (all names disguised). Evidence was examined, validated (triangulated), and interpreted. The research was also subjected to a control self-assessment.

The overriding theoretical paradigm assumes that this complex phenomenon in the given context is the Realism paradigm (Perry et al. 1997), which is somewhere in the continuum between 100% objectivity (positivism) and 100% subjectivity (constructivism).

16.3.1 Research Questions

The research questions clarify the intertwining issues which are the constructs highlighted in the research:

- What were the dimensions of the innovation?
- How did the initiation phase start?
- What (or who) triggered the innovation?
- How did the exploration phase begin?
- Who were the key participants?
- What were the key barriers? What were their implications, especially to the executive sponsor?
- What factors affected the perception and the process? Did the process make sense? Why? Why not?

The answers to these questions are anecdotal evidence (presented in the fourth section) which lead to a type of knowledge called justified true beliefs. After further analysis and interpretation, they can be used to form reasoned arguments and to explain the research problem.

16.3.2 The Literature Review

The current body of DoI literature is far-reaching. Alongside basic references like “The Laws of Imitations” by Gabriel Tarde (1903), the “Diffusion of Innovations” by Rogers ([1962] 2003), and the “Innovation Journey” of Van de Ven et al. (1999), there is also much literature on related disciplines. A comprehensive review would include the meta-analyses of Damapour (1991; 1992), Granados et al. (1997), Greenhalgh et al. (2004), Meyers et al. (1999), Tornatzky and Klein (1982), Wejnert (2002), Williams et al. (2009), and Wolfe (1994). It is not possible to cover all the related literature. Thus, this paper did not trace all these resources, though it does acknowledge their contributions to the field.

16.3.3 Units of Analysis and Limitations

The case study utilizes two streams of diffusion research, each with its strengths and limitations. The first is the Process Theory (PT). It examines the nature of the innovation process, what triggered it, and how it happened within its context (e.g., Baskerville and Pries-Heje 2001; Daft 1978; Cooper and Zmud 1990; Ettlie 1980; Zmud 1984). Unfortunately, PT is weakened by its suggestion that each stage of the process is self-contained and exclusive, so that one cannot begin until the previous one has ended, because the reality is that innovation is a *nonlinear* process (Van de Ven et al. 1999). Secondly, current PT research has focused on the exploitation phase and neglected the exploration phase. Other weaknesses include the faulty recollection of key actors (Rogers [1962] 2003) and time-consuming retrieval of source documents are other limitations.

The second stream is the DoI, which helps explain the adoption, its antecedents, and its undesirable consequences (e.g., Ahuja and Thatcher 2005; Brown and Venkatesh 2005; Gattiker and Goodhue 2005; Lapointe and Rivard 2005; Leonard-Barton 1985, 1988; Moore and Benbasat 1991; Ryan and Gross 1943). Its own limitation is its many stringent assumptions about diffusion which can make the theory difficult to apply in practice (Argyris 2004; Leonard-Barton 1985, 1988; Leonard-Barton and Deschamps 1988; Moore and Benbasat 1991; Tornatzky and Fleishcher 1990; Wolfe 1994).

The main strength of this case study was the timing. The study was conducted while the innovation process was ongoing, thereby doing away with the third weakness inherent to the PT stream. Also, the research took care to articulate,[10] examine, and discuss the inherent theoretical assumptions thoroughly with peers, to avoid rigidity and inconsistencies between theory and practice [11] (Bhaskar 2002; Smaling 1987; Smith 2006; Taleb 2007).

[10] The theoretical assumptions were thoroughly articulated, examined, and discussed with peers, to avoid rigidity and inconsistencies. The first is that the deployment (or the replacement) of enterprise systems is a problem-solving intervention (Thull 2005) with expected consequences. It embodies hard realities that consist of physical evidence and documentations as well as soft realities, such as interactions, shared meanings, and defensive reasoning (Argyris 2004; Bryman 2001; Burrell and Morgan 2005; Gilbert 2006; Heidegger 1962; Kant 1934; Weber 2004). Second, unexpected consequences are always in perpetual motion and change (Ormerod 2005; Rogers, [1962] 2003), and a large unexpected consequence may have very small causes (Ormerod 2005). Third, the purpose of technological innovations is seamless alignment that comes with a value orientation (strategic vision). This expected consequence concerns (a) value proposition and performance, (b) information availability, (c) value chain or network linkages, and (d) transactional efficiencies. The gatekeepers configure the enterprise systems, align business processes, and extend the value chain toward a strategic vision (Canals 2000). Fourth, understanding how to solve problems, make decisions, and act under conditions of incomplete information is the highest and most urgent human pursuit (Taleb 2007). Fifth, because of the possible presence of defensive reasoning and behaviors, rational behavior may be irrational behavior in disguise (Argyris 2004; Luhmann 2006).

[11] Alignment of theory and practice can never be perfect because the evidence is generally incomplete and not necessarily the source of truth. Although many sources may be drawn from all at once (Stake 2005), what constitutes knowledge depends on the thorough understanding of the researchers and the participants and on the nature of the empirical evidence and reasoning required. Thus, a single piece of information can be as meaningful as a lot of data. The merit of the evidence relies on how it forms part of a chain of evidence, how it functions in the context, and how it is reflected in the social-emotional systems.

Table 16.1 List of players in the case study

Craig Smith[a]	The executive sponsor, the Finance Director of the University of Australasia
David Ramirez	Chief operating officer and superior of Craig Smith
Stanley Lim[a]	Opinion leader, the Financial Analyst of the University of Australasia
Gary Washington	Director of Providence Consulting, Facilitator of Business Case Workshop on Deploying New Enterprise Systems
Kevin Peters[a]	Third-party change agent from Providence Consulting
K Consulting	Competed with Providence Consulting to provide the service of change agent
Providence Consulting	Vendor for the change agent, with office in the same building as that of Vendor F
Vendor F	Enterprise software solution provider with offices in Australasia, Malaysia, and the UK
Vendor I[a]	The incumbent vendor
Vendor S[a]	Another global company with offices in North and South America, Australasia, Asia Pacific, Europe, Africa, Middle East
Vendor O	Also a global company with offices in 95 countries
Vendor N[a]	Now (in 2010) a business unit of a global company operating in about 50 countries
Paul Dash[a]	Finance manager of another higher institution using the software package of Vendor F
Other respondents	Participants of the business research methodology sessions

[a] In-depth interview participants

16.3.4 Replication and Challenges in Data Gathering, Analysis, and Narration, Threats to the Single-Case Study, and Control Self-assessment

An important mode of analysis is simply (a_1) noticing, (b_1) collecting, and (c_1) thinking (Corbin and Strauss 1990; Jorgensen 1989; Seidel 1998). This iterative and progressive technique makes the data clearer via a continuous process, until the first draft of the research is completed. The archival documents are (a_2) broken down into units, (b_2) sorted, and (c_2) perused for types, classes, sequences, processes, and patterns, without losing sight of the whole (Jorgensen 1989).

Another technique is similar to Grounded Theory as discussed by Corbin and Strauss (1990). For example, the examination of the twenty responses to the Request for Information (RFI) included open coding (i.e., naming and categorizing) and the breaking of the documents into discrete parts. This (a_3) noticing and (b_3) collecting were followed by (c_3) thinking, as responses were compared and contrasted and questions were continuously asked.

The respondents' perception of the reality also became an analytical lens. The seven individuals interviewed were the executive sponsor (Craig Smith in Table 16.1), the financial analyst (Stanley Lim), the change agent (Kevin Peters), the incumbent Vendor I, the two short-listed vendors who did not participate in the RFP (Vendor N and Vendor S), and a financial manager (Paul Dash) of another institution using the software package of Vendor F. These players represent the best group available to mine for data. Among the other important players in the story, Vendor O did not respond to the request for interview, Vendor F was represented by the change agent, Kevin Peters, and David Ramirez was too busy to provide the opportunity for an interview. Of these seven respondents, Craig was interviewed three times, and Stanley, twice. Since the executive sponsor and the opinion leader were the key players, their active interaction with the researcher resulted in "negotiated, contextually based results"[12] (Fontana and Frey 2005, p. 698; Silverman 1997, 2006).

Making up the chain of evidence also were four open-ended questionnaires to four project team members and 40 hours of observations (on business research methodology and detailed training sessions). The change agent refused to allow interviews of the project team members, all of whom were sent the open-ended questionnaire instead. Only four responded.

The archival documents examined included the Request for Information (RFI), 20 responses to RFI, 20 score cards, RFI evaluation results, Request for Proposals (RFP), two responses to the RFP, the RFP proposals evaluation, the "business case" document, two project definition documents (prior and updated), a project strategic evaluation, four project risk assessments, cost summary, cost–benefit analysis, and other documents about the project and business process changes. The concurrency of the research and the project promoted the availability of these critical physical documents, which served as bases for triangulating the "business case" document.

Since different respondents had different views of reality at different interview times, a three-level-protocol approach was necessary. This approach ensures the congruence of the data gathered from multiple respondents and keeps the focus on the case. At the first level, the theoretical questions were open-ended and broad,[13]

[12] The "inextricably and unavoidably…contextually…boundedness [in interviewing] refutes the whole tradition of the interview…" (Fontana and Frey 2005, p. 695). The executive sponsor and the opinion leader (the financial analyst) were heavily involved in the deployment of the new enterprise systems. Along with being interviewed, they want to be updated with the research. Spradley (1979) encountered a similar situation where he discussed what he learned with the interviewee. In the traditional sense, this approach is unthinkable (Fontana and Frey 2005). But, it is acceptable to frame the interview as part of an active emergent process (Fontana and Frey 2005), something which fosters an understanding of the language and culture. It can also aid the creation of "sharedness of meanings" among specific referents, between both the interviewer and the respondent (Fontana and Frey 2005, p. 713).

[13] The first-level protocol was developed to guide the interviews during the four stages of the research. The first stage was to determine the focus of the study; the second, to ask questions about the phenomenon, its states, and properties; the third, to integrate all data into a coherent theoretical storyline; and the last, to ask for details and get further clarification. In the first two stages, the theoretical questions attempt to justify why a particular theory is appropriate to the case study, clarifying the beliefs explicit and implicit in both the theory and the phenomenon itself. They also identify and examine other relevant constructs and concepts. In the final stages, the issues (practice) are explored as well as the constructs and the concepts (theory), in order to create a model that illustrates their relationships with each other.

while the empirical questions[14] were more specific and contextual[15] and became more so as the inquiry entered the second level. The three-level protocols highlight the strength of the case study. These instruments provided a frame of references for crafting the in-depth interviews and ensured responsiveness to the situation as it changed. Thus, the resulting guiding questions[16] could take into account the characteristics and positions of the key informants. Interviews were combined with a set of structural questions,[17] such as: *Have I reached the saturation point?* Such an approach (Strauss and Corbin 1998) served as “forethought” in the research (Yin 2003, p. 69).

This research relied on all available sources of data and the multiple levels of in-depth interview instruments. Each source not only provided important data but also served as a means to triangulate the data gathered.

Despite the aforementioned methodology, there nevertheless remained six threats to the case study. The idea that there is “no single-appropriate approach” is the first; although, the reverse that just any approach can be appropriate is also not true. Such flexibility required the researcher to take greater care to ensure that each process achieved its intended purpose, such as by interviewing key respondents more than once. The second threat concerned the biases and how to resolve them. Three quality control measures[18] made certain that the research design was

[14] The researcher developed empirical questions at the initial level. What is going on? What is the problem? What are the issues? Explain why the innovation and adoption provide the appropriate context as opposed to analyzing the case as an organizational buying decision?

[15] As the data gathering continued, second-level empirical questions reflected the inevitable situational changes over time. When does the phenomenon happen? How does it happen? Who are the actors who are more powerful than expected, and who hold back the adoption or even lead to the system’s failure? How do the actors define their situations? What does it mean to them and to others? What are its consequences? What are the implications of these consequences?

[16] A third-level protocol used guiding questions. For example, the executive sponsor was asked: What is your greatest challenge at this stage? Describe it (look out for the vendor resourcing issue). What is your priority now? What is your greatest concern now? If you have to do the implementation all over again, how would it be? Who are your top three internal customers whom you want to be happy? How will you satisfy them? What lessons have you learned that are valuable to you? Are there documents that are important for me to read?

[17] In the first stage of research, the structural questions were: What broad resource will be required? Which concepts are well developed? Which are not? How do I gather the concepts? What permission is needed? How long will it take? In the second and subsequent stages, other structural questions were: What must be done next to gather the data for my evolving theory? What further data do I need? How logical is my theory? Where are the breaks in logic? Have I reached the saturation point?

[18] The first measure is to ensure the methodology’s concurrency with the validity and reliability tests. The second is the nature of the case study (process), which is iterative, reflective, adaptive, contextual, and integrated with the big picture. The third is the presence of knowledgeable researchers to conduct many of the discussions, which resolved those inherent and unavoidable biases.

sufficient to achieve the study's objectives. The third threat[19] was the possible evolution of "the case" (Yin 1993, 1994), which should always remain constant. The fourth threat came from the context-rich data.[20] Eisenhardt (1989) and Yin (1993, 1994) regard transferability (external validity) as another possible threat. However, it is not a threat to this study,[21] in which a context-free theory is not a concern. The sixth and more viable threat was the risk of incongruence in the data gathered across the multiple sources. This compelled the researcher's use of protocols.

This single-case study utilized the Control Self-Assessment[22] (CSA) technique to ensure quality in all its critical elements (Ahrens and Chapman 2006; Benbasat et al. 2002; Darke et al. 1998; Guba and Lincoln 2005) and to guard against critical controversies (Denzin and Lincoln 2005; Easterbrook et al. 2005; Flyvbjerg 2006; Silverman 2006). The aspects of confirmability (construct validity), credibility (internal validity), and dependability (reliability) were relevant to the study (e.g., Creswell and Miller 2000; Riege 2003; Yin 1993, 1994).

[19] The approach to asking theoretical, empirical, structural, and guiding questions mitigated this third threat. Moreover, the study was always kept abreast of contemporary events and news. The knowledge of current events and the awareness of this threat helped to mitigate its influence.

[20] The context-rich data are the root of both the strengths and the weaknesses of the case study. Several measures mitigated this fourth threat: an extensive literature review including concepts which overlap with the Diffusion of Innovations theory; a systematic development of the model (e.g., the evolution of the conceptual framework); meticulous derivation of research questions; and the use of argumentation approach. These measures also extended the study toward interdisciplinary research.

[21] External validity is not a threat in a case study. Optimizing and understanding the case does not involve generalizing it as well. Yet a lack of generalization does not mean a lack of theorizing, bearing in mind Llewelyn's (2003) five types of theory and Weber's (2003) 21 approaches to generating theory.

[22] The construct validity compels the breaking down of the complex phenomenon into components. This systematic thinking about the whole, its parts, and its boundary, is interpretative and emergent (Denzin and Lincoln 2005). Item 2 of the CSA is to articulate thoroughly the case and its boundary (e.g., the issues and research questions). The boundary helps to set the scope and delineate the multiple sources and methods for gathering pieces of evidence, to establish the chain of evidence, and to verify or falsify the theory. The third and fourth items in the CSA checklist state the use of pieces of evidence gathered from multiple sources and methods and the establishment of the chain of reasoning on the basis of the evidence gathered and the literature reviewed. To assess internal validity, Items 5 and 6 of the CSA compel the alignment of philosophical assumptions with the theoretical paradigm and the clarification of the chosen paradigm and personal biases. The next five items concern dependability. Item 7 demands the development of protocols (e.g., three-level protocols) that are amenable to change as the research progresses. Furthermore, the data gathered from questions based on the protocol should reflect congruence between the issues and the theory (Item 8), congruence between the issues and the research design (Item 9), and consistency of meaning across the sources of pieces of evidence gathered. Furthermore, the modes of analysis must facilitate the establishment of labels for coding and analysis (Item 11) and of the pattern using the ATLAS.ti (Item 12).

16.4 The Empirical Evidence

There are five stages which precede the Business Case Development stage to be thoroughly discussed in the following section. In the case study of the University of Australasia's deployment of new enterprise systems, these stages are easily discerned from the chain of events. The Exploration phase begins when a powerful opinion leader makes the case that the current systems are not meeting the users' needs. The opinion leader in this case was Stanley, an analyst in the Finance Division, who pitched his recommendations to Craig, the Director of Finance (see Table 16.1). After Craig was convinced, the first stage of "Setting the Agenda into Motion" began. This is a particularly difficult phase in the process because the sponsor and opinion leader must do further research into the matter, gathering as much information as possible about their options and alternatives, in order to present a good case before upper management, which makes the final decision about the enterprise systems. Many of these activities can be considered part of the DoI's Matchmaking stage.

The next stage is "Change Agent Selection." Large organizations with a high fear of risk prefer to entrust such a major procurement to an expert, and so look for a third-party change agent to guide them through the structured process. Out of two options, Craig chose Kevin of Providence Consulting, due to positive feedback from Stanley. It is worth noting that Kevin and Stanley had a significant interpersonal relationship prior to this working relationship, and the former may have influenced the latter.

Third is the "User Requirements" stage, during which the third-party change agent begins to diffuse the innovation within the organization and the needs of the users are properly determined. Kevin achieved this during 37 consultations with over 70 individuals from all branches of the University.

Table 16.2 The "business case" document

Executive summary	
1.	The evaluation process
2.	Why is a new finance system needed?
3.	Benefits of a new financial system
4.	What is the recommended solution?
5.	What will happen if a new financial system is not implemented?
6.	Proposed time frame
7.	What resources will be required?
Supporting documents	
a.	Project definition
b.	Project strategic evaluation
c.	Project risk assessments of the four options
d.	Cost summary
e.	Cost–benefit analysis
f.	Memorandum – Project summary (evidence not made available)

Source: The "business case" document submitted by Craig Smith mentioned in Table 16.2

The fourth and fifth stages mark the release of the RFI (Request for Information) and the RFP (Request for Proposal), which communicate the agenda to vendors outside the company. Kevin received over 20 formal responses to his RFI, and short-listed four vendors to whom he sent the RFP. Yet two of the vendors did not participate further. Vendor N lost the executive in charge of the University's account and was not able to follow up in his absence. Vendor S cited the high cost of sales balanced against the low chance of winning the account as two main reasons for withdrawing, but added that the discovery that Providence Consulting was involved also weighed on his decision. In his experience, whenever Providence is a selection agent and Vendor F is in the running, Vendor F, which shares a building with Providence, usually wins.

Indeed, the prediction that Vendor F would win was accurate. After audiences judged its software package most user friendly and it came out on top in other weights determined by Stanley, Craig, and Kevin, Vendor F was awarded the account.

What follows is a more in-depth discussion of the "Business Case Development" stage. At this critical milestone, the upper management makes its decision about how to proceed with the innovation.

16.4.1 The "Business Case" Document

Craig submitted a formal "business case" document to the University Council (the upper management) on 25 July 2006. Since the Chief Operating Officer and the Council had previously agreed in principle to the project, the "business case" document was a mere formality. Nevertheless, it represented an agency from the upper management to explore and exploit new enterprise systems.

The business case had emotional and rational elements. The fear element, for instance, was the imminent danger of losing support from the incumbent vendor. This was the expected undesirable consequence that Craig wanted to avoid. As for the rational elements, they were a set of justifications: the small and falling number of organizations using the old software package; poor reporting capability, limited functions, and unfriendly user interface; the unhappy University-wide users; and the system's inability to meet increasing demand. Other justifications for the new systems were its ability to support a large customer base, capability, user-friendliness, and the vendor's credibility (especially when it came to support the software). Further justifications included the University's strategic decision to invest in information technology to achieve excellence as a research university, and the due diligence during the exploration phase of the project.

16.4.1.1 Section 1: The Evaluation Process

The first section of the business case described the exploration phase. Craig had conducted site visits and examined relevant issues with the Chief Financial Officers of several Australasian universities. He had also hired Kevin of Providence Consulting to take charge of the first five stages of the innovation and diffusion processes summarized in previous paragraphs. Craig commenced his business case with the due diligence necessary to communicate that the evaluation process was thorough, transparent, and reasonable.

The last paragraph of this section articulated an opinion against System O: “[The Finance Division] has also considered the option of a joint venture with other [Australasian] universities whereby a shared system, in a similar vein to the library system would be set up. However, this was rejected due to other universities’ preference for [System O].” The statement implied a positive mindset in favor of a shared system with the other universities. At the same time, it was explicit against System O.

16.4.1.2 Section 2: Why is a New Finance System Needed?

The fear in the Executive Summary was reinforced under a major reason for new enterprise systems: the ongoing support for the software and infrastructure environment. Although the University had the in-house capacity to maintain the old software package written in COBOL, the number of employees with that expertise was declining. This meant that reliance on them would increase for as long as the systems remained in place.

Other major reasons were: feral systems, user requirements and reporting, functionality, and an interface that was not user-friendly. The old systems could not provide reliable information, an inadequacy which prompted users to create feral systems of their own. Yet the latter provided just as much unreliable information and incorrect decision-making. System F’s integrated modules, such as budgeting and forecasting, grants and research, fixed asset register, commitments, inventory, receipting, and procurement, could replace the feral systems. This reason was critical to individual users, who thought the COBOL DOS-based interface required too many steps and was counterintuitive.

This section highlighted three weaknesses of the old systems: (a) Re-keying of the same data into the feral system; (b) dumping of data into other software to generate reports; and (c) inability to distribute reports electronically. Central generation of reports and the extra step of distributing them to the relevant divisions led to delays in the monthly reporting.

Craig made his case for the change with not only words, but also images and the opinions of users. After seeing a screen shot of the DOS-based old systems, the upper management could better understand and hear the feedback: “Get rid of [the old systems] and get something that is user-friendly.” “A new financial system is badly in order. [The old systems] is so out of date and useless, it isn’t funny.”

The project’s seven new modules, along with the regular financial modules (e.g., general ledger, accounts receivable, and accounts payable), showed that staggered implementation was appropriate.

16.4.1.3 Section 3: Benefits of a New Financial System

The weaknesses of the COBOL system were the strengths of the new software package. (i) Ongoing support tightly intertwined with vendor's credibility. Vendor F's length of time in the industry and the current version of the software were proxies of credibility. (ii) The user requirements and usability subsection mentioned the intuitive and user-friendly screen shot and showed the user interface to be more in line with current user expectations. For reporting and functionality, both System F and System O could generate reports more easily, distribute them electronically, and allow configuration to individual user requirements. Adjectives used to describe the functionality of the new enterprise systems were: (a) modern, (b) significantly more advanced, (c) more integrated, (d) unnecessary internal interfacing with other modules, (e) significant process savings, (f) "more" accurate information, and (g) straightforward and customizable interface. The "more" implied the "less" accurate information from the old software package and the feral systems.

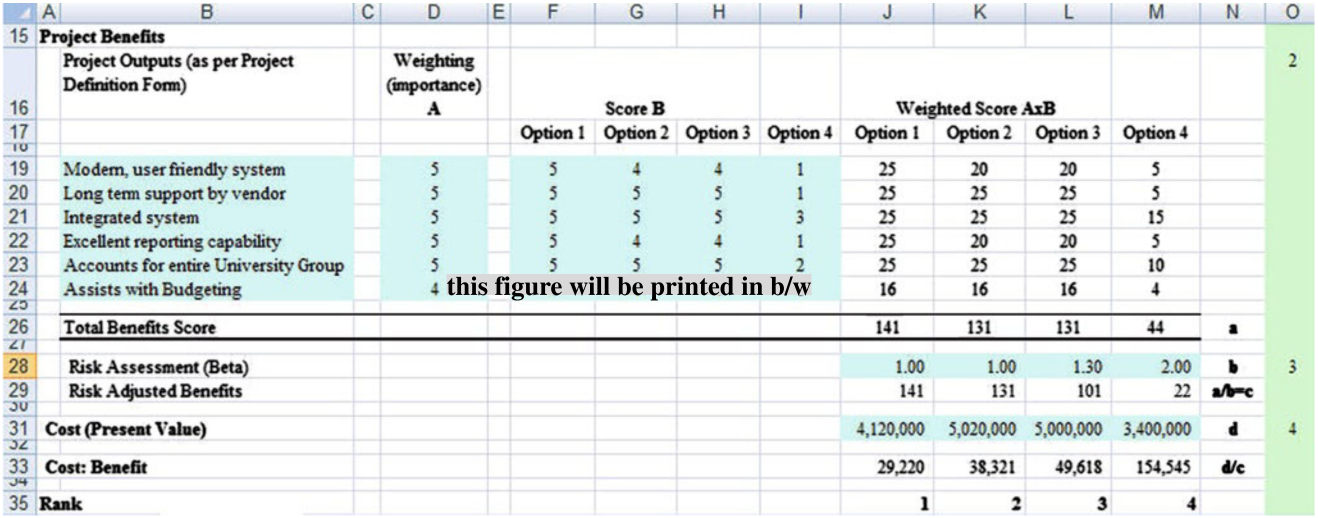
16.4.1.4 Section 4: What is the Recommended Solution?

The fourth section touched directly on System F and identified certain criteria. Systems F had higher overall weighing scores than System O (see the spreadsheet calculation in Fig. 16.1). Some criteria were higher functional fit, higher weighting scores, better user interface, good references without major issues, lower TCO, ongoing support, significant number of customers (in excess of 500 clients throughout Australasia), and (h) presence in the tertiary sector. Each criterion represented an attribute of the innovation to be of value to the users and organization to achieve desirable expected consequences and to avoid undesirable expected consequences. These perceived attributes of the innovation integrated economic (quantitative) and noneconomic (qualitative) attributes of the innovation to justify the recommendation.

Judging the first four sections of this business case, together with the forthcoming attachments, the integrity, competence, and legitimacy of Craig embody certain qualities, such as the rigor and relevance, in the business case. Without these qualities, he is unlikely to be effective and successful to sell his agenda to upper management. This case study exhibits a common practice in all of its aspects. What is not common is the Vendor S's reaction of the involvement of Providence Consulting and of the accurate prediction of the winner in the RFP.

16.4.1.5 Section 5: What Will Happen if a New Financial System Is Not Implemented?

Section 5 touched again on the dreadful conditions of the status quo. The old systems might go unsupported in the medium term by the incumbent vendor. In that case, the maintenance cost would likely increase. It was only a matter of time before a new



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
15	**Project Benefits**														
16		**Project Outputs (as per Project Definition Form)**		**Weighting (importance) A**			**Score B**				**Weighted Score AxB**				2
17						**Option 1**	**Option 2**	**Option 3**	**Option 4**	**Option 1**	**Option 2**	**Option 3**	**Option 4**		
19		Modern, user friendly system		5		5	4	4	1	25	20	20	5		
20		Long term support by vendor		5		5	5	5	1	25	25	25	5		
21		Integrated system		5		5	5	5	3	25	25	25	15		
22		Excellent reporting capability		5		5	4	4	1	25	20	20	5		
23		Accounts for entire University Group		5		5	5	5	2	25	25	25	10		
24		Assists with Budgeting		4						16	16	16	4		
26		**Total Benefits Score**								141	131	131	44	**a**	
28		**Risk Assessment (Beta)**								1.00	1.00	1.30	2.00	**b**	3
29		**Risk Adjusted Benefits**								141	131	101	22	**a/b=c**	
31	**Cost (Present Value)**									4,120,000	5,020,000	5,000,000	3,400,000	**d**	4
33	**Cost: Benefit**									29,220	38,321	49,618	154,545	**d/c**	
35	**Rank**									1	2	3	4		

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Fig. 16.1 Overall weighting scores

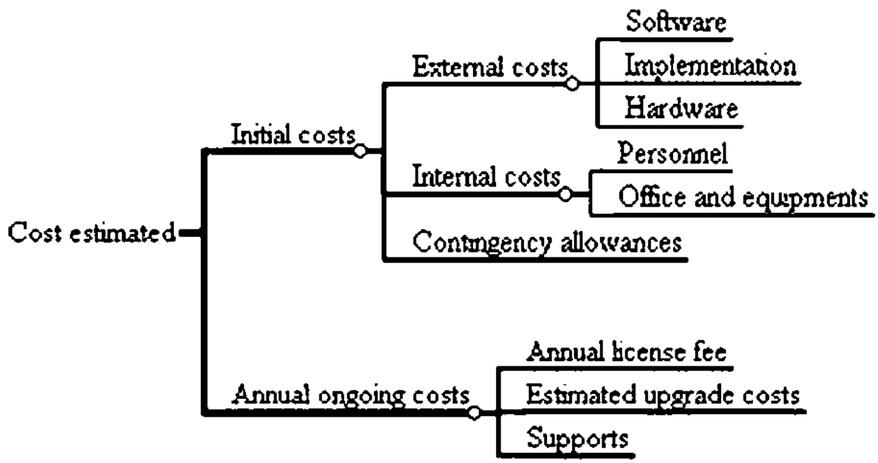

Fig. 16.2 Total costs of ownership

system really would be required. Other expected undesirable consequences to avoid were the continued dissatisfaction of the University staff and continued usability issues.

16.4.1.6 Section 6: Proposed Time Frame

The time frame was tentative. Craig believed that the project could start in September or October of the same year; the core modules could go live after 8 months; other modules after another 3–4 months.

16.4.1.7 Section 7: What Resources will be Required?

Craig identified four options (see Fig. 16.1): (1) Preferred – System F, (2) Next – System O, (3) Shared Services – System O, and (4) Do Nothing. When the Council accepted the preferred option, the preproduction stage in the implementation phase finally began.

The estimated TCO consisted of initial costs and annual ongoing costs (Fig. 16.2). The internal costs specified an external change agent and costs associated with backfilling of staff.

16.4.1.8 Attachment A: Project Definition (2 Pages)

Craig submitted a project definition with a detailed description of the project. He revised this attachment on 22 May 2006. The replacement of financial system was classified as a strategically justifiable project. Its indicative cost was $2.8 million for Systems F and $2.6 million for System O. Its annual ongoing costs were estimated, respectively, at $188,500 and $344,500. The expected outcomes of the short-listed systems include improved reporting, information, and vendor's long-term support.

In the project definition, the performance metrics first included (1) user-friendliness, (2) ability to meet the needs of the clients of the Finance division, (3) improved reporting capability, (4) assistance with departmental budgeting, (5) integration of other necessary financial modules, and (6) discouragement of the use of feral systems. Later on, it included (7) the ability to account for the entire University group on a single system and simplify reporting, reconciliation, and budgeting procedures. The long-term support by vendor, a performance metrics specified in the cost-benefit analysis (Attachment E) was not included.

16.4.1.9 Attachment B: Project Strategic Evaluation (1 Page)

Also dated 22 May 2006, the project strategic evaluation form linked the project to the university-wide and divisional strategic linkages. Craig identified three sources (the University charter, strategic direction to 2012, and divisional plan) that triggered his agenda and stated how the project would respond to them.

16.4.1.10 Attachment C: Project Risk Assessments of the Four Options (4 Pages)

Four project risk assessments, likewise dated 22 May 2006, analyzed the risk of each of the four options: purchasing System F, purchasing System O, sharing a service with other universities using System O, and doing nothing. The beta score for each option ranged from 1.00 to 2.00. System F and System O had the lowest risk (1.00). The requirements to establish the facility and the entity to run the system on behalf of the member universities increased the beta index of Option 3 to 1.30. Option 4 had a very high beta of 2.00.

16.4.1.11 Attachment D: Cost Summary (1 Page)

The sum of the present value of the initial costs and annual ongoing costs for 10 years constituted the total cost of ownership (TCO). The TCO for Option 1 (System F) amounted to $4,120,000 and that of Option 2 (System O), to $5,020,000. Costing for Option 3 was estimated, but not calculated, at $5,000,000. The discounted present value of Option 4 assumed that Option 1 would become essential in 3 years.

16.4.1.12 Attachment E: Cost-Benefit Analysis

The cost-benefit analysis utilized a spreadsheet template and calculated the cost per unit of risk-adjusted benefit. To illustrate, in Fig. 16.1, Option 1 had a total benefit score of 141. It means that Option 1 had 141 benefits. There were six benefits expected from each option (column 1). Each benefit had a maximum weighing score (column 2). The total benefit score could be derived by multiplying the weighting score (column A) and the assigned score (column B) and then adding its scores. Given that Option 1 had a beta index of 1.00, therefore the risk-adjusted benefit was derived by dividing the total benefit score of 141 by the beta index of 1.00. The answer was still 141, meaning that there were 141 benefits for Option 1. If its beta index was 2.00, the risk-adjusted benefits would be lower (70.50). A higher risk made the beta index higher. A higher beta index made the number of risk-adjusted benefits lower. Given that total cost of ownership was roughly about $4,120,000 and that there were 141 benefits accrued from Option 1, the average cost per one benefit was calculated by dividing the first figure by the second figure. The cost per benefit of Option 1 was $29,220. Each option was then ranked by the cost per benefit.

16.5 Discussions

To reiterate, the first a posteriori proposition states that the business case enables the executive sponsor to be the upper management's agent to explore and exploit an opportunity, which is the innovation. Figure 16.3 gears toward this notion of agency as ultimately influencing the diffusion by the executive sponsor to the upper management.

The findings also supports the second a posteriori proposition that each perceived attribute of the innovation is of value to the organization, individually and collectively, to achieve desirable expected consequences and to avoid undesirable expected consequences.

The second proposition in turn supports the third a posteriori proposition (Fig. 16.4), which states that the perceived attributes of the innovation consist of classical diffusion and the economic attributes of the innovation. These attributes provide justifications and reasons for the executive sponsor to diffuse the innovation to the upper management. In practice, the business case integrates all attributes into one collective justification to adopt the innovation.

Thus, a "business case" document diffuses the innovation to the upper management, so it might make a favorable informed judgment and commit resources to the exploitation (which is the fourth a posteriori proposition).

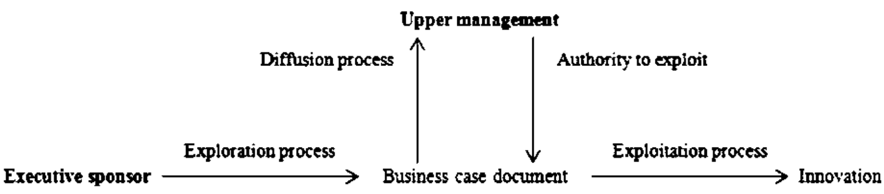

Fig. 16.3 Proxy to explore and exploit the innovation

***a posteriori* Proposition 2**

Each perceived attribute of the innovation is of value to the organization, individually and collectively, to achieve desirable expected consequences and to avoid undesirable expected consequences

a posteriori Proposition 3

The perceived attributes of the innovation consist of classical diffusion and the economic attributes of the innovation. The business case integrates all attributes into one collective justification to adopt the innovation.

a posteriori Proposition 1

The business case enables the executive sponsor to be the upper management's agent to explore and exploit an opportunity, which is the innovation.

***a posteriori* Proposition 4**

A business case document diffuses the innovation to the upper management, so it might make a favorable informed judgment and commit resources to the exploitation

Conclusion

The credibility of the business case document comes from four sources: (i) its message, (ii) the justifications for the innovation, (iii) the evidence presented, and (iv) the executive sponsor (its author). These 4 Cs collectively signify the quality of information, the right depth of analysis, and the viewpoint of the executive sponsor (or the 4 Rs of rigor, relevance, responsibility, and reputation).

Fig. 16.4 Argumentation

Accordingly, it is essential to ask questions which allow perceptive thinking about the business case. As stated previously, these are (a) *what kind of diffusion is the business case*, (b) *what are its ends*, and (c) *what are the means used to achieve these ends.*

Given the objective of a business case to persuade upper management to adopt the innovation (a posteriori Proposition 4), the document is a deliberate form of diffusion which openly carries the executive sponsor's intentions. Its critical messages are the means to this end. Since every innovation is unique, each project sponsor and business case is also unique.

Since instrumentalism has its root in causality, the narrative truth conveyed in the "business case" document must be correct, adequate, intelligible, relevant, and complete (see the explanation in the first section). Only after the upper management reads this does it make an accept-reject-delay decision. This decision causes the exploration phase to end and/or the exploration phase to follow.

The *telos* of the "business case" document involves this final decision of upper management, finally making it accountable. Yet the executive sponsor, who has written the business case, is equally responsible for driving the ultimate end. The causality can be traced backward to all people who participated in the diffusion-innovation process. This interpretation of the essence of the business case leads back to the first question.

16.6 Conclusion and Directions for Future Research

The critical reflection connects the second lens (the DoI theory) and the third lens (empirical evidence gathered and inferred from the single-case study) in order to foster better understanding of the business case in the diffusion of a radical innovation.

For a business case to serve as the executive sponsor's purpose of influencing the upper management to make a favorable informed judgment and to commit resources to the innovation, the document should be credible. Its credibility comes from four sources: (1) its message, (2) the justifications for the innovation, (3) the evidence presented, and (4) the executive sponsor (its author). These four Cs of the business case are assessed by upper management before it makes its decision.

The quality of information, the right depth of analysis, and the viewpoint of the executive sponsor in turn collectively signify the four Rs of rigor, relevance, responsibility, and reputation. Rigor depends on the executive sponsor's treatment of the risks presented by the innovation. It must be clear that he or she has fully considered and mitigated them. Relevance refers to the value inherent in the innovation, while responsibility refers to the accountability in the innovation process. This can consist of project ownership, a form of corporate governance, and concern for stakeholders. Reputation is an important element because the reputation of the organization is at stake in such an instance.

A direction for future research concerns the agency mindset in the "business case" document. The state of agency differs prior to and after the business case. *Why must the executive sponsor diffuse a good innovation? How does he assess whether it is good or bad? How can the executive sponsor or upper management prevent a bad idea from being selected? How does a new idea evolve or reinvent itself during diffusion? How can an executive sponsor enhance or the upper management support such diffusion?*

Another direction involves identifying and developing key indicators to ensure that the radical innovation will fit the corporate vision. *How can the process or its individual stages be assessed appropriately? How can this assessment be fed into the whole process?*

The diffusion literature is inadequate for framing empirical data to build strong business cases (Clarke 2007). Given that the anticipated outcomes include the benefits which justify the adoption, worthwhile questions include *what are the benefits to date (n months after the exploitation). How can intangible benefits* *(*e.g.*, Value Creation Index of Cap Gemini Ernst and Young for Business Innovation) be measured (*Funk 2003*;* Olavson and Fry 2006*;* Roberts and Daker 2004*)? How does the innovation drive the wealth creation? How does the business case reflect the leadership of the executive sponsor? How does improved leadership translate into overall value proposition? How can the importance of the innovation be reflected in the business case?*

Future research could measure the business case and assess its congruence with stakeholders' values. Their wants and needs need to be aligned with those of the organization undertaking the innovation (Clarke 2007; Moir et al. 2007). This research will integrate the Diffusion of Innovations, Value Proposition, Corporate Governance, Internal Marketing, Stakeholder Analysis, and even Porter's Five Forces Analysis.

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Chapter 17
Punctuated Equilibrium Theory in IS Research

Christopher T. Street and James S. Denford

Abstract Punctuated Equilibrium is a theory originating in paleobiology which has been adopted by management researchers to explain organizational change. In this theory, episodes of radical change are preceded and followed by longer periods of relative stability. Comprised of equilibrium periods, revolutionary periods, and punctuations, Punctuated Equilibrium can be contrasted with other perspectives on organizational change including persistent gradualism, tectonic shift, and turbulent adaptation. The use of the theory in IS research is identified in areas as diverse as virtual teams, IS implementation, organizational change, and strategic alignment. Finally, suggestions regarding how researchers may operationalize Punctuated Equilibrium are made focusing on key components of the definition of punctuations.

Keywords Punctuated equilibrium • Organizational change • IS implementation • Virtual teams • Strategic alignment

Abbreviations

IS	Information systems
NSO	National Sports Organization
PE	Punctuated equilibrium

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17.1 Introduction

Organizational change has been a key topic in organization studies since its inception (Gersick 1991). Within strategic management, a key question is "why are firms different" (Rumelt et al. 1994) and an answer from the dynamic capabilities literature is grounded in sustained competitive advantage requiring continual change ahead of a firm's competitors (Eisenhardt and Martin 2000). How this change is conceptualized can have a significant impact on the studies of change in organizations and management, including management of information systems (Van de Ven and Poole 2005). In this chapter, we examine one particular perspective that views organizational change as an episodic paroxysm of revolution preceded and followed by periods of relative stability and inertia. This is the theory of Punctuated Equilibrium.

The chapter is organized as follows. First, we introduce Punctuated Equilibrium in terms of its origins in paleobiology (Eldridge and Gould 1972) before focusing on its application in management research (Gersick 1991). Discourse on organizational change is heterogeneous and contested (Plowman et al. 2007; Van de Ven and Poole 2005), so we next identify several competing and complementary views. Areas of application for the theory in IS research are then outlined, focusing on four key research domains. Finally, suggestions to researchers on how to operationalize Punctuated Equilibrium are provided.

17.2 Theory Description

Punctuated Equilibrium (often abbreviated "PE" or colloquially termed "punc eq") is a theory that conceptualizes change in a system as being triggered relatively suddenly over a brief period, while between these brief episodes are relatively long periods of time where changes still occur but rarely accumulate to cause noticeable differences. For example, in the airline industry between 1935 and 1980, seat-miles-per-year capacity increased by over 150% with the introduction of the DC-3 in 1936, the Boeing 707–120 in 1959 and the Boeing 747 in 1969, with increases of under 25% in all other years (Tushman and Anderson 1986). These capacity changes allowed efficiencies to be realized leading to operational changes in the industry.

17.2.1 Theory Origins

PE is based upon Eldridge and Gould's (1972) development of the concept in paleobiology to account for patterns of change among animal species as recorded in fossil records, in which the development of species can be described as discontinuous. The concept was developed as an alternative to phyletic gradualism, which stresses consistent, cumulative changes to species. The difference between the two theories is illustrated in Fig. 17.1. The central proposition of Punctuated Equilibrium embodies

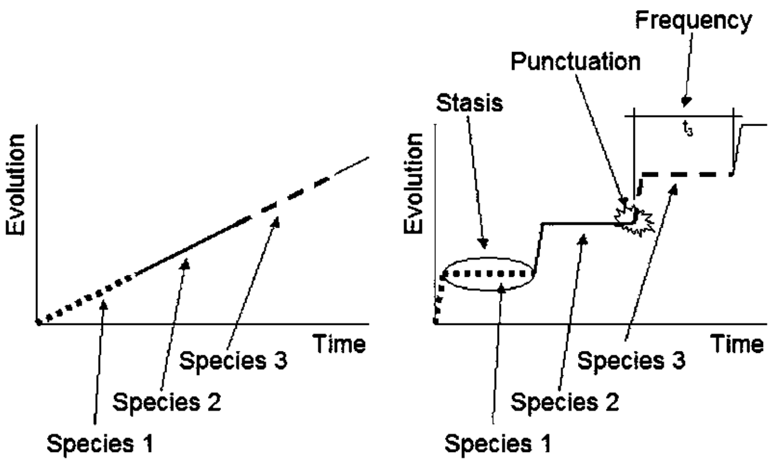

Fig. 17.1 Phyletic gradualism versus Punctuated Equilibrium

three concepts: stasis, punctuation, and dominant relative frequency (Eldridge and Gould 1972). Stasis refers to a long period of relatively unchanged form; punctuation is radical change over a short duration; and dominant relative frequency is the rate these events occur in a particular situation. It should be noted that the theory is not universally accepted in the natural sciences and has engendered significant debate from proponents on both sides (Sterelny 2001).

17.2.2 Application to Management

Within the context of organizations, the Punctuated Equilibrium model consists of equilibrium periods, revolutionary periods, and deep structures. Similar to Eldridge and Gould's stasis, equilibrium periods are characterized by the maintenance of organizational structures and activity patterns, where small incremental adjustments are made to adjust for environmental changes without significantly affecting the status quo over a long period of time. Revolutionary periods are shorter and occur due to significant changes in the environment that lead to wholesale upheaval where a system's status quo comes apart, leaving it in disarray until the period ends and choices are made around which a new structure forms (Gersick 1991). Revolutionary periods are triggered by punctuations, which can be defined as triggering events that result in pervasive changes occurring to the entire organization over a relatively short period of time. Deep structure is "the set of fundamental 'choices' a system has made of (1) the basic parts into which its units will be organized – e.g. organizing a business by departments or product lines, and (2) the basic activity patterns that will maintain its existence" – for example, centralized versus decentralized governance structures (Gersick 1991, p. 14). Deep structures, because they are often difficult to modify, help to maintain a status quo. Consequently, Eldridge and

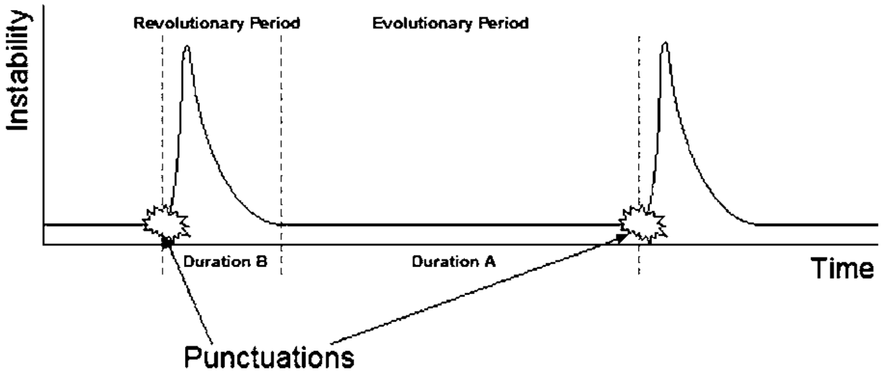

Fig. 17.2 Organizational punctuations

Gould's "dominant relative frequency" is analogous to the frequency of radical changes in an industry, as illustrated in Fig. 17.2.

PE hypothesizes that some organizations remain substantively unchanged in structure (e.g., governance, internal organization of divisions, product lines) or patterns of behavior (e.g., management practices, ways of competing or strategic orientations) for extended periods of time because restraining forces of inertia and institutionalism resist changes from accumulating (Tushman and Romanelli 1985). This statement does not preclude an organization continually changing its practices, structures, or strategies over time, simply that these changes do not "stick," or accumulate, and that the firm remains effectively unchanged over time. PE theory further hypothesizes that when changes to these organizations do occur, they happen over short periods of time, are triggered by some significant event occurring, and involve very rapid, major adaptation. Table 17.1 provides key examples from recent management literature on Punctuated Equilibrium.

17.2.3 Decomposing Punctuated Equilibrium

Table 17.2 deconstructs Punctuated Equilibrium as this theory is commonly used in the organization sciences (Kuhn 1970; Gersick 1991; Romanelli and Tushman 1994; Sastry 1997). Punctuated Equilibrium consists of two temporal constructs and one organizational construct (equilibrium periods, revolutionary periods, and punctuations, respectively):

- *Equilibrium periods*. Periods when an organization makes incremental adjustments in response to predictable changes in the internal and external environment.
- *Revolutionary periods*. Periods when an organization makes discontinuous adjustments in response to acute, often unexpected, changes in the internal and external environment.
- *Punctuations*. An instance of an acute or unexpected trigger event that the organization is unable to incrementally adapt with.

Table 17.1 Selection of management research using Punctuated Equilibrium

Study	Punctuation	Industry	Empirical result
Tushman and Anderson (1986)	Order-of-magnitude improvements in price-performance	Airlines, Cement and Minicomputers	Most industry change occurs soon after a discontinuous technological innovation. Discontinuities affect the industry differently depending on the qualities of the technological innovation
Anderson and Tushman (1990)	Technological discontinuities: industry innovations that push a company's performance frontier along a parameter of interest by a significant amount and do so by changing the product or process dominant design as opposed to merely enlarging the scale of existing design	Cement, Glass, and Minicomputers	Technological discontinues are followed by single standards, but discontinuities do not become standards. Time span between discontinuities and standard adoption varies by industry and type of discontinuity
Romanelli and Tushman (1994)	Revolutionary transformations: A change in all three dimensions of their organizational domains typology (strategy, organizational structure, and power distribution)	Minicomputers	A majority of organizational transformations were accomplished via rapid and discontinuous change across all or most domains of organizational activity
Hoffman (1999)	Disruptive events: examples include publication of "Silent Spring"; celebration of the first "Earth Day"; changes in industry regulation; and large industrial accidents	Chemical	Observable disruptive events (industry-level) preceded pervasive changes in organizational field (number and type of industry stakeholders and relative power) and industry institutions
Haverman, Russo and Meyer (2001)	Major changes to existing regulatory structure	Hospital and Thrifts	Regulatory punctuations resulted in changes in organizational domains and CEO leadership. Effects were relative to industry

To summarize the table, Punctuated Equilibrium theory makes two strong claims: (1) a pervasive change in the organization occurs (2) in a rapid time frame. A path-dependent process is hypothesized where the occurrence of triggering events, the "punctuation," increases the probability of a significant organizational change occurring very rapidly and impacting the entire organization.

Table 17.2 Deconstructing Punctuated Equilibrium theory

Element	Description
What	Organizations change through alternating between periods of equilibrium (in which organizations undergo only incremental change) and periods of revolution (in which organizations undergo discontinuous change) that are triggered by events of acute, radical change that the organization is not able to incrementally adapt with
How	A crisis point – a point in time where an unavoidable problem is recognized – occurs, which attracts a triggering event (a punctuation) often in response to the crisis. The triggering event initiates the beginning of a revolutionary period of discontinuous change that creates the basis for the next period of stability. A crisis point does not, however, trigger revolutionary change, it only creates the need – triggering events create the revolution
Why	Organizations establish initial patterns of structure and activity based on the environmental conditions and management philosophies at a particular point in time, and, as a result of inertia and institutionalism, organizations strengthen ("thicken" Siggelkow 2002) these structures and activities over time, supporting the stability of established patterns. Organizations benefit from stability by being better able to pursue mutually well-understood goals, effectively and efficiently accomplish work, and becoming increasingly better at what they do
	Existing structures and activities must therefore be significantly weakened or eliminated for fundamental changes (such as those required in response to a crisis) to occur. Punctuations break inertial and institutional forces and allow for significant changes to established structures and activities. Punctuations, in disrupting existing patterns of structure and activity, mark the beginning of a resettling period where structures and activities are reestablished. Once reestablished, organizational structures and activities once again become increasingly strengthened over time, marking the beginning of a new equilibrium period
Where	Punctuated change, being driven by organizational responses to internal and external variations over time, is more likely to occur in situations/environments where variations occur more often (e.g., democratic governments regularly changing leadership), or at times in history when variations occur more often (e.g., following innovative technology introductions such as the development of the transistor in the 1950s)
When	Punctuated change is more likely to occur when organizations experience changes in their internal or external environments that build up (over time) or occur (all at once) at a faster rate than they are able to recognize and incrementally adapt with. However, as mentioned above, it is not the change, incremental or sudden, that increases the probability of punctuated change, it is the ability of the organization to adapt to the change without having to make radical changes. Punctuations are more likely to originate after unavoidable problems are recognized
Who	Organizations that are less susceptible to inertial and institutional barriers are probably less likely to be subject to punctuated change

17.2.4 Discussion of Theory

Punctuated Equilibrium theory is one theory of organizational change that is somewhat differentiated by other change theories in that it focuses on the context and velocity in which changes occur in organizations. At its heart, Punctuated Equilibrium theory explains organizational change and forms predictions about patterns of fundamental organizational transformation. Using Gregor's (2006) typology of theories in IS, this would make PE a Type IV theory for explaining and predicting. The theory contends that the normal state of an organization is to be in "stasis": a situation marked by stable organizational activities and structures that are in equilibrium (Greiner 1972; Van de Ven and Poole 1995). Occurrences of organizational, behavioral, and technological stasis are common observations in MIS research (e.g., Street and Meister 2004; Krovi 1993; Cross et al. 1997, respectively).

Steady-state conditions are jointly created by both existing environmental circumstances and the managerial decisions made over time. Organizations then continue to actively support the steady-state pattern of activities as a joint result of organizational inertia (Haveman et al. 2001) and institutionalization (Meyer and Rowan 1977) and come to develop coordinated, interdependent systems of action (Tushman and Romanelli 1985).

Organizational inertia comes from at least two sources, cognition and motivation. Cognitive barriers include problem recognition (phenomena "that will not fit the box are often not seen at all" – Kuhn 1970, p. 24) and "Einstellung effects," people's tendency to continue with the same approach to a problem or series of problems regardless of whether the approach is productive or not (Luchins 1940). Within IS literature motivational barriers to change have included pain of loss of control (Bhattacherjee and Hikmet 2007), uncertainty (Pavlou et al. 2007), fear of failure (Fitzgerald and Russo 2005), and sunk costs (Keil et al. 2000) associated with changing established organizational patterns.

Institutional barriers originate from at least two sources, regulatory and socialization effects. Regulatory effects include the formal and informal limits placed on an organization's structures and activities through government legislation or industry norms influencing what an organization can and cannot do. Socialization effects include the shared understanding among organizational managers of how and why particular structures and activities exist as they do. Inertia and institutionalism help keep structures and activities intact, first by preventing changes that deviate from established structures and activities, and second by pulling any deviations back into line (Silva and Hirschheim 2007).

According to Punctuated Equilibrium theory, these periods of stasis are difficult to modify and require sharp, radical and often discontinuous change to break free from the organizational gravity associated with existing patterns of behavior and structure (Lewin 1951). A principal hypothesis of Punctuated Equilibrium theory is that fundamental organizational change is triggered by rapid, radical, and pervasive adjustments to some element of an organization's critical domains, overcoming inertia and institutionalism.

The extent to which an entity survives and prospers following a punctuation is dependent on its ability to develop new ways of "being and doing" (Eldridge and Gould 1972). The post-punctuation environment is typically different from what was seen before and often creates the opportunity, if not the requirement, for new ways of doing things. In organizational studies, different managerial activities are theorized to be required because the organizational environment is simply not the same as it was before in terms of the challenges it faces and/or the environment it coexists in. Greiner (1972) argued that new management challenges are posed in each successive postrevolutionary period and that new ways of dealing with growth, administrative control, and employee development issues, for example, require different skills sets in different periods. D'Aveni (1994) discussed how companies often need to fundamentally transform their organizational activity patterns following significant changes in the competitive marketplace in order to survive and prosper. It should be noted, however, that revolutionary outcomes, based on interactions of a system's historical resources with current events, are not predictable and they may or may not leave a system better off (Gersick 1991).

Organizational theorists argue that organizations remain or become successful over time in constantly shifting environments by capitalizing on opportunities to radically redefine or develop new repertoires of organizational activities in order to better fit their environment over time (Schumpeter 1934; Brown and Eisenhardt 1997; Siggelkow 2001). According to this view, capitalizing on opportunities to redefine or develop new organizational activities is considered a prerequisite to later success. Capitalizing on opportunities to develop new activities in transformed environments is critical to Punctuated Equilibrium theory in that it establishes the key condition that supports progression through revolutionary transformations as the principal means through which organizations remain or become increasingly more successful over time.

17.3 Levels of Analysis, Alternative Theories, and Applications

While Punctuated Equilibrium developed from biology (Eldridge and Gould 1972) and is described in the previous section within an organizational context (Tushman and Romanelli 1985), Gersick (1991) describes several alternative applications of PE as a type of revolutionary change theory. At the individual adult development level, a life structure can be viewed as a relatively orderly sequence of stable and transitional periods (Levinson 1978). Group development is similarly subject to inertial and revolutionary forces over time (Gersick 1988). Within scientific fields, periods of normal science are punctuated by scientific revolutions that overturn the traditional establishment and body of knowledge (Kuhn 1970). Finally, at the self-organizing systems level, stable periods support a dominant rule of law that is supplanted periodically with instable periods where multiple possibilities exist for the future form of the system (Prigogine and Stengers 1984).

This theory is one of several proposed explanations of how organizations evolve over time as well as why some may be less conducive to change than others and is only one competing evolutionary theory in the natural sciences (Sterelny 2001). In a similar fashion, Punctuated Equilibrium can also be situated within a framework of competing organizational change theories constructed from dimensions of pace and scope (Plowman et al. 2007). Pace refers to whether change is continuous or episodic (Weick and Quinn 1999) whereas scope refers to whether the change is convergent or radical (Greenwood and Hinings 1996; Tushman and Romanelli 1985). Continuous change is frequent, cumulative, and incremental, resulting from instability caused by tension between existing priorities and future opportunities (Meyer et al. 1990; Rindova and Kotha 2001). Conversely, episodic change is infrequent,

Table 17.3 Framework of organizational change theories

		Scope	
		Convergent	Radical
Pace	Continuous	Persistent gradualism	Turbulent adaptation
	Episodic	Tectonic shift	Punctuated equilibrium

noncumulative, and dramatic, resulting from breaking of prolonged institutional inertia in the face of organizational or environmental challenges (Watzlawick et al. 1974; Tushman and Romanelli 1985). Convergent change is consistent with the existing organizational frame and builds on existing practices and strategies (Siggelkow 2002; Weick and Quinn 1999). In contrast, radical change requires organizational adaptation to new practices that challenge the existing order, organizational frame, or dominant design (Plowman et al. 2007; Anderson and Tushman 1990). Table 17.3 depicts the combination of the dimensions in a single framework (adapted from Plowman et al. 2007 and Street and Gallupe 2009).

17.3.1 Persistent Gradualism

Similar to the concept of phyletic gradualism in biology, persistent gradualism in organizations consists of small, emergent adaptations that occur within the existing organizational frame (Greenwood and Hinings 1996; Plowman et al. 2007). An example of this approach is the "linear progression" of a constant evolution in core organizational elements through a process of "thickening (reinforcement of an existing core element by new elaborating elements), patching (creation of a new core element and its reinforcement by new elaborating elements), coasting (no further elaboration of a new core element in a given period), and trimming (deletion of a core element and its elaborating elements)" resulting in continual organizational transformation (Siggelkow 2002, p. 125). Similarly, there have also been observations of continual, path-dependent change based on low-cost probes of future paths in industries used to support PE, such as the computer industry (Brown and Eisenhardt 1997). In essence, persistent gradualism argues that small changes accumulate over time to create large changes, while PE asserts that small changes do not accumulate over time (Tushman and Romanelli 1985).

17.3.2 Tectonic Shift

The core PE concept of long periods of stability being interrupted by episodic change is common with tectonic shift (Nadler and Tushman 1989). However, in tectonic shift, the adaptations to processes and practices, while often rapid and dramatic, are still consistent with the organizational frame (Greenwood and Hinings 1996; Weick and Quinn 1999). In a study of national sport organizations (NSO), it was found that the scope of change was independent of pace, and that episodic change could support existing competences of the organization (Amis et al. 2004). In the case of the NSOs, substantial external pressure triggered organizational changes in structure, but the organization's mission remained the same. Loch and Huberman (1999) modeled similar patterns in their examination of technology diffusion following punctuations. Tectonic shift is similar to PE in that both are episodic in nature, but different in that it does not destroy the existing competences of the organization as PE does (e.g., Loch and Huberman 1999).

17.3.3 Turbulent Adaptation

Companies can fundamentally transform themselves in a short period of time without a punctuation being involved, using processes of "continuous morphing" (Rindova and Kotha 2001) or "fast adaptation" (Eisenhardt and Tabrizi 1995). Adaptation is a continuous process, which is reinforced by new practices becoming the basis for further change, replacing the existing organizational frame (Romanelli and Tushman 1994; Weick and Quinn 1999). For example, 3M is known for regularly introducing new product lines and creating entire new markets with their product innovations over much shorter time frames than their competitors (Stevens 2004). Internet companies such as Yahoo! and Excite that started out looking very similar transform into entirely different businesses after only a few years of experimenting (Rindova and Kotha 2001), a computer company like Hewlett Packard evolved through entirely different product lines (Eisenhardt and Tabrizi 1995) and a church morphed itself from a conservative place of worship to an activist supporter of the homeless (Plowman et al. 2007). The radical adaptation of these organizations takes the form of continuous turbulence within them. PE would suggest that this level of radical change occurs episodically, while turbulent adaptation would suggest that it can be a continuous process.

17.4 Four Applications of Punctuated Equilibrium in IS Research

One of the key punctuations noted in research is major environmental change caused by technological innovation (Romanelli and Tushman 1994) where a technological discontinuity triggers a period of instability, which is followed by the emergence of a dominant design or business paradigm (Anderson and Tushman 1990). Diffusion of such technology is dependent upon punctuations of the equilibrium between the use of the old and the new technologies (Loch and Huberman 1999). The introduction of a disruptive, or competence destroying, IS innovation (Lyytinen and Rose 2003) can be considered a punctuation that interrupts the existing stasis, destroying the existing deep structure. Within the IS literature, PE has been used to predict and explain periods of change in four different contexts, virtual teams, IS implementation, organizational change, and strategic alignment, highlighted here and summarized in Table 17.4.

Table 17.4 Selection of information systems research using Punctuated Equilibrium

Study	Area	Results
Lassila and Brancheau (1999)	IS Implementation	Adaptation of commercial software packages and organizational processes follows a discontinuous change pattern where significant changes in the appropriation of technology, users, or organization context disturb the equilibrium of utilization. Redefinition of the technology in a revolutionary phase concludes with the incorporation of changes into altered work processes into a new equilibrium state
Porra (1999)	Organizational change	Colonial systems are based in PE and operate through periods of homeostasis (equilibrium) and radical change (revolution). A method of punctuated prototyping allows local colonies to survive and prosper by creating and adopting isolated prototypes. This model explains how information systems, organizations, and social institutions change
Sabherwal et al. (2001)	IS alignment	IT alignment goes through long periods of relative stability, or evolutionary change, interrupted by short periods of quick and extensive, or revolutionary, change. Findings suggest that during stable times, IT may not be properly aligned. Deep changes from a punctuation are beneficial to the firm in the long run
Arnott (2004)	IS implementation	Evolutionary processes of decision support systems (DSS) are shown to follow either continuous evolution or Punctuated Equilibrium processes. A framework is developed where causal factors of change and application relationships result in a particular evolutionary path
Jarvenpaa et al. (2004)	Virtual teams	PE is used to theorize about structural strength of IT-enabled relationships and how it changes for individuals during the life of a team. PE is used to identify the midpoint of team development and classify the team's activities and trust before and after the midpoint
Street and Meister (2004)	Organizational change	The study investigated how small business management team developed an IS-enabled solution to address their growth needs. Based in PE, a model was developed examining the relationship between internal transparency, small business growth, and IS
Street (2006)	IS alignment	Alignment capabilities develop over time, such as: IS service matching, environmental IT scanning, assessing alignment, building stakeholder commitment, IT filtering, prioritizing IT resources, and strategic IT experiments. The alignment capabilities of organizations that experience punctuations were weakened by the change, while those that did not strengthened their capabilities over time

(continued)

Table 17.4 (continued)

Study	Area	Results
Silva and Hirschheim (2007)	IS implementation	Implementing strategic information systems (SIS) may bring radical changes to an organization's deep structure. Implementation should, therefore, include not only technical aspects but also the social dynamics of an organization, as SIS are oriented on strategic objectives and therefore can initiate revolutionary periods
Lyytinen and Newman (2008)	IS implementation	The Punctuated Socio-Technical Information System Change model recognizes IS change has incremental and revolutionary components and operates at the work system level, the building system level, and the organizational environment. Critical socio-technical events, which can be punctuations, are seen to occur in the gaps of socio-technical systems, leading to revolutionary periods

17.4.1 Virtual Teams

Virtual teams are networked organizations enabled by advances in communications and information systems technologies (Jarvenpaa and Ives 1994). Several IS studies on virtual teams used Gersick's (1988, 1989) PE-based model of team development. PE plays a particularly important role in time of group development and diversity, as it provides a more flexible model than a strictly stage model (Carte and Chidambaram 2004). The model has also been used to define transition points in projects to examine the effects of trust on virtual teams and project outcomes (Jarvenpaa et al. 2004). In these two studies, PE proved an effective model for viewing team development; however, not all virtual team studies fully support Gersick's PE-based model. For example, while one study reported that gradualism was not present, they had difficulty identifying a suitable punctuation to define the team's transition (Sarker and Sahay 2003).

17.4.2 IS Implementation

The implementation of information systems has been framed in terms of Punctuated Equilibrium versus continual evolution (i.e., persistent gradualism) (Arnott 2004). External pressures and complex linkages were both seen as leading to punctuations due to the requirement to overcome organizational inertia. For example, software packages are seen as likely to disturb the equilibrium as they often contain new capabilities and business logic that require changes to organizational processes (Lassila and Brancheau 1999). Due to their complexity, ERP implementations have been viewed as punctuations, where gaps in the system will require changes to equilibrium processes resulting in a revolutionary period (Newman and Zhao 2008).

Other strategic IS implementations have similarly been seen as punctuations, due to their wide scope and impacts on the organization's deep structure (Silva and Hirschheim 2007). PE has even been integrated with socio-technical theory to develop a multilevel model of episodic system changed called the Punctuated Socio-Technical IS Change (PSIC) model (Lyytinen and Newman 2008). Research into post-adoptive behavior has also been conducted using PE as a lens. Patterns of IS use are characterized as deep structures, whereas new system implementations are regarded as punctuations triggering periods where the systems are dismantled and then recreated as new (or modified) deep structures (Jasperson et al. 2005). However, it is interesting to note that not all IS implementations are seen as triggering periods of revolutionary change, as some implementations result in incremental adaptation (Lassila and Brancheau 1999). To date, no one has proposed explanations for why the implementation process may follow one pattern or another.

17.4.3 Organizational Change

The IS function itself is popularly considered a deep structure in MIS research (Jasperson et al. 2005; Stoddard and Jarvenpaa 1995), where changes to the IS function can either initiate or be the result of punctuations. These effects are not unique to large firms, but have been observed in IS implementations in small businesses, such as in a case where an IS system procurement was used to create a revolutionary period of growth and change the deep structures of the firm (Street and Meister 2004). The concept of colonial systems, used to describe system, organizational, and social change, is also grounded in PE (Porra 1999). Changes to IS management and structures can be examined in terms of PE and colonial systems. For example, a series of organizational changes in Texaco and their resultant governance impacts have been identified as punctuations using the colonial systems interpretation (Porra et al. 2005).

17.4.4 Strategic Alignment

Alignment has been conceptualized in various ways, but is frequently tied to fit between business and IS missions, visions, objectives, goals, strategies, and structures (Chan and Reich 2007). Sabherwal et al. (2001) examined the alignment process in traditional competitive contexts and established that IS alignment evolves in patterns that resemble a Punctuated Equilibrium (Gersick 1991) organizational model. In this view, alignment is a persistent organizational characteristic that does not change significantly over short-to-medium-term time spans unless preceded by organizational "punctuations" that shake up the organization and allow changes to occur. One important punctuation that impacts on alignment is in mergers and acquisitions (Mehta and Hirschheim 2007). The role, sourcing, and structure of IS can be changed significantly during the revolutionary period, but IS alignment was shown generally not to be considered as a significant issue in merger planning. Alignment capabilities have also been seen to develop over time and that in organizations that experience episodic punctuations, these capabilities are weakened, while those that did not are strengthened (Street 2006). The linkage between dynamic IS alignment and PE has not been uniformly supported, as persistent gradualism has also been proposed as a mechanism for investigating alignment (Benbya and McKelvey 2006; Boddy and Paton 2005).

17.5 Operationalization of Punctuated Equilibrium

In order to be useful in IS research, a theory must be operationalized. In delimiting the boundaries of Punctuated Equilibrium theory it is useful to also explain what is not normally considered punctuated change. As per the discussion above regarding the differences between the pace and scope of change, not all rapid change is necessarily punctuated change. Operationalization of the concept for IS research, therefore, needs to address identification of these boundary conditions in a falsifiable manner. A suggested method for operationalizing PE is by examining a potential punctuation through the application of four key elements of a definition of the concept: an organizational punctuation is a *triggering event* that results in *pervasive change* occurring to the *entire organization* over a relatively *short period of time*. As this technique requires the identification of potential punctuations over a period of time it is applicable to longitudinal methods such as retrospective case studies.

17.5.1 Triggering Event: Was the Change Event-Driven?

The first premise of Punctuated Equilibrium theory states that, since an organization's defining character is created very soon after its inception and that no significant change accumulates afterward, some readily observable event must occur that has bearing on a persistent characteristic of the organization in order to trigger a noticeable change to occur. Triggering events can be either external to an organization (e.g., change in governing legislations or economic conditions) or internal to an organization (e.g., board meetings that result in changes in senior leadership). To qualify, events must therefore satisfy the criteria of being observable (common knowledge to the majority of the organization's decision makers), distinguishing (impacting a persistent organizational quality), and relevant (capable of having an impact on the strategy or function of an organization).

17.5.2 Pervasive Change: Was There a Transformation?

Most applications of Punctuated Equilibrium theory in management study associate punctuations with changes occurring to an organization's defining structures and processes. As defined by Gersick (1991) and Drazin and Sandelands (1992), these structures and processes refer to the sum total of institutional, technological, and other kinds of structures and processes that tend to make an organizations' "production system" relatively stable and distinct over time. Punctuations are related to structures and processes in the sense that punctuations precede, or trigger, pervasive changes to them. In paleobiology, punctuations are associated with speciation, the creation of a new organism that differs from its close relatives in certain physiological characteristics. The organizational equivalent of speciation is the transformation of a company with different functional, strategic, structural, technological, or procedural characteristics than seen in its predecessor (Romanelli and Tushman 1994).

17.5.3 Entire Organization: Was There an Entity-Wide Systemic Change?

Consistent with the institutionalism and organizational inertia arguments (DiMaggio and Powell 1983) explaining the reasons why punctuations are necessary for change, as well as speciation arguments, the effects of a punctuation are hypothesized to influence the entire organization. This characteristic contrasts with the types of localized change that might result from nonsystemic adaptations occurring, such as a marketing department choosing to drastically reorient an advertising campaign without requiring major changes to basic products. Since institutionalism and inertia are typically regarded as having entity-wide effects, punctuations should theoretically have entity-wide effects as well.

17.5.4 Short Period of Time: Was the Occurrence Rapid?

Strong claims are made that discontinuous revolutionary change occurs "quickly" or "rapidly" while evolutionary incremental change occurs "slowly" or "gradually" (Gersick 1991). In the natural sciences and other domains, doubling and halving are often identified as standards of recognized change (Street and Gallupe 2009). Using this as a measurement standard, if the temporal length of a prior stable period is at least more than double the length of a subsequent "change period," then the change could be considered to have occurred "rapidly." In simple notation:

If $A > 2B$, then B is a period of rapid change, where $A =$ period length of stasis and $B =$ period length of punctuation, both A and B measured on the same scale.

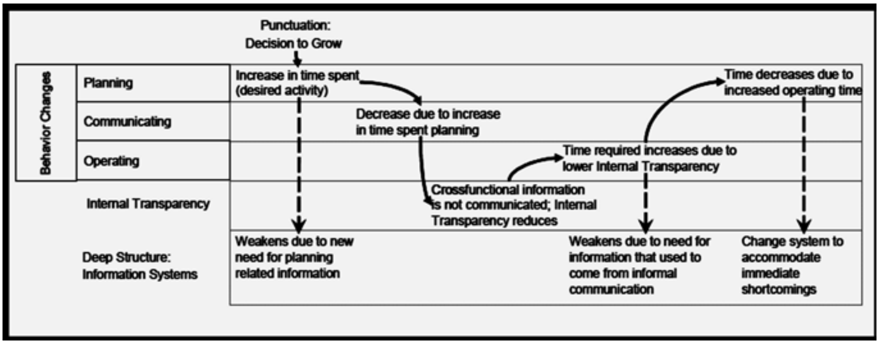

Fig. 17.3 Punctuated Equilibrium model, from Street and Meister (2004)

This approach can be expressed in any time units (e.g., weeks, months, quarters, years) and can be used to compare across organizations with different timescales.

As an example of an IS punctuation triggering a period of pervasive, systemic, and rapid change, consider the model developed in Street and Meister (2004) pictured in Fig. 17.3. In their study, the authors considered a new owner's decision to significantly expand the operations of a mid-sized electronics manufacturer as a triggering punctuation while the planning, operating, and communicating practices and antiquated information system that enabled everything at the time were deep structures holding the organization's status quo together.

As explained in the article, following the triggering punctuation there were a rapid series of pervasive changes that occurred in each area of the organization. These systemic changes were occurring rapidly (2 years), particularly when seen in terms of how long the organization had to set their status quo in place (15 years).

17.6 Conclusion

Looking at the contributions to the IS literature domain from Punctuated Equilibrium theory, our review of the four main areas of research (virtual teams, IS implementation, organizational change, and strategic alignment) suggests a few interesting observations. The virtual team's research illustrates how it is not always clear what a punctuation is or if one has occurred. A critical review of the IS implementation and organizational change research shows a gap in understanding why the change process would be more likely to follow a punctuated pattern versus a continuous or evolutionary pattern. Perhaps most curious, it is not really known in reviewing these four areas whether punctuations are to be regarded as a negative or a positive influence. In some cases punctuated change seems to have an unwanted or unexpected connotation for the organization (e.g., Street and Meister 2004; Sabherwal et al. 2001). In other contexts the opposite appears true;

punctuations could be creating a beneficial sense of crisis that stimulates adaptations (e.g., Silva and Hirschheim 2007). One question we are left wondering is when punctuations might be embraced as a positive influence as opposed to something to be avoided at all costs.

Looking beyond current applications of the PE we also see an opportunity for IS researchers to contribute to PE theory. IS researcher should begin searching for boundary conditions to the theory to find out when and why PE does not predict or explain the technological world. To our knowledge, testing this theory in situations where it might not be expected to be relevant has not occurred in prior research. We see no reasons why identifiable boundary conditions to the theory would not exist. Because of the relationships between organizational change and IS alignment, technology acceptance, diffusion, and implementation, some areas of IS research discussed in this chapter are well-suited to establishing boundary conditions for the theory and thereby contributing to the general advancement of management research.

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Chapter 18
Discrepancy Theory Models of Satisfaction in IS Research

James J. Jiang, Gary Klein, and Carol Saunders

Abstract In this chapter, we present the versatility of discrepancy theory in the explanation and prediction of satisfaction in IS research models and show how to avoid many of the analytical pitfalls. First, we describe the use of discrepancy theory in other disciplines relevant to IS research. Then, we discuss satisfaction as used in IS research starting with user satisfaction followed by employee job satisfaction. In each case, we provide a brief history and show the evolution toward discrepancy models. Next comes an introduction to several common comparative models encapsulated by discrepancy theory that have been deployed in IS research. The remainder of the material in the chapter considers methodological issues and a discussion of implications for future research.

Keywords User satisfaction • Job satisfaction • Expectation-confirmation theory • Discrepancy theory • Difference scores

Abbreviations

ECT	Expectation confirmation theory
EDP	Electronic data processing
IS	Information systems

There are some days when I think I am going to die from an overdose of satisfaction.

–Salvador Dali

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18.1 Introduction

In a very broad sense, satisfaction may be considered the fulfillment of a need or want (Merriam-Webster's Online 2010). Satisfaction weaves through many situations as the result of a judgment about an object or performance as to whether the need or want was fulfilled. Satisfaction is often studied because it is believed that an increase to satisfaction leads to sought-after feelings, attitudes, intentions, and behaviors (Michalos 1985). As IS practitioners we strive to keep our IS employees satisfied, so that they are retained to develop the systems and services for our clients (Rutner et al. 2008). We endeavor to meet client expectations so that they are satisfied with the output of the IS employees, and they use our systems, return to our webstore for future purchases, and remain loyal to our services (Chiou et al. 2010; Huang and Fong-Ling 2009; Kettinger and Lee 2005). We build systems with desirable traits that lead to satisfied users, determine ways to incorporate service concepts into our products to achieve satisfaction with the quality or our system and organization, and sweat over details of information content and presentation to increase the usage by potential customers (DeLone and McLean 1992, 2003; Venkatesh and Davis 2000). Clearly, the achievement of satisfaction in the target individual has become a major goal of IS professionals.

Partly due to its value in practice, satisfaction is also a frequently applied concept in IS research as a judgment about a product, service, practice, or condition. One value of applying satisfaction in a research model arises from an ease of measurement, in addition to its use as antecedents, mediators, and consequences in research models. Given the difficulty involved to accurately and appropriately measure the many complex IS benefits of decision-making effectiveness, productivity, and flexibility, satisfaction is a widely used surrogate for IS success (Au et al. 2008; DeLone and McLean 1992, 2003; Hamilton and Chervany 1981b; Saunders and Jones 1992). The use of satisfaction as measures of success fits well with reasoned action and planned behavior theories applied in the IS literature that indicate positive attitudes will lead to desirable consequences (Davis 1989). Satisfied users lead to an intent to use a system (Bhattacherjee and Premkumar 2004). Further, users who are better trained to anticipate negative surprises resulting from systems use are more likely to be satisfied with new information systems (Griffith and Northcraft 1996). Perceptions of service, information, and system quality impact user satisfaction (DeLone and McLean 2003). Further, IS employees who are satisfied with their jobs have a lower intent to leave (Ferratt et al. 2005). Job satisfaction mediates work exhaustion and turnover intention (Rutner et al. 2008). Thus, satisfaction is used to explain and predict many other facets of an information system and the behaviors of many stakeholders.

Should satisfaction really be a useful surrogate for success, then it is pivotal that we achieve a greater understanding of its formation. In other words we should better understand how to explain and predict the formation of satisfaction. Models developed in the past may not successfully capture the underlying structure of satisfaction (Au et al. 2008; Edwards 2001). For a number of years, researchers in the management disciplines have considered the formation of satisfaction to be a cognitive process of comparison (Locke 1969; Oliver 1981). Two states of nature are compared and any judged discrepancy affects individual levels of satisfaction. The exact form of impact on satisfaction by the discrepancy can vary according to the context, scale, specific theory, and individual (Edwards and Cooper 1990; Tesch et al. 2003). In judging, an individual determines an anchor as a basis of comparison and then forms a level of satisfaction by comparing the anchor to a perceived state of nature for the same scale. The comparison yields both a magnitude of difference and direction away from the anchor. Both direction and magnitude of the difference can be crucial in the determination of satisfaction (Klein et al. 2009). This relationship among the components and judgment is a crucial aspect of discrepancy theory.

Though this may be simple in concept, there are many complications in the application of discrepancy theory in research. For each application of the theory, a researcher must determine the appropriate anchor likely selected by the subject as being one component of the comparison. A second component is the perceived state of nature experienced by the subject. The comparison of the two serves as a judgment resulting in a level satisfaction about the object of evaluation. Any specific model must be based on sound theory or empirical history. The same theoretical basis or empirical history must drive the form of the relationship of the discrepancy between the components to the effect of satisfaction in terms of magnitude and direction (Edwards and Cooper 1990). Proper conclusions are often lacking because analytical methods do not properly handle nonlinearity in the discrepancy and may erroneously reduce the components to a single difference (Edwards 2001; Klein et al. 2009).

In this chapter we present the versatility of discrepancy theory in the research of satisfaction in IS models and show how to avoid many of the analytical pitfalls. First, we describe the use of discrepancy theory in other disciplines relevant to IS research. After that, we discuss satisfaction used in IS research starting with user satisfaction followed by employee job satisfaction. In each case, we provide a brief history and show the evolution toward discrepancy models. Next comes an introduction to several common comparative models encapsulated by discrepancy theory that have been deployed in IS research. The remainder of the material in the chapter considers methodological issues, and a discussion of implications for future research.

18.2 Origins of Discrepancy-Based Satisfaction

Satisfaction is considered by many researchers to be the effect of a judgment of the difference between what is expected or desired compared to what is actually experienced about a product or service (Jiang and Klein 2002; Locke 1976; Oliver 1981). Discrepancy theory research, which we overview below, is the study of this difference between an *a priori* state and subsequent perception. Our focus of discussion will be on two types of satisfaction related to information systems: user satisfaction with information systems and employee satisfaction related to information systems jobs. To understand these two types of satisfaction we draw from the disciplines of marketing and management. In particular, we briefly describe satisfaction from these perspectives. First, we provide an overview of discrepancy theory about satisfaction since it plays an important role in understanding and advancing satisfaction research in multiple disciplines.

18.2.1 Discrepancy Theory Overview

Just what does being different mean to us and what do we do about it? Did you ever experience peer pressure and strive to change to fit in? Are peers the best basis of comparison, or do you strive to meet the standards of personal expectations? Do differences from your standard of comparison make you leery, make you proud, or does it depend on the attributes that you are comparing? These are questions that discrepancy theorists have tackled formally for a number of years (Locke 1969, 1976; Michalos 1985; Oliver 1981; Rice et al. 1989). To generalize from these works, a *discrepancy* is a perceived difference between an anchor and a personal understanding of accomplishment along the same dimension. The anchor can be set by social pressure, established employment goals, personal expectations, threshold requirements, free markets, or any agency or existing bias (Michalos 1985). Depending on the theory, the perceived discrepancy can result in a number of effects, including an adjustment or dismissal of the anchor, a change in the perception of accomplishment, or a resulting belief that may in turn lead to a particular attitude or action.

The magnitude and direction of the discrepancy assist in determining the level of satisfaction. The further we are from meeting our publication goals as research faculty, the less satisfied we become. Subsequent actions are not dictated by discrepancy theory but may lead us to question the wisdom of our career choice, question the standards set by our dean, dedicate more time each week to getting that next paper out, or take one of many other actions. However, if we exceed our publishing goals we are more satisfied and can relax, take a longer vacation, push for raise in money to be allocated based on research instead of teaching, or a subset of many possible actions that can be modeled and studied. Personal satisfaction with our publication performance might vary from extremely dissatisfied at high magnitudes of failing to meet an established publication anchor to extremely satisfied at high magnitudes of exceeding the anchor.

Discrepancy theory can help explain or predict almost any satisfaction, and the resulting satisfaction be employed to study other theories that consider the antecedents or consequences of satisfaction. But the application of discrepancy theory has strong restrictions and analytical hurdles that must be overcome. The researcher must choose an anchor that best reflects a consistent meaning across subjects in the context of any study. Both ends of the comparison, the anchor and perceived or actual value, must be measureable by identical items in each scale. Anchors adjust over time, since as experiences accumulate personal anchors change through internal adjustment and external processes. Forms of satisfaction are numerous, so only those that can be well explained by the comparative process can be selected. The representation of discrepancy is problematic for modeling as the shape of the relationship among the components, the judgment of whether the components match, and the resulting satisfaction vary from the linear and may even have discontinuities (Edwards and Cooper 1990). Measuring the magnitude of the discrepancy and modeling the relationship between the discrepancy and satisfaction must be done with a great deal of care (Klein et al. 2009). Perhaps for these reasons, discrepancy models have seen minimal use in the information systems field, and limited use in related management disciplines.

18.2.2 Management Studies of Job Satisfaction

Based on Maslow's hierarchy of needs theory (1943), Porter (1961) explored perceptions of need fulfillment and importance by level of management. The highest-order need of self-actualization was the most critical in terms of both perceived deficiency of fulfillment and perceived importance to the individual. This was an early use of a discrepancy concept in personnel management. Since then, numerous organizational researchers have proposed discrepancy theories of pay and job satisfaction (Caligiuri et al. 2001; Cooper and Artz 1995; Irving and Meyer 1994, 1999; King et al. 1988; Lawler 1971; Locke 1969, 1976; Shapiro and Wahba 1978). In this section, our focus is on *job satisfaction*, where job satisfaction is a function of "the extent to which rewards actually received meet the perceived equitable level of rewards" (Porter and Lawler 1968, p. 31). Job satisfaction may be viewed either as a global, overall view of satisfaction or as specific satisfactions with the various facets of the job (i.e., pay, supervisor, promotion, etc.) which are somehow combined to determine overall job satisfaction.

As noted by Locke (1969, 1976), the effects of positive and negative discrepancies depend on the specific combination of job facet and standard of comparison being considered to produce dissatisfaction. Locke believed that only unfulfilled desires can cause dissatisfaction and that satisfaction results from comparing fulfillment of a job facet with the desired or ideal state for that facet (Wanous and Lawler 1972). In other words, when pay is the job facet considered and the amount received by coworkers is the standard of comparison, workers receiving less pay than coworkers are likely to be dissatisfied and workers receiving higher pay than coworkers are pleased with the positive discrepancy (Lawler 1971). In this case the employee determines if the job provides equitable outcomes by comparing his outcomes with others. Such a comparison resulting in a perception of equitable outcomes is the basis of equity theory (Adams 1963, 1965). Satisfaction is often the effect of discrepancy theory. However, a discrepancy also can occur when individuals ask if their present job comes close to what they believe the ideal job to be based on their own personal standard (Wanous and Lawler 1972).

Locke does not believe it is necessary to consider the importance of a job facet in calculating job satisfaction (Wanous and Lawler 1972). Porter (1961) agrees with Locke that satisfaction should be calculated based on determining the discrepancy between what "should be" and "what is now" for each job facet and then summing the job facets scores to determine job satisfaction. However, Porter, unlike Locke, believes that the discrepancy term for each job facet should be multiplied by an importance or valence factor. These early differences in models already show a wide variation in components, relationship shapes, and anchors.

Research on discrepancies has informed our understanding of job satisfaction in a number of ways. For example, Rice et al. (1989) found that satisfaction with specific job facets is clearly related to discrepancies between facet experiences and the desired level of those same job facets. Irving and Meyer (1999) found that meeting job expectations predicts job satisfaction, organizational commitment, intention to leave (remain) job survival, and job performance (Wanous et al. 1992). The communication of high valence rewards also predicts job satisfaction (King et al. 1988).

On the whole, a discrepancy theory framework forms the underpinning of models suggesting that job satisfaction is determined, in part, by the discrepancies resulting from a psychological comparison process involving the appraisal of current job experiences against some personal standards of comparison (Rice et al. 1989). The psychological comparison process can produce both positive and negative discrepancies depending on the specific combination of job facet and standard of comparison (King et al. 1988; Locke 1969, 1976). For this reason, discrepancy theory has a unique capability to predict satisfaction (Cooper and Artz 1995; Michalos 1985; Rice et al. 1989). It acknowledges that job satisfaction is related to both the direction of deviation and the magnitude of deviation, but not necessarily proportionally. A 7–7 (high importance and high fulfillment) = 0 discrepancy is likely not the same as a 1–1 (low importance and low fulfillment) = 0 discrepancy (Wanous and Lawler 1972). Weights on any deviation in the positive direction may not be the same as those in the negative direction (Lindsay et al. 1967). Further, variations are essential as the relationship from facet to satisfaction is different for each facet (Schein 1978). The closer the collective match between organizational haves and individual wants, the higher the job satisfaction and the lower the turnover intention (Irving and Meyer 1999). The weights on each facet are not uniform, however (Jiang and Klein 2002). They may vary depending upon which facet is more important. These variations make it difficult to define the anchor reflective across respondents.

18.2.3 Marketing Studies of Consumer Satisfaction

The literature in consumer satisfaction provides a general framework for the examination of how perceptions of delivery and expectations can impact user satisfaction (Churchill and Surprenant 1982; Szymanski and Henard 2001). *Consumer satisfaction* is commonly defined as a "post-choice evaluation which varies along a hedonic continuum from unfavorable to favorable, in terms of whether or not the experience of a specific purchase was at least as good as it was supposed to be" (Jun et al. 2001, p. 142). *Expectations* reflect anticipated performance. They can be

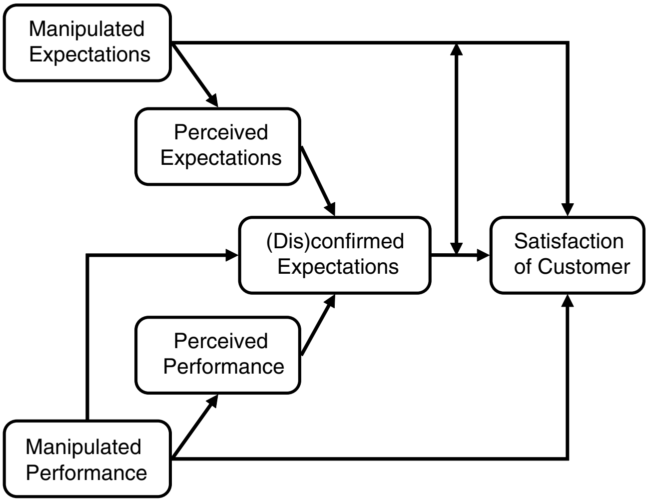

Fig. 18.1 Linkages tested in prior marketing research (Adapted from Churchill and Surprenant (1982))

considered in a variety of ways, including anticipatory elements or comparison to other referents (Szymanski and Henard 2001). *Performance* in consumer satisfaction studies is the ability of the product or offering to add value along the lines promised by the provider. One of its primary importances in the consumer satisfaction literature has been as a standard of comparison by which to assess disconfirmation (Churchill and Surprenant 1982). That is, expectations and performance delivery perceptions lead to a disconfirmation measure of the discrepancy between expectations and perceived performance. Expectations can influence perceived performance as perceptions can be clouded by prior expectations (Niedrich et al. 2005). Expectations, perceptions of performance, and a perception of whether the performance met expectations all lead to consumer satisfaction (Churchill and Surprenant 1982).

While the dominant focus in empirical investigations in consumer satisfaction research has been on modeling disconfirmation and performance for their effects on satisfaction, the cumulative findings suggest that performance is not a dominant predictor of satisfaction (Szymanski and Henard 2001). That may explain why the focus of consumer satisfaction research shifted to the relationships among perceived expectations, disconfirmation, and satisfaction (Churchill and Surprenant 1982). *Disconfirmation* "arises from discrepancies between prior expectations and actual performance" (Churchill and Surprenant 1982, p. 492). It holds a central position as the crucial intervening variable in consumer satisfaction research literature.

Figure 18.1 illustrates linkages that were tested in early consumer satisfaction research (Churchill and Surprenant 1982). Subsequent studies have looked at such factors as the role of offering type (i.e., product vs. service) (Anderson et al. 1997;

Churchill and Surprenant 1982; Halstead et al. 1994), affect versus cognitions (Jun et al. 2001; Szymanski and Henard 2001), context (i.e., industry type, students vs. nonstudent participants) (Fornell 1992; Jun et al. 2001), information satisfaction (Spreng et al. 1996), and outcomes (e.g., complaining, negative word of mouth, repurchase intentions) (Szymanski and Henard 2001). Based on a meta-analysis of 50 studies, Szymanski and Henard (2001) found that the product services distinction is important when trying to understand the relationship between affect and satisfaction and satisfaction and repeat purchases. Both relationships were typically lower for products than for services. The realization of expectations matches other psychological fulfillment models that show how attitudes are affected by the correspondence between requirements and the provisions in the environment that meet those desires (Oliver 1981). Finally, the meta-analysis also supported the importance of equity theory in consumer satisfaction research.

Marketing research on consumer satisfaction has been quite concerned about methodological issues. One focus has been on the comparison of multi-item versus single-item scales for capturing satisfaction. Szymanski and Henard's (2001) meta-analysis has revealed that the multi-item measures are definitely preferable. Another focus of consumer satisfaction research has been on whether the comparison process is single and unique or whether it entails multiple comparisons (Tse and Wilton 1988). A third focus has been on the debate between subtractive versus subjective disconfirmation approaches (Tse and Wilton 1988). The subtractive disconfirmation approach assumes that the effects of a post-experience comparison on satisfaction can be expressed as the algebraic difference between a comparison standard and product performance. The subjective disconfirmation approach is based on the subjective evaluation of the difference between a comparison standard and product performance. The subtractive approach may be directly related to satisfaction whereas subjective disconfirmation may be an intervening cognitive state following the comparison process but preceding a satisfaction judgment (Tse and Wilton 1988). Finally, there are a large number of measures for both satisfaction and performance (Fornell 1992; Szymanski and Henard 2001).

18.3 Satisfaction in IS Research

In this section we discuss satisfaction in IS research. Two major streams of satisfaction in IS research are introduced. First, we discuss user satisfaction with IS. This stream of research draws from both marketing and management disciplines. Development of a measure of user satisfaction has been very important in this stream. The second stream of research draws from the management literature on job satisfaction and addresses both the job satisfaction of IS professionals and the impact of IS on the job satisfaction of end users.

18.3.1 User Satisfaction with Information Systems

The IS field has long been interested in developing measures of information systems success. Metrics such as system usage (Doll and Torkzadeh 1988; Ein-Dor and Sege 1982; Lucas 1974), costs versus benefits (King and Schrems 1978), financial returns, decision-making impacts (Larker and Lessig 1980; Hamilton and Chervany 1981a), and organizational advantages (Saunders and Jones 1992), have all been used with mixed results to gauge the benefits of IS to individuals and organizations. IS user satisfaction as an appropriate representation of IS success was proposed in early IS research (Hamilton and Chervany 1981b; King and Epstein 1983; Schewe 1976; Swanson 1974). These authors and subsequent researchers have argued that IS success is achieved when key stakeholders are satisfied with the IS product. Broadly, we consider satisfaction to be the overall affective evaluation a stakeholder has regarding his or her experience related to the information system product or service. This definition is similar to that proposed by Chin and Lee (2000).

User satisfaction has been measured in terms of attitude (Bailey and Pearson 1983; Robey 1979; Swanson 1974), perceived information value and quality (Gallagher 1974; O'Reilly 1982), and perceived improvements in decision-making effectiveness (Schewe 1976). Based on the earlier works, Ives et al. (1983) designed an instrument to measure user satisfaction that was widely applied. However, Doll and Torkzadeh (1988) suggested that the early instrument was designed too narrowly for traditional data processing environments and extended general user satisfaction measures to include EDP staff and service, information products, and user involvement. This expanded scale consisted of information content, information accuracy, information format, ease of use, and timeliness in the end-user computing environments. Chin and Lee (2000) developed additional measures for Doll and Torkzadeh's five satisfaction areas by additionally comparing what an end-user receives to a standard (prior desire or expectation). A summary of articles describing approaches to measuring user satisfaction with information systems is provided in Table 18.1. The correlates identified serve to build scales to measure user satisfaction.

It is clear from Table 18.1 that many scales for an IS user satisfaction measure have been proposed. In general, to ensure important aspects of satisfaction were not omitted under different computing environments (e.g., Internet individual shopping, B2B computing, e-learning, outsourcing… etc.), researchers have proposed different indicators for measuring user satisfaction. It is believed that regardless of how an instrument may have been carefully validated in its original form, changing contexts, deleting items, or modifying selected items do not result in a valid derivative instrument (Straub 1989). For example, Wang et al. (2001) argued that the scales of user information satisfaction developed for the conventional data processing or end-user computing environments may not be appropriate for the digital marketing context where the role of an individual customer is different to individual users in an organization. They proposed seven dimensions of web-based user satisfaction: customer support, security, ease of use, digital/product services, transaction and payment,

Table 18.1 User satisfaction scale development in IS research

Studies	Correlates of user satisfaction
Swanson (1974)	Timeliness, relevance, uniqueness, accuracy, instructiveness, conciseness, clarity, readability, efficiency, convenience, reliability, untroublesomeness, adequacy, promptness, valuableness, cooperativeness
Gallagher (1974)	Quantity, quality-format, quality-reliability, timeliness, cost
Schultz and Slevin (1975)	Individual job performance, interpersonal relations and communication, changes in organization, goals, top management support/resistance, client/researcher work relations, urgency
Schewe (1976)	Decision-making effectiveness, managerial capabilities, job productivity, personal prestige, management control, information usefulness, quality of information, corporate costs, clerical costs, corporate procedures
Larcker and Lessig (1980)	Perceived usefulness (importance and usableness) regarding six aspects of information in the decision-making process
King and Epstein (1983)	Reporting cycle, sufficiency, understandability, freedom from bias, reporting delay, reliability, decision relevance, cost efficiency, comparability, quantitativeness
Baroudi and Orlikowski (1988)	Information product; EDP staff and services; user knowledge and involvement
Doll and Torkzadeh (1988)	Information content; accuracy; format; ease of use; timeliness
Bergeron and Berube (1988)	Presence of user support structure (steering committee, information center, and support group); frequency of consulting with support structures; establishment of microcomputer plan and establishment of policies
Igbaria and Nachman (1990)	Leadership style of IS manager; hardware/software accessibility and availability; computer background of users; user attitudes toward end-user computing and system utilization
Ives et al. (1983)	Relationship with the EDP staff, processing of requests for changes to existing systems, means of input/output with the EDP center, interdepartmental competition with the EDP unit, confidence in systems, chargeback method of payment for services, perceived utility (worth vs. cost), vendor support, computer language, expectation (expected vs. actual level of computer-based support), correction of errors, data security, degree of EDP training provided to users, users' understanding of systems, users' feelings of participation, output information (timeliness, currency, reliability, volume, relevancy, accuracy, precision, completeness), attitude of the EDP staff, top management involvement in EDP activities, format of output, response/turnaround time, determination of priorities for allocation of EDP resources, convenience of access, personal job effects resulting from the computer-based support, communication with the EDP staff, organizational position of the EDP function, time required for new systems development, personal control of EDP service received, schedule of recurring output products and services, documentation, technical competence of the EDP staff, system flexibility, database integration

(continued)

Table 18.1 (continued)

Studies	Correlates of user satisfaction
Bailey and Pearson (1983)	Top management involvement, organizational competition with the EDP unit; charge-back method of payment for services, relationship with the EDP staff, communication with the EDP staff; technical competence of the EDP staff; attitude of EDP staff; schedule of product and services; time required for new development; processing of change requests; vendor support; response time; means of input/output with EDP center; convenience of access; accuracy; timeliness; reliability; completeness; relevancy; precision; currency; format of output; language; volume of output; error recovery; data security; documentation; expectations; understanding of the system; perceived utility; confidence in the systems; feeling of participation; feeling of control; degree of training; job effects; organizational position of the EDP function; flexibility of systems; integration of systems
Rushinek and Rushinek (1985)	# of users; # of computer systems at the site; average life of system; type of system; ease of operation; reliability; maintenance service responsiveness and effectiveness; technical support; documentation; operation system; ease of programming; ease of conversion; expectation
Henry and Stone (1994)	Management support; ease of system use; previous computer experience; computer self-efficacy; computer expectancy
Kettinger et al. (1994)	Service quality: tangibles; reliability; responsiveness; assurance; empathy
Lee and Pow (1996)	Information access behavior; expectation of quality
Sethi and King (1998)	Use of IT; relationship with computer support staff; technical skills of computer support staff; responsiveness of computer support staff; access to computer support staff; effectiveness of computer support staff; participation in decision-making about computer resources; degree of control over computer resources; training programs availability; steps that the administration have taken to improve computing facilities and resources provided for computing activities
Palvia and Palvia (1999)	Software adequacy; software maintenance; information content; information accuracy; information format; ease of use; timeliness; security and integrity; reproductivity; documentation; vendor support; training and education
Chin and Lee (2000)	Expectation- and desire-based satisfaction: information accuracy, information format, information timeliness, system ease of use, speed of operation; overall
Wang et al. (2001)	Customer support; security; ease of use; digital product/service; transaction and payment; information content; innovation
Wang et al. (2007)	Customer attitude, perceived utility, overall satisfaction

information content, and product/service innovation. By exploring and validating user satisfaction factors, these studies have provided insights on what technical, behavioral, and organizational factors may influence the users' satisfaction on any particular IS application.

The scales developed to measure user satisfaction have appeared in a large number of IS studies, with a small sample appearing in Table 18.2. The studies represent a variety of contexts, factors, and measures. However, only a small number of IS

Table 18.2 A sample of user satisfaction in IS research

Study	Factors	Role for satisfaction	Measure	Discrepancy view of satisfaction?
McKinney et al. (2002)	Web customer satisfaction, information quality, system quality	Both information and system quality are components of customer satisfaction	Four items for information satisfaction, four for system satisfaction, six for overall satisfaction	Yes
Negash et al. (2003)	Information quality, system quality, service quality	User satisfaction as dependent variable	Two items of overall satisfaction	No
Karimi et al. (2004)	Environmental uncertainty, task interdependence and routineness	User satisfaction with data as dependent variable	Six items for satisfaction with data	No
Wixom and Todd (2005)	Information quality, system quality, usefulness, ease of use, attitude, intention	Mediator to ease of use and usefulness	Two items of system satisfaction, two items of information satisfaction	No
Nadkarni and Gupta (2007)	Perceived and objective website complexity, user familiarity, task goals	User satisfaction as dependent variable	Six items from McKinney et al. (2002)	No
McGill and Klobas (2008)	System quality, participation, involvement, perceived system quality, individual impact, perceived individual impact	Mediator to impacts	Two items of needs, efficiency, effectiveness, overall	No
Zhang (2010)	Information quality, system quality, sense of community, usage	Mediator to usage	Three items from McKinney et al. (2002)	No
Schaupp (2010)	Information quality, perceived usefulness, social influence, intent to reuse	Mediator to intent to reuse	Three items from McKinney et al. (2002)	No

studies consider the formation of satisfaction using the comparative approach suggested by discrepancy theory, in spite of the large body of work in other disciplines that suggests satisfaction is formed by the comparative process. The aspects of service provisions by the IS function in an organization are viewed through a discrepancy lens (Kettinger et al. 1994). Other aspects of satisfaction with IS products require an examination of expectations compared to the user perception of delivery (McKinney et al. 2002). These arguments represent a movement into discrepancy considerations shaped by consumer research and considering IS users as customers.

18.3.2 Job Satisfaction in the Information Systems Literature

Job satisfaction has been approached in the IS literature in two major ways. By far the largest number of articles about job satisfaction have been premised upon the assumption that IS professionals are markedly different from other employees because of the nature of their work. When the supply of IS professionals cannot meet the demand, research seeks to understand what can be done to keep the IS professionals satisfied, entice them to stay with the organization, and ensure that their skills are current (Galup et al. 1997; Guimaraes and Igbaria 1992; Igbaria et al. 1994; Jiang et al. 2001; Joseph et al. 2007; Rong and Grover 2009; Ruth et al. 2005).

A second stream of job satisfaction research is concerned with the impact of information technologies and information systems on users within the organization. These studies focus on the relationship between job satisfaction and user information satisfaction (Ang and Soh 1997), a new technology or information system (Morris and Venkatesh 2010), and technostress from using the new information technologies (Ragu-Nathan et al. 2008) or IS personnel skills (Tesch et al. 2003). Sample articles from these two streams of IS research related to job satisfaction are described in Table 18.3. Only a limited number of the IS personnel studies consider the common aspect of satisfaction formed by discrepancies, leaving room for future studies that include the two components of a comparative process.

18.3.3 Discrepancy Theory Formation of Satisfaction

The basis of discrepancy theory–derived satisfaction is the cognitive comparison on the part of an individual. A comparison requires that each individual establish an anchor, have a context-dependent state of nature to compare to the anchor, realize individual expectations or perceptions of both the anchor and state of nature, and judge these with a (potentially) complex relationship that determines how satisfaction is derived from the two components (anchor and state of nature). There may be a relationship between the components; there may be an intermediate variable of the perceived difference between the components; there may be an inclusion of both the magnitude and direction of the resulting comparison; there may be a multiplication by

Table 18.3 A sample of job satisfaction in IS research

Study	Factors	Role for satisfaction	Measure	Discrepancy view of satisfaction?
Morris and Venkatesh (2010)	Task significance, task identity, skill variety, autonomy, feedback	Dependent	Three items from Janssen (2001)	No
Rong and Grover (2009)	Perceived technological knowledge renewal effectiveness	Dependent	Fifteen items from Morrison et al. (2005)	No
Ragu-Nathan et al. (2008)	Technostress creators and inhibitors	Dependent	Three items from Spector (1985)	No
Rutner et al. (2008)	Role stressors, autonomy, fairness of rewards, negative and positive emotional dissonance	Dependent	Three items from McKnight (1997)	No
Joseph et al. (2007)	Job-related (boundary spanning, job performance, role ambiguity, and conflict), organizational, demographic (age and sex)	Mediator to turnover intention	Meta-analysis	No
Ruth et al. (2005)	Role ambiguity and role conflict	Mediator to organizational commitment and turnover intention	Six items from Guimaraes and Igbaria (1992)	No
Tesch et al. (2003)	User expectation on skill proficiency, perceived skill proficiency	Dependent	Thirteen items from Baroudi and Orlikowski (1988)	Yes
Jiang et al. (2001)	IS employees internal career want, IS employees external career have	Dependent	Five items from satisfaction Greenhaus et al. (1990)	Yes
Joshi and Rai (2000)	Quality of information product, role ambiguity, role conflict	Dependent	Four items from Hackman and Oldham (1975)	No
Galup et al. (1997)	Temporary/permanent compensation	Dependent	Hackman and Oldham (1980)	No
Igbaria et al. (1994)	Demographic (age, tenure) experience (boundary spanning activities, role stressors, task characteristics, and salary)	Dependent	Three items scale from Hackman and Oldham (1980)	No
	Career expectations (advancement)			
Guimaraes and Igbaria (1992)	Demographics (age, gender, education, and tenure)	Mediator to organizational commitment and intent to leave	Six items of Smith et al. (1969)	No
	Boundary spanning activities, role stressors			

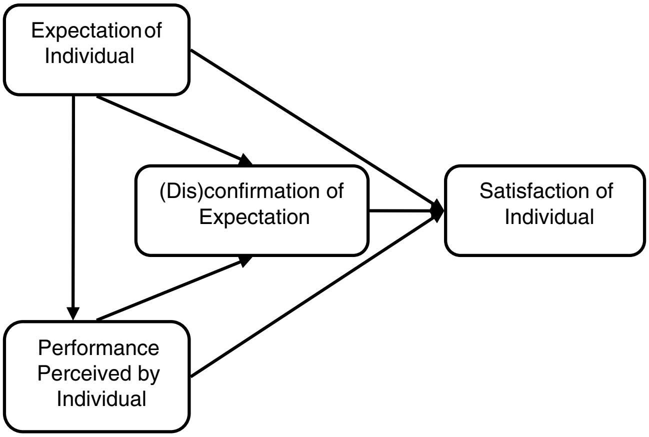

Fig. 18.2 Generic expectation-confirmation model

importance or valence; and, there may be linear or nonlinear forms between the components and final satisfaction. Numerous combinations have been applied in past literature, a number of them in the IS literature. The following represent a number of variations and examples of application in the management and IS literature.

The *expectation–reality gap* of Fig. 18.2 is perhaps the more commonly employed discrepancy model. Here, satisfaction is regarded as function of the perceived gap between what one actually has (achieved state of nature) and what one wants to have (anchor as a goal). Expectation–confirmation theory (ECT) is a derivative of this gap. In the marketing literature, ECT has become one of the primary theories for explaining consumer satisfaction (Cheung et al. 2005). ECT stipulates that satisfaction is determined by intensity and direction of the gap between perceived performance and a prior expectation of a product or service. Positive disconfirmation (performance > expectation) is likely to result in satisfaction; on the other hand, negative disconfirmation (performance < expectation) results in dissatisfaction. Mixed findings were reported regarding the consequences of confirmation. While some researchers argued that mere confirmation should lead to satisfaction, others suggested that it would result in indifference, since there were no "pleasant surprises" (Erevelles and Leavitt 1992).

Timing could be an issue with the expectations. It is usual to peg expectations to a prior set or to those adjusted based on experiencing performance (Watson et al. 1993). However, one can consider a short-term or long-term perspective and compare with what the expectations were previously, currently, or even what one expects for the future (Michalos 1985). The inclusion of all components and relationships in any given study is rare. Expectation to perceived performance is often not considered because it is not crucial in the formation of satisfaction (Churchill and Surprenant 1982). Many researchers eliminate expectations from the model altogether as its link to satisfaction is historically weak (Cronin and Taylor 1992, 1994). Some researchers consider only the disconfirmation measure believing it to capture all the relevant information in the formation of satisfaction (Bhattacherjee 2001). Still others eliminate the disconfirmation variable from the model as it presents measurement difficulties and can adequately be represented with the components (Edwards 2001; Klein et al. 2009). Regardless of the many ways to fashion the model, ECT posits that (dis)confirmation shapes satisfaction. More comprehensive models may then relate satisfaction to other variables consistent with well-established models of behavior (Fishbein and Ajzen 2010).

ECT is commonly applied in IS studies, though modeling, measuring, and analysis can be problematic due to the comparative process (Klein et al. 2009). ECT forms the basis of studies involving the satisfaction derived from service experiences (Kettinger et al. 1994), continuance decisions (Bhattacherjee 2001), consumer satisfaction of Internet service providers (Erevelles et al. 2003), web portal content (Lin et al. 2005), and features designed into a system (Nevo and Wade 2007). Many of the advantages to using ECT as a gap model derive from a strong explanatory basis in addition to the theoretical basis (Jiang and Klein 2009).

Still other discrepancy models exist that may be of use in future IS research. Irving and Meyer (1999) introduced a *goal–achievement gap* as the difference between what a person personally seeks and what the workplace provides, and found this gap can predict job satisfaction. In earlier studies, the goal–achievement gap was employed to study the causes of joy, personal satisfaction, and intrinsic and extrinsic job satisfaction (Argyle and Martin 1991). In translation to the IS domain, Jiang and Klein (2002) applied this discrepancy form to consider the career wants of IS personnel and how they perceived their organization fulfilled those wants, the resulting satisfaction being closely related to turnover indicators. The wants were represented by the career orientations proposed by Schein (1978). This has been an active stream of work in the IS discipline for a number of years (Igbaria and Baroudi 1993).

Other comparative bases have appeared in the management literature that may someday serve IS researchers. A *previous–best comparison gap* is where satisfaction is a function of the perceived gap between what one has now and the best one has ever had in the past. Rice et al. (1989) found discrepancies between current job facet experiences and what they found good from their past jobs. An *actual–deserved gap* is between what one has and what one feels they deserve to have (Michalos 1985). This gap is consistent with equity theory in which people derive satisfaction from an equal distribution in which each person gets the same as every other person, though equity theorists usually ignore this distinction and define equitable relationships as those in which “all participates are receiving equal relative outcomes” (Walster et al. 1976, p. 7).

In a gap derived from *social comparison*, satisfaction is strongly influenced by the perception of a gap between what one has, and what some relevant other person or group has. Emmons and Diener (1985) defined social comparison as to how the person believes he/she compares to proximal others. One may be satisfied as long as one thinks he/she is doing better than others (Freedman 1978). With an *ideal–real gap*, satisfaction is regarded as a function of the perceived gap between what one actually has, or expects to have and what one considers to be ideal, preferable, or desirable. For example, when considering what is preferable, King et al. (1988)

found that individuals who receive high valence rewards through communication are significantly more satisfied in their jobs than are individuals to whom high valence rewards are not communicated. *Cognitive dissonance* describes a different discrepancy influenced by the gap between what one has and what one expected to have where adjustments are made based on perceptions of having made an error in setting the original expectation (Festinger 1954). Cognitive dissonance may help to explain variations due to over- or understating expectations used as components in discrepancy models (Olshavsky and Miller 1972).

18.4 Methodological Issues in Applying Discrepancy Theories

To operationalize gap-explanatory theories in primarily survey-based research, there are, at least, four major issues that need to be addressed by researchers. These are (1) determination of the appropriate component measures to represent the anchor and state of nature for the subjects and context, (2) measuring the discrepancy, (3) choosing the appropriate shape for the relationship to satisfaction, and (4) analyzing the relationship. The anchor and state of nature should be determined by the underlying theory or strong empirical support while the best form of measurement for the discrepancy between the two components must be driven by methodological and data quality concerns.

18.4.1 Choosing the Components

The first step is to consider the factors that comprise individual satisfaction for different phenomenon. For example, in digital marketing, Giese and Cote (2000) reviewed 20 different definitions used in the past 30 years of consumer satisfaction research and concluded customer satisfaction to be "a summary affective response of varying intensity that follows consumption, and is stimulated by focal aspects of sales activities, information systems (websites), digital product/services, customer support, after-sale service, and company culture." Thus, the factors that might influence satisfaction must first be selected to fit the context.

The second step is to consider the "referring standard." Do individuals compare their perceived performance against some standard that they develop based on an ideal, best prior experience, desired level, prediction, and/or what others have? Adaptation theory has postulated that perception of stimuli (i.e., perceived performance) is linked to an adapted standard (i.e., the cognitive standard) (Bearden and Teel 1983). This new standard represents an adaptation level based on the perception of the stimulus, the context, and the organisms. It is employed as a benchmark in subsequent evaluation processes (i.e., satisfaction judgment).

Researchers may need to apply different comparative standards to examine different phenomena. In employee-satisfaction discrepancy theory, researchers applied a goal–achievement gap premise and suggested that an individual employee's satisfaction is a function of the perceived gap between what one actually has and what one wants to have (Jiang and Klein 1999–2000). ECT follows the expectation–reality gap premise and suggests that satisfaction is a function of the perceived gap between what is the case now and what one expects (or expected) to be the case (Oliver 1981).

However, ECT is inadequate in the case of extremely high or low expectations. An individual may be satisfied (dissatisfied) if possessing an extremely high (low) expectation. To address this inadequacy, Suh et al. (1994) proposed the use of desires instead of expectations as the cognitive standard in the disconfirmation process. Unlike expectations, which are formed mainly based on prior experience and existing knowledge (Zeithaml and Bitner 2000), desires represent inner emotional needs and wants that are not necessarily limited to rational cognitive understanding of environmental circumstances. According to means-end theory (Gutman 1982), desires are generally more present-oriented and are likely to stay stable over time. An individual may develop desires that are different from his or her expectations toward the same subject of evaluation. For example, an individual user may desire a high level of data security in a new application; however, he or she may not expect much because of an understanding of the limited resources available to the project. Hence, perceived performance exceeding expectations does not necessarily lead to satisfaction if it falls below desires.

Experience-based norms can be another alternative standard for disconfirmation. They denote certain beliefs about similar kinds of products/services formed based on past personal usage experience and word-of-mouth evidence (Woodruff et al. 1983). The norm-based disconfirmation could be superior to expectation-based disconfirmation by accounting for past experience with similar subjects of evaluation. However, norms are constrained by the individual's actual experience, and may not be applicable to new products/services. Selecting the appropriate comparative basis may not be an easy task and studies should carefully select the anchor based on any theories that may be present to explain formation in the context being studied.

18.4.2 Measuring Discrepancy

In early satisfaction research, discrepancies were operationalized as difference scores (Oliver 1981; Swan et al. 1981). For example, discrepancies in the service quality area are usually conceptualized as the discrepancy between a consumer's expected level of product performance and the consumer's observation of actual performance after product usage (Parasuraman et al. 1985). However, difference scores are known to have a number of problems that must be surmounted or dismissed in any research dataset. A difference score as a "simulation" of a psychological process is too simplistic to measure the intricate cognitive appraisal process (Peter et al.1993). Since there are so many possible anchors or forms of expectation, multiple interpretations of "expectations" can result in serious measurement errors when differencing (Teas 1993). Difference scores often have unstable dimensionality, low reliability, and poor discriminant validity (Cronin and Taylor 1992; Van Dyke et al. 1999).

From an applied standpoint, the crucial concern is indistinctness of interpretation. Difference scores collapse measures of conceptually distinct constructs into a sole score, resulting in a number that eliminates the value of the component magnitudes. The predictive power of using a difference score is also of dubious value because taking the difference removes information content. So even though a raw difference score might provide information as to the fulfillment of a customer, little added information is provided (Cronin and Taylor 1992). Similar problems exist when using just one of components in a model or asking subjects to respond with a difference score (Edwards 2001). Being able to preserve the information in the components can add considerably to the practical applicability of the scales and be extended to other facets of satisfaction as well (Kettinger and Lee 2005). Even more problematic for researchers is how to deal with the theoretical assumptions of taking a difference. In particular, difference scores force constraints on the connection between the constituent components and the outcome variable. In a linear relationship, an implied assumption of a difference score is that the two components of the difference score have *equal but opposite* effects on the dependent variable S (satisfaction), as can be seen from regression equation 18.1 and its restatement as (18.2), where P is a performance component and E is an expectation component:

$$S = b_0 + b_1 \left(P_i - E_i\right) + e \tag{18.1}$$

$$S = b_0 + b_1 \left(P_i\right) - b_1 \left(E_i\right) + e \tag{18.2}$$

Noticeably, the effect of performance on satisfaction (b1) must be equal and opposite to the effect of expectations ($-b_1$). "Like any constraint, this cannot increase the variance explained, and in most cases will decrease it" (Edwards 1994, p. 56). Regrettably, this implicit assumption is often ignored. A second implicit assumption is that there is no disparity in the relationship to the dependent variable at varying magnitudes. A difference score determined as in (18.1) will present the same level of the objective value regardless of component magnitudes. In other words, the extent of the components is removed by taking the difference, so any model implicitly claims that a variable dependent on a difference score is independent of the size of the component values. This is very different than a relationship where the dependent variable is determined by both components, such as in (18.3):

$$S = b_0 + b_1 \left(P_i\right) + b_2 \left(E_i\right) + e \tag{18.3}$$

For these reasons, researchers consider it best to retain both components in the analysis of a model to preserve the theoretical structure associated with discrepancy theory and to avoid the issues associated with difference scores (Edwards 2001; Klein et al. 2009). However, even though difference scores may not be an appropriate form, identical items should still be used in the scales of each component to guarantee that the anchor is directly comparable to the state of nature.

18.4.3 Choosing the Shape

From an analysis perspective, it is easiest to assume the relationships to be linear, which also happens to be the most parsimonious choice. Quite often, a linear relationship as represented in (18.3) will be adequate. An employee will have an expectation of compensation. Failure to meet that expectation results in dissatisfaction, exceeding it results in satisfaction. For at least a reasonable range around the expectation, a linear relationship adequately expresses satisfaction as a result of expectation and actual compensation (Shapiro and Wahba 1978). However, comparative relationships are not often that simple (Edwards 1994).

Past studies have incorporated a variety of shapes in the study of satisfaction that involve comparative measures. Workers need some activity in their jobs to maintain mental well-being, but being overworked also has detrimental effects (Warr 1994). Certain aspects of service may be nonlinear: consider the case where you cannot find help in a store compared to the case where you cannot get away from an overachieving sales representative. These are examples of dissatisfaction arising when deviating on either side of the anchor setting your expectation for level of service and may best be represented by a U-shaped curve and a quadratic equation (Edwards 1994). In services of the IS function within an organization, some consider dissatisfaction to occur more the further you fall below a minimum standard, satisfaction increase beyond a desired level, and a relatively flat level of satisfaction reached between this pair of anchors (Kettinger and Lee 2005). This is a variation on the commonly applied prospect theory shape which may be applicable to a number of personal preferences and best represented by a cubic equation (Kahneman and Tversky 1979). When possible, IS researchers should consider the form dictated by the theory employed by their research.

18.4.4 Analyzing the Relationship

Models of regression can incorporate the various shapes that discrepancies might dictate by incorporating higher-order terms into a polynomial equation. Coefficients of the resulting regression can be examined for significance to determine the importance of each component or higher-order term, with the R-square value representing overall fit. Interpretation of the relationship between the components and satisfaction can be aided by a three-dimensional plot and response surface analysis (Khuri and Cornell 1987). Path models that include the components in a linear relationship to satisfaction can bring the component variables directly into the model (Cheung 2009). Nonlinear relationships are more problematic (Edwards 2009), but creating block variables appears to be an adequate solution (Marsden 1982). Further guidelines for conducting an analysis can be found in Klein et al. (2009).

18.5 Conclusions

Discrepancy theory provides broad coverage in explaining satisfaction. Essentially, satisfaction is said to be derived from a comparative process that considers a prior formed impression about an event, product, or process along with the experience of that same event, product, or process. The comparison is made along a set of factors that are the same between the prior expectation and the subsequent experience. The difference between the anticipated levels and experienced levels is cognitively judged to arrive at a level of satisfaction. Such formation of satisfaction is a dominant consideration in determining satisfaction in a number of relevant disciplines for information systems researchers, but only infrequently for those conducting IS research. Exceptions are the study by McKinney et al. (2002) that measured disconfirmation, expectations, and perceived performance using an 11-point semantic differential scale and the Chin and Lee (2000) paper that used 11- point scales to measure the extent to which original expectations and desires were met. In addition, Jiang et al. (2001) use career anchors to determine if employers meet the career desires of employees.

Once scales for the anchors and states of nature have been selected and validated based upon sound theory, the same scales need to be used across both components. This will make it possible to make judgments and compare results across similar contexts. Particular attention must be paid to the shape of the discrepancies.

Using the strong history of discrepancy models and strong descriptive powers with a comparative basis, we propose that IS researchers should consider the formation of satisfaction using discrepancy models given the importance of satisfaction as a measure of success in IS research models. IS researchers can learn from those in marketing, management, and other disciplines. However, they must be careful not to mindlessly borrow their scales and theory. IS researchers must adapt the scales and theory to the unique context of information systems and IS professionals.

Discrepancy theory has a strong history of support in the literature, but it does present unique problems in measuring the components and the resulting comparison. Theory should drive all actions taken in selecting the factors in any new context that drive determination of satisfaction, the anchors that best represent the comparison by an individual within the context, and methods that can be employed to test any relationships. In particular, difference scores must be dealt with appropriately or analyses must be employed that avoid their use.

Many possible topics arise under a lens of discrepancy. Determination of appropriate forms for any given context requires a sound basis and empirical validation. Satisfaction can be studied not only from the perspective of IS employee satisfaction, but also satisfaction of their managers with their performance. Satisfaction with the performance of any IS employee may be determined by a comparison of skill expectations and implementation of those skills. The resulting satisfaction on the part of evaluators may impact performance evaluations and can be considered in a 360° framework. Finally, user satisfaction may be distinguished in terms of satisfaction between products (i.e., systems that are developed and implemented) and services. These are but a few directions that IS research may take in the obviously important, but extremely complex, construct of satisfaction.

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Chapter 19
Institutional Change and Green IS: Towards Problem-Driven, Mechanism-Based Explanations

Tom Butler

Abstract There is growing global unease in relation to the environmental sustainability of business activities, particularly where climate change is concerned. Consequently, the increase in emissions of Greenhouse Gases (GHG) associated with economic growth is identified by the Organisation for Economic Cooperation and Development (OECD) as a problem of grave concern. In the EU, ambitious targets have been set for GHG emissions reductions. Both the OECD and the Global e-Sustainability Initiative (GeSI) have identified that between now and 2020 the direct and enabling effects of Green IS could help achieve significant reductions in GHG emissions across all industry sectors. In order to help understand how this objective may be achieved, this chapter presents mechanism-based explanations, which draw on institutional theory and social movement theory, to help explain and predict the adoption, implementation and use of Green IS in organizational fields. Thus, in keeping with extant perspectives in the social sciences, the study eschews the quest for universal laws or general theory, in favour of conceptual mechanism-based explanations of IS phenomena. While environmental sustainability has exercised the interest of researchers in cognate disciplines, Green IS is a new area of interest for IS researchers, hence this chapter's contribution is timely.

Keywords Green IS • Institutional theory • Social movement theory • Climate change

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Abbreviations

CDP	Carbon disclosure project
GeSI	Global e-sustainability initiative
GHG	Greenhouse gas
ICT	Information and communication technologies
IEEE	Institute of electrical and electronics engineers
IPCC	Intergovernmental panel on climate change
IS	Information systems
ISO	International standards organisation
IT	Information technology

19.1 Introduction

The scientific evidence is unequivocal in its assessment of the effects of Greenhouse Gas (GHG) emissions on planetary climate change (cf. IPCC 2007; Stern 2006). So much so, former sceptics now consider global warming to be the gravest threat facing humanity (Lomborg 2010). Thus, the United Nations' Intergovernmental Panel on Climate Change (IPCC 2007) argues that industrialized countries must reduce their emissions to 20% of 1990 levels. In 2009, the Carbon Disclosure Project (CDP) studied the performance of the top 100 global companies with respect to emissions reductions: it found a chasm between the required reductions and those actually achieved (Carbon Disclosure Project 2009). By 2010, matters did not change much (cf. Carbon Disclosure Project 2010); thus, Mindy S. Lubber, President of Coalition for Environmentally Responsible Economies (CERES) argued that 'Companies must produce tangible results that put us on a truly sustainable path. For climate change, that means a 50% improvement in energy efficiency and a 25% lower carbon footprint by 2020' (Ceres 2010, p. 4). Hence, there are growing institutional pressures on organizations to lower GHG emissions.

In response to these and other pressures, organizations have been publishing corporate sustainability reports (Melville 2010; Schaltegger and Burritt 2005) as part of their corporate social responsibility (CSR) initiatives (Campbell 2007; Petersen and Vrendedburg 2009). Thus, Lynes, and Andrachuk (2008, p. 378) propose the term corporate social and environmental responsibility (CSER) to reflect developments in practice and to explore 'the relationships between motivations for both social and environmental responsibility'. In its widest sense, firms practicing CSER attend to a triple bottom line, that is accounting for (1) profits and shareholder value; (2) environmental impacts of processes and products; (3) social externalities (Schwab 2008).

The Organisation for Economic Co-operation and Development (OECD) argues that information and communications technologies (ICT) contribute significantly to environmental problems both directly and indirectly (OECD 2009a). The direct effects are estimated by Gartner (2007) to account for over 2% of global GHG emissions: ICT contributes indirectly through its ability to underpin economic growth (OECD 2009a). However, both the Climate Group and the Global eSustainability Initiative (GeSI) maintain that the prudent and innovative use of ICT – that is Green IT and Green IS – could contribute to reductions in GHG emissions of up to 15% by 2020 through what is known as ICT's direct and enabling effects in lowering GHG emission (GeSI 2008; OECD 2009a, b).

The objective of this chapter is to draw on institutional theory (Scott 2004) and social movement theory (Davis et al. 2005) to offer mechanism-based theoretical explanations of how social and organizational fields can be structured such that the direct effects and enabling effects of Green IS can be attained to reach the 2020 objectives set out by the OECD, GeSI and the European Commission. First, however, two of this study's core constructs are defined.

19.1.1 Green IT and Green IS Defined

This chapter defines Green IT as information technologies that have minimum direct effects on the environment in that they (1) consume low amounts of electrical energy in operation and standby; (2) contribute minimally to GHG emissions when in use (e.g. using desktop and/or server virtualization); (3) are designed for the environment and are therefore in compliance with regulations on hazardous and restricted substances; and (4) can be easily disposed of, reused or recycled (cf. Murugesan 2008; GeSI 2008; OECD 2009a, b). Green IS are defined as IT-based software applications that enable reductions in GHG emissions associated with social and organizational processes, products and services (cf. Chen et al. 2008; GeSI 2008). Depending on the context in which it is used, a Green IS typically performs one or more of the following functions: (1) monitor and report on GHG emissions; (2) control and report on waste, toxic and hazardous materials use; (3) manage energy-consuming facilities such as office and other buildings, including datacentres; (4) enable Design for Environment (DfE); (5) redesign business processes to make them energy efficient; (6) enable energy efficient logistics and transport; (7) enable dematerialization of travel and other physical carbon-intensive artefacts; (8) integrate with existing IT-based platforms to make them and/or the business processes they support energy efficient (Cf. Chen et al. 2008; GeSI 2008; Watson et al. 2010).

While the enabling effects of Green IS is taken to refer to the features of the underlying software application, it must be remembered that an IS consists of people, processes and technologies (Keen 1993). We can therefore posit that ceteris paribus, change of one or more of the elements in an IS can alter the energy efficiency and GHG emissions of the whole system. Thus, the direct effect of a Green IT component in this mix may increase energy efficiency of the entire system, without alteration to people or process dimensions. The enabling effect of Green IS may (or may not) incorporate the direct effect while enabling energy efficiencies in people or process dimensions, or both. The remainder of this chapter takes an information systems perspective and employs the term Green IS to refer to all IT-enabled based systems that lower GHG emissions.

Thus, this chapter theorizes that an organization attending to the triple bottom line and exercising corporate social and environmental responsibility will:

1. Apply the direct effects of Green IS to reduce GHG emissions in IT infrastructures
2. Apply the enabling effects of Green IS to reduce GHG emissions across business processes and related activities

The transition to environmentally sustainable IT infrastructures and business processes poses significant problems for organizations and society. The challenge for IS researchers is to predict and explain how these non-trivial problems might be solved. That is the goal of this chapter, which provides theoretical, mechanism-based explanations of how institutional and organizational fields can be structured to facilitate the timely adoption, implementation and use of Green IS by organizations.

19.2 Institutional Theory

Institutional theory is concerned with the influences that shape social and organizational structures, schemas, rules, norms, routines and, ultimately the behaviour of social actors (Scott 2004). According to Scott (1995, p. 33), institutions exhibit ‘cognitive, normative, and regulative structures and activities that provide stability and meaning to social behaviour’: these influences operate on three primary layers or levels – societal field, organizational field, and organization. At a societal level, institutions structure organizational fields (Scott 1995). According to DiMaggio and Powell (1983, p. 143) an organizational field is constituted by a collection of ‘organisations that, in the aggregate, constitute a recognized area of institutional life’; inter alia, the field consists of ‘key suppliers, resource and product consumers, regulatory agencies, and other organisations that produce similar services or products’. As the societal field provides the institutional environment for organisational fields, an organisational field provides ‘institutional structures within which specific organisations operate’: in turn, ‘organisations provide institutional contexts within which particular actors are located and take action’ (Scott 1995, p. 141).

In terms of the process of institutionalization, Selznick (1957, p. 16) argues that:

> It is something that happens to an organisation over time, reflecting the organisation’s own distinctive history, the people who have been in it, the groups it embodies and the vested interests they have created, and the way it has adapted to its environment.

It is clear from Selznick then that organizations evolve into institutions as internal and external, formal and informal, social and institutional forces *infuse with value* the technical structures, processes, and contexts of an organization. He (Selznick 1957, p. 16) further argues that the degree of institutionalization *depends on how much leeway there is for personal and group interaction* among social actors, internally and externally. Selznick’s (1957) focus on adaptation to the institutional environment, as constituted by societal and organizational fields, is important as it indicates that institutionalization is an ongoing process. However, as Scott (1995, 2000, 2004) notes, during such change, one set of institutionalized beliefs and practices are replaced by another – this brings into focus the process of deinstitutionalization (Oliver 1991; Scott 1995, 2004). Institutional change, be it institutionalization or deinstitutionalization, is complex and multifaceted and, as Scott (1995, 2004) emphasizes, requires researchers to focus on regulative, normative and cultural-cognitive elements or pillars. Regulative elements involves 'rule setting, monitoring and sanctioning activities' by government departments, state-sponsored agencies, the judiciary, and so on (Scott 1995, p. 35). Normative elements include prescribed (and proscribed) structures, arrangements and practices typically instituted by industry associations, professional bodies, non-government organizations (NGOs), and social movements (Hiatt et al. 2009). Cultural-cognitive elements rest on deeply held beliefs and assumptions about the nature of reality (Scott 2004). These elements are reflected in individual world views and socially constructed collective understandings (Berger and Luckmann 1967) – thus, key actors here are individuals, social and organizational groups, and social movements (cf. Hiatt et al. 2009).

19.2.1 Mechanisms-Based Explanations from Institutional and Social Movement Theory

Davis and Marquis (2005, p. 340) argue that the 'most productive theoretical work going forward will be in cataloguing and developing organizational mechanisms. Mechanisms, unlike theories, are not falsified; rather, they are employed as tools for explanations (which can themselves be rejected, of course)'. A social mechanism is a configuration of social structures, artefacts, routines and activities which typically produce a particular pattern of beliefs, behaviours or structures in social entities. Significantly, Hedstrom (2005, p. 24) argues that 'by focusing on the mechanisms that generate change in social entities, rather than statistical regularities between variables, a foundation for powerful explanations can be established'. Thus following Davis and Marquis (2005), this chapter employs mechanisms drawn from institutional and social movement theory to help explain the exogenous and endogenous influences on change towards environmental sustainable structures, artefacts, routines and activities in societal and organizational fields and organizations.

Scott (1995, 2004) argues that coercive, normative and mimetic mechanisms shape societal and organizational fields and organizations. However, a social movement can coerce a response from a regulatory authority (McAdam and Scott 2005) or organizations (Rao 2009). Likewise, an industry association can coerce a non-conforming organization to maintain adherence to a particular standard (Campbell 2007). Hence, this chapter argues that the mechanism of coercion is not exclusive to regulatory actors in the institutional environment; it may be phrased differently, but the outcome is the same (cf. Hiatt et al. 2009). Scott (2004), however, points out that social mechanisms may act together to produce institutional change; conversely one or more may act to maintain current institutionalized structures and patterns of activity, while others act to deinstitutionalize them (cf. Aplain and Hegarty 1980; Schuler 1996; Rao 2009; Sine and Lee 2009).

Operating from a social movement theory perspective, McAdam et al. (2001, pp. 25–26) posit a related categorization of institutional mechanisms to that of Scott, which focuses on institutional change brought about by social movements:

1. *Environmental mechanisms*, namely, 'externally generated influences on conditions affecting social life'
2. *Relational mechanisms*, which 'alter connections among people, groups, and interpersonal networks'
3. *Cognitive mechanisms*, which 'operate through alterations of individual and collective perception'

While Scott's (1995, 2004) and McAdam et al.'s (2001) mechanisms help explain institutional change at a high level of analysis, explanatory mechanisms that operate at lower levels and which offer explanations with a high degree of granularity are required. Campbell (2005) proposes several mechanisms that operate in societal and organizational fields and in organizations to institute institutional change – these map onto the above. Campbell's mechanisms are:

1. *Framing* (cognitive) involves the use of metaphors and symbols which influence how issues are perceived and which inform social action in the context of socially constructed realities.
2. *Diffusion* (environmental/relational) refers to the dissemination of concepts, social structures and practices, mainly through social networks (this is a type of relational mechanism).
3. *Translation* (environmental/relational mechanism) refers to how diffused concepts and ideas are transformed for application in new social contexts.
4. *Bricolage* (environmental/relational) involves the recombination of concepts, practices, etc. from other social contexts to produce new forms of social activity.
5. *Network cultivation* (relational) which involves creating social and institutional movements and associations.
6. *Strategic leadership* (environmental/relational) in which social actors decide which direction a social, institutional or organizational entity should take.

Clearly, these mechanisms offer greater explanatory power than that of McAdam et al.'s and will be used in concert with those articulated by Scott (1995).

19.2.2 Institutional and Social Movement Theory in IS Research

Institutional theory is proposed as a valuable perspective with which to study IS-based organizational change (Robey and Boudreau 1999). In addition, Orlikowski and Barley (2001) propose that IS researchers employ institutional theory to investigate the influence of regulative, normative and cultural-cognitive processes and structures in the design and operation of IT-based information systems. The review paper by Mignerat and Rivard (2009) in the special issue of the Journal of Information Technology on the use of institutional theory in IS research illustrates the range of IS-related phenomena that have been studied by researchers. They report that many of the 53 IS-related studies they found focused on the institutional effects governing the diffusion of IT innovations.

One of the first IS studies to use an institutional perspective was a paper by Klein and Hirschheim (1989) on the institutionalization of IS development practices. However, arguably the first paper to comprehensively employ the perspective was King et al.'s (1994) investigation of the institutional factors influencing IT innovation – this apparently set the trend for many of the subsequent publications. Following Orlikowski and Barley (2001), Chen et al. (2008) employ institutional theory to theorize on the use of IS for environmental sustainability; however, there are limitations in the paper's broad, high-level focus and narrow use of institutional perspectives (e.g. that of DiMaggio and Powell 1983). Likewise Butler et al. (2008) employ Scott's (1995) perspective to examine the effects of the institutional environment in shaping the organizational field of IT manufacturers' design for environment decisions, particularly the institutional arrangements involving the use of Environmental Compliance Management Systems. Significantly, Mignerat and Rivard (2009) reported in their review study that the majority of IS studies focused on the organizational level of analysis; hence, echoing Currie (2009), they argued for more studies at the level of societal and organizational fields – hence the chief focus of the present study.

In contrast to the level of interest shown in institutional theory, IS scholars have not embraced social movement theory to the same degree. This is, perhaps, explained by the particular orientation of the theory, with its emphasis on social emancipation and its critical theoretic perspective. Examples of IS studies here come from Kling and Iacono (1996) who study the history of computerization through a social movement lens; Beynon-Davies and Williams (2001) who build on this seminal paper and conceptualize IS development method diffusion as a social movement; Lamb and Kling (2003) briefly draw on it in their reconceptualization of the user as social actor using institutional theory; finally, Colazo and Fang (2009) adopt social movement theory in their study of Open Source Software development.

19.2.3 Evidence of Institutional and Social Mechanisms in IS Research

Previous IS research provides support for the contention that regulative, normative and cultural-cognitive pressures act through coercive, normative and mimetic mechanisms to influence the 'comprehension', 'adoption', 'implementation' and 'assimilation' of IS (Mignerat and Rivard 2009). Studies which provide support for the influence of coercive mechanisms in IS come from Standing et al. (2009), King et al. (1994), Gosain (2004) and Noir and Walsham (2007). IS researchers also support the influence of normative mechanisms across the above activities (cf. King et al. 1994; Gosain 2004; Benders et al. 2006; and Son and Benbasat 2007).

Support for the influence of mimetic mechanisms comes from several sources, viz. Son and Benbasat (2007), Bala and Venkatesh (2007), Gosain (2004) and Standing et al. (2009). Evidence for the influences of wider cultural-cognitive influences from societal fields on IS comprehension, etc. by organizations is scant. Clearly all pressures may not exert equal influence on institutional structures and processes; hence, Teo et al. (2003) found that normative mechanisms strongly influenced Electronic Data Interchange adoption, while intra-organizational coercive pressures and those from customers and suppliers were also significant, with mimetic mechanism less so. Normative and mimetic influences were also found to dominate the adoption of B2B marketplaces (Son and Benbasat 2007). In another area of study, Bala and Venkatesh (2007) found that dominant organizations were most influenced by normative pressures in the adoption of inter-organizational systems, while less influential firms were influenced by competitors (mimetic), industry norms, and client/intra-organizational pressures (coercive). Interestingly, Gosain (2004) argues that firms operating in highly regulated organizational fields will possess similarly configured enterprise systems. The problem, however, is that organizational response to such pressures may not be uniform nor desirable in that compromise, avoidance, defiance, and manipulation may dominate, rather than acquiescence or compliance (cf. Oliver 1991; Chen et al. 2008).

19.3 Towards a Problem-Driven Explanatory Theory of Green IS

This chapter does not propose a falsifiable theory of the institutional change required to realize the environmentally sustainable goals associated with the direct effects of Green IT or the enabling effects of Green IS; neither does it postulate universal laws that help predict the conditions under which such change occurs. Following Davis and Marquis (2005), it presents a problem-driven, as opposed to paradigm-driven, theory that seeks to explain a practical problem. As indicated, Davis and Marquis (2005) argue that what is required in organization theory is a 'sometimes-true' theory that occupies a position between description and universal laws.

A theory is typically constituted by a high-level theoretical proposition that includes core constructs and explanations of relationships (Gregor 2006). Formally stated, this chapter's molar or formative theory is:

> Institutional change is brought about by a confluence of social mechanisms or elements, regulative, normative and cultural-cognitive, which institutionalise or deinstitutionalise structures and patterns of activities at the levels of societal and organisational fields and organisation.

This general high-level theory needs to be applied to the phenomena of interest in this study. Accordingly, the remainder of this chapter considers how the structures and patterns of activities of societal and organizational fields and organizations can be made more environmentally sustainable. Of interest to the present study are the social mechanisms present in societal and organizational fields that will influence the adoption of Green IS by organizations.

19.3.1 Social Mechanisms Operating from the Regulative Pillar

The point of departure for this section comes from Jennings and Zandbergen (1995, p. 1032) who state that the 'sanctioning power of state agencies will result in better compliance with environmental legislation by organisations' (cf. Scott 1995; DiMaggio and Powell 1983). Indeed, this assertion is underpinned by the findings of recent research which illustrates the successful role that public policy plays in instituting change where environmental issues are concerned (Reid and Toffel 2009). While not specifically discussing environmental regulation, Campbell (2007, p. 954) notes that in the USA the absence of effective public policy and 'government deregulation during the 1980s and 1990s…[meant that] corporations began to take more liberties and act in more socially irresponsible ways than they would have otherwise'. This observation is echoed by Stiglitz (2010) who commented on the serious consequences of the neoliberal approach to deregulation that ultimately led to the financial crises of 2008. Bakan (2005) also notes the reluctance of corporations to behave voluntarily in socially and environmentally responsible ways. He describes in detail their failure to account for externalities related to their activities and concludes that such a mindset is ingrained in extant perspectives in economics and management. One example he cites comes from the economist Milton Friedman, who considered corporate social and environmental responsibility as a means to an end – the end being to increase profits. This type of thinking is, certainly, at odds with the extant conception of the triple bottom line (cf. Elkington 1997).

It is perhaps for these reasons that governments have increasingly enacted environmental legislation to deter corporations from behaving in environmentally irresponsible ways (Thornton et al. 2005). The proliferation of electronic and electrical goods in the developed world, including IT, and the inability of this global industry to regulate itself, had governments regulate hazardous substances and legislate for associated waste, recycling and reuse (Hristev 2006). Thus, IT manufacturers have, for several years, been confronted with diverse regulations governing the design, production and performance of CPUs, computers, and other IT artefacts (Butler and McGovern 2009). Briefly, such regulations impact all aspects of IT design, manufacture, use and disposal and include, for example, the European Union's (EU) Waste Electrical and Electronic Equipment Directive (WEEE), the EU's Restriction of Hazardous Substances Directive (RoHS), its Registration, Evaluation and Authorisation of Chemicals (REACh) Regulation, and the Eco-Design for Energy Using Products (EuP) Directive (Hristev 2006). The success of such regulations is indicated by Greenpeace, although it argues much more needs to done (Hojsik et al. 2008).

In terms of the design and manufacture of Green IT, the EU's EuP Directive requires manufacturers to make voluntary disclosures on the energy used in the design, packaging, distribution, and recycling of products across various supply chains, in addition to the energy consumed during use. This EC Directive sets a challenging target for energy savings of up to 9% in the period 2008–2016. Additionally, the EU Green Book on energy efficiency estimates that energy savings of up to 30% for businesses is possible by 2020. However, current thinking within the European Commission indicates that member states will have to regulate to have widespread efficient use of EuP, if they are to stand any chance of meeting GHG emission targets. This signals the increasing use of *coercive* and *diffusion* mechanisms.

Extant IS research indicates that the rest of the world is catching up with the EU in terms of regulating for the direct effects of ICT (Butler and McGovern 2008, 2009). In the USA, for example, the Environmental Protection Agency (EPA) has numerous regulations covering environmental issues and hazardous substances across the whole range of manufacturing sectors, including emissions. Significantly, in September 2009 the Final Mandatory Reporting of Greenhouse Gases Rule was enacted as US law. Other jurisdictions are no less active in institution regulatory change, as Japan has stringent environmental legislation, while Korea, Australia, China and Canada have also introduced RoHS- and WEEE-like laws, as have US states such as California.

The problem with *coercive* mechanisms is that regulated entities need to be monitored and credible sanctions imposed (cf. Short and Toffel 2008; Reid and Toffel 2009). However, Campbell (2007, p. 995) argues that '[the] fact that the creation and enforcement of effective state regulations turn in part on the capacity of external actors, such as environmentalists, unions, consumers, and other stakeholders, to participate in and monitor these regulatory processes'. Regulatory agencies, he (Campbell 2007, p. 995) argues, need to *diffuse* relevant information, for example, to 'afford citizens access to information about toxic emissions, legal standing in court to sue suspected polluters, and sufficient resources to support both of these activities'. Replace 'toxic' with GHG and we get some extent of the mechanisms that need to be put in place. Another diffusion mechanism is indicated by Thornton et al. (2005) who report that high-profile sanctions against major players or dominant organizations can exert a powerful influence over other members of an organizational field to become compliant. Nevertheless, Oliver (1991) indicates that organizations may not deinstitutionalize non-compliant structures or activities, and simply adopt legitimizing strategies such as acquiescence, compromise, avoidance, defiance, or manipulation. The latter strategy is important to note, as it is well-acknowledged that individual and/or organizational groupings, industry associations, etc. will lobby regulators to draft or change legislation in their favour, either to confer a strategic advantage or minimize accounting for externalities (Aplin and Hegarty 1980; Schuler 1996; Hillman et al. 1999).

The European Commission, the regulatory body with primary responsibility for EU law, is concerned that electricity consumed in EU member states is growing at 2% annually; such increases are deemed unsustainable given the need to reduce energy-related related GHG emissions (OECD 2008). Of concern is that energy consumption by ICT is projected to increase by 3% annually to 2030 (McKinsey 2007). It appears that this estimate may be conservative, as research by Gartner (2007) projects that the energy portion of IT departments' budgets is due to rise from 10% to

50% in a much shorter time period – datacentres will account for much of this increase. Thus, corporate datacentres merit special attention, as the EPA estimates that they typically account for 1.5% of US energy consumption (EPA 2007). Take, for example, that Smart 2020 Report found that there were 18 million servers in the world in 2008; the report also estimated that this figure will rise 122 million in 2020 – this translates into 349 $MtCO_2e$ (millions of tonne of GHG) (GeSI 2008). If the direct and enabling effects of Green IS are realized it is estimated that IT-related emissions will be limited to 259 $MtCO_2e$.

It is evident that if organizations are to meet various targets set by regulatory agencies full compliance will be necessary, as opposed to avoidance, defiance or compromise (cf. Oliver 1991). However, it is also clear that the world's governments will have to agree on common policies. Given the disappointing outcome to the UN's Copenhagen Conference, there is little likelihood of international agreement.[1] However, if the mechanism of *strategic leadership* is exercised by the EU, as happened with RoHS, WEEE, and EuP, then other nations may follow. Indeed, Peter Johnston, a senior European Commission official, states that '[i]n the European Commission, we have identified ICT-enabled improvements in energy efficiency as one of the potentially most cost-effective ways in which Member States can meet their 2020 targets' (Johnston 2008, p. 19). He adds that 'energy efficiency is therefore emerging as the cornerstone of energy and climate policies'. The EU's approach recognizes that the present strategy of depending on market forces and the price mechanism to control inefficient energy use by businesses will increasingly be replaced by legislation and energy audits. Indeed, the UK's Carbon Reduction Commitment Energy Efficiency Scheme (CRC) obliges over 5,000 public and private sector organizations to monitor their CO_2 emissions to comply with specified targets; performance in meeting these targets must be reported from 2010. Non-compliant organizations will be *coerced* into adopting energy efficient structures and activities. However, while significant fines and penalties apply, the major coercive influence is regarded to be public disclosure of poor performers. Those organizations that make significant progress in reducing GHG emissions stand to gain most.

19.3.2 The Role of Social Mechanisms in Shaping Influences from the Normative Pillar

This section explores chiefly normative influences emanating from professional and industry associations, standards bodies, and dominant organizations in structuring and determining the patterns of activities in an organizational field. It will be seen, however, that subtle and not so subtle coercive mechanisms are employed in conjunction with normative mechanisms. Normative influences in an organizational field typically emanate from industry associations. In the IT sector, the Electronics

[1] http://europa.eu/rapid/pressReleasesAction.do?reference=IP/09/1997&format=HTML&aged=0&language=EN&guiLanguage=en.

Industry Citizenship Coalition (EICC), whose members include HP, Apple, Microsoft, Sony, and Dell, instituted a common Code of Conduct for both members and suppliers – the EICC Code. This is one of many examples of *network cultivation* coupled with *strategic leadership* on behalf of dominant organizations in *diffusing* standards. The EICC thus sets standards across several social and environmental criteria that mandate supplier compliance in areas that include health and safety, the environment, and GHG emissions. In order to give effect to the latter, the EICC Carbon Reporting System was introduced. This on-line system enables members and suppliers to calculate GHG emissions and disclose this data with clients and other suppliers across the supply chain. This primarily normative influence is significant as it is estimated that suppliers account for up to 90% of the GHG emissions associated with a typical organization's products (Field 2008). As an EICC member, Apple Inc.'s Environment webpage indicates the degree to which organizations are willing to go to disclose (i.e. *diffuse*) to the public and other EICC members the measures taken to reduce GHG emissions. It is also an example of Apple Inc. *framing* how its efforts at environmental sustainability are perceived.

The OECD (2009b) report mentioned earlier provides a list of national and global industry associations focusing on the IT sector and IT end users in terms of the direct effects of Green IT and enabling effects of Green IS. This is evidence of the degree of *network cultivation* taking place in the organizational field. Of particular interest are the voluntary industry bodies listed. The OECD classify these into sector-specific (e.g. Consumer Electronics Association (CEA)), non-sector-specific (e.g. Climate Savers Computing Initiative and GeSI), and standards bodies (e.g. Institute of Electrical and Electronics Engineers (IEEE)). One major voluntary, non-sector-specific body with considerable influence is the Greenhouse Gas Protocol Initiative. This entity provides the foundation or reference point for GHG reporting standards globally through its GHG Protocol Corporate Standard. Take, for example, its influence on the International Standards Organisation (ISO), The Climate Registry, as well as its role in helping individual organizations structure their sustainability reports and disclose their emissions. In order to achieve this, the GHG Protocol Initiative publishes (i.e. *diffuses*) sector-specific toolsets for the IT industry among others. Other influential IT-based associations include the Climate Savers Computing Initiative, which was founded in 2007 by Intel and Google. Environment-oriented programmes introduced by industry standards bodies such as the Institute of Electrical and Electronics Engineers (IEEE), the International Electronics Manufacturing Initiative (iNEMI), the US-based Electronic Product Environmental Assessment Tool (EPEAT) NGO, and non-sector-specific bodies like the Global e-Sustainability Initiative all indicate that self-regulation via normative mechanisms is achievable. Indeed, as Campbell (2007, p. 955) points out, 'sometimes the most effective means of facilitating increased corporate social responsibility is through corporate peer pressure': this observation is supported in a general context by IS researchers (Mignerat and Rivard 2009).

Normative pressures from standards bodies such as the ISO and IEEE directly influence IT practitioners' decisions to make their processes and products environmentally sustainable. Of increasing importance to manufacturers and customers alike is the Electronic Product Environmental Assessment Tool (EPEAT), which was developed by the Green Electronics Council in 2006. (The council includes the US Environmental Protection Agency, the US Department of Energy, and various industry standards bodies.) EPEAT is based on the Institute of Electrical and Electronics Engineers (IEEE) 1680 Standard, Section 4 of which governs environmental performance criteria for desktop PCs, notebooks and PC monitors. This has become the de facto standard for Green IT artefacts. Other significant normative standards on computer environmental footprints include the EPA's Energy Star and the EU's Eco-label (Flower label), the Blue Angel in Germany and Nordic Swan in Scandinavia. However, the most influential normative influence globally comes from EPEAT as it focuses on the (1) the reduction/elimination of environmentally sensitive materials; (2) materials selection; (3) design for end of life; (4) product longevity/life cycle extension; (5) energy conservation (Section 4.5 covers adherence to the Energy Star standard); (6) end-of-life management (take-back and recycling); (7) corporate performance (in terms of CSR); and (8) packaging (toxics, labelling). Significantly, an Executive Order was issued by President Bush in 2007 mandating US government departments and federal agencies to purchase only EPEAT-certified artefacts (Ryan 2008). Currently, Hewlett Packard (HP), Dell and Toshiba manufacture computers to reach EPEAT Gold standard certification (there are also Silver and Bronze certificates). The Energy Star programme is a related but no less important standard as in 2007 devices designed to Energy Star specifications resulted in savings of 40 million metric tons of GHG emissions; this is equivalent to taking 27 million vehicles off the road annually (Hojlo and Jacobson 2008). EPEAT and Energy Star standards are evolving to cover a full range of IT artefacts to servers and storage solutions. On from this are the buildings that facilitate IT equipment, these are increasingly covered by environmental standards: take, for example, the Leadership in Energy and Environmental Design (LEED) Standard, which is a Green building rating system developed by the US Green Building Council. My unpublished review of the Sustainability Reports of a sample of Fortune 500 companies revealed increasing adoption of the LEED standard by leading corporations. The prevalence of numerous standards bodies is an example of the mechanisms of *translation* and *bricolage* at work, as many promote similar agendae, albeit to different organizational populations.

My unpublished review of the practitioner literature, both on- and off-line, such as *Computerworld*, *NetworkWorld*, *CNET*, *Cutter IT Journal*, illustrates that they have been raising awareness of environmental issues to practitioners (*framing*), particularly the issue of energy efficiency as it relates to the direct effects of Green IT. Consultancy firms such as the Gartner Group, Forrester Research, McKinsey and Company, and the Aberdeen Group have also conducted several studies on the design, implementation and use of Green IT, while also calling for Green IS to be developed (Butler and McGovern 2009). Increasingly, social networking sites such as Linkedin, Twitter and Facebook provide platforms for diffusion of news, ideas and innovations to IT and business professionals. Groups on LinkedIn include, for example The Green Data Center Alliance, Green Professionals, CleanTechies Around the World, etc.

Eisner (2004) reports that the Ford Motor Co. exercises *strategic leadership* in concert with *coercive* mechanisms to ensure that all of its suppliers are ISO14001 compliant. This series of standards are becoming increasing influential as they cover business processes (cf. Field 2008). The ISO 14000 standards series address several aspects of environmental management: ISO 14001 and ISO 14004 provide for the requirements and guidelines for environmental management systems (EMS). As Eisner (2004) indicates, Ford is thus using its power in the supply chain as a vehicle to drive environmental responsibility with adherence to ISO14001 as a benchmark. The latter's success as an industry-wide standard is indicated by the fact that several software vendors market applications that support the implementation of ISO 14001-based EMS. However, a recent study of nine Canadian organizations that adopted and implemented the standards found only one IT-enabled EMS (Boiral 2007). Significantly, Bioral reports that just one of the organizations studied exhibited genuine concern for environmental issues. In the other eight cases studied, institutional legitimacy (cf. Oliver 1991 – whether acquiescence, compromise, avoidance or manipulation) was found to underpin the adoption of the standard. Hence, it may be argued that there are very mixed results in outcomes associated with the application of the standard; plus, there are questions over its utility as a normative mechanism to vet suppliers.

Most IT manufacturers' supply chains originate in the Far East and China. Even if such suppliers are adopting the ISO 14001-based EMS, the mechanism of *coercion* is of little use without monitoring. Concerns with supply chain transparency and monitoring costs is evident among major IT manufacturers, especially those with several tiers in their supply chains (Field 2008). Take, for example that Egels-Zanden (2007) found that Swedish toy manufacturers reported that most of their Chinese suppliers were not in compliance with the standards and codes of conduct set down by them. Egels-Zanden (ibid. p. 45) maintains that monitoring was ineffective as 'Chinese suppliers successfully deceive toy retailers monitoring organizations by decoupling the formal monitored part of their organization from the actual operational part of their organisation'. Field (2008, p. 42) argues that this problem is widespread, so much so that 'some companies are rethinking the benefits of using far-flung manufacturers and seeking production closer to the customer. And they're doing more manufacturing on their own, instead of using third parties'. She argues that dominant organizations can employ market power to coerce suppliers to adhere to standards. Baden et al. (2009) echo this and report on the *coercive* influence by buyers on suppliers in SMEs to have them demonstrate social responsibility.

Finally, it is clear from the OECD's (2009b) study of national, regional and global organizations that institutions in the organizational field that constitute the IT sector have become key players in determining what is appropriate and morally correct (Scott 1995). They legitimize organizational responses and initiative through accreditation while helping *diffuse* environmental concepts and solutions, and are, in effect, grassroots networks of members of organizational fields (Campbell 2005). This section has described how one organizational field, the IT industry sector, has employed primarily normative mechanisms (e.g. diffusion and network cultivation) to bring about institutional change around environmental sustainability. However, it was seen that *coercive* and *mimeti*c mechanisms (*framing, translation,* and *bricolage*) were also at play, as was *strategic leadership*. This chapter theorizes that such mechanisms will prove important in structuring this and other organizational fields' adoption of Green IS.

19.3.3 Social Mechanisms and the Cultural-Cognitive Pillar

It is now accepted that the structures and activities of successful organizations are aligned with the belief systems, normative expectations, and regulatory obligations of social actors in the institutional environment (Hiatt, Sine and Tolbert 2009). Socially constructed symbols, beliefs, taken-for-granted assumptions, and world views (Berger and Luckmann 1967) inform the attitudes, expectations and actions of social actors in the institutional environment (Scott 1995), who then use such *frames* to bring about institutional change (Campbell 2005). At the level of the organizational field, Den Hond and de Bakker (2007, p. 905) posit that *frames* 'provide order and stability in an organizational field, since they comprise the technical, legal, or market standards that define the normal modes of operation'. In keeping with the earlier point, they (ibid.) argue that 'activist groups employ various tactics in order to better align the prevailing field frame with the preference structure that characterizes the social movement they represent' (cf. Azad and Faraj 2010).

In terms of the present thesis, Petersen and Vredenburg (2009) contend that cultural-cognitive influences and mimetic mechanisms, such as *framing*, play a formative role in structuring CSR initiatives in organizations. An example of this is that environmental concerns and the emergence of climate change have increasingly led to investors and investment managers to favour green investments (Petersen and Vredenburg 2009). Since 2000, there has been a notable increase in interest by individual and institutional investors on environmentally sustainable companies (Mincer 2007). Proof of this is found in the institution of the Dow Jones Sustainability Index and the FTSE4Good Index. Both of these financial indices act to *diffuse* information on organizations whose structures and activities are aligned well with Green *field frames*. Hence, whatever their personal beliefs or attitudes, C-level executives in organizations are responding to shareholders' preferences for shares in environmentally sustainable companies by the increased exercise of corporate sustainable responsibility. Clearly they believe that if they did not act their organization's reputation and market performance would suffer, and so by extension would their bonuses (Petersen and Vredenburg 2009). There is evidence of *mimetic, translation* and *bricolage* mechanisms in action here, particularly as to the manner in which particular *frames* are *diffused*. Take, for example, that the NGO Coalition for Environmentally Responsible Economies (CERES) has as its central aim the disclosure of information on the environmental impact of an organization's processes and products. From a theoretical perspective, CERES seeks to bring institutional change to *field frames* by lobbying organizations to adopt and adhere to ten core environmental principles. Similar to CERES, but more recent in its institution, is the London-based Carbon Disclosure Project (CDP). This NGO conducts annual surveys of global corporations, the majority of which are Fortune 500, for the purpose of gathering investor related information on carbon emissions, related strategies, and so on.

Organizations are increasingly conscious of changing customer perceptions on corporate environmental sustainability. Take, for example, that Green business strategies first emerged in the 1990s (Hart 1997), and research published in the Harvard Business Review indicates the continued growth of such strategies (HBR 2007). This research underpins the influence exerted by a cross section of stakeholders, including customers, investors, regulators and competitors in shaping green responses. Field (2008, p. 42) offers evidence that investor and customer *frames* are driving the development of green corporate strategies, viz. Hewlett Packard (HP) Inc. has 'reduced its use of manufacturers in Asia from 70% to about 50–60% and, at the same time, has started doing more of its own manufacturing. Recently, for example, the company built a facility in Brazil to service South America. And it's constructing a plant in India for the Indian market'. Thus, stakeholder concerns are argued to be influencing manufacturer decisions to vertically integrate their operations and reduce the length of supply chains in pursuit of developing a Green identity. Of course, regulatory concerns are also in evidence, as firms such as HP find it difficult to ensure compliance with global suppliers given they secure thousands of parts from hundreds, if not thousands, of suppliers over long supply chains (Butler and McGovern 2009). However, while customers are concerned about environmental issues, this concern often does not translate into practical action when budgetary issues dominate (Ginsberg and Bloom 2004). Ginsberg and Bloom (2004) indicate the important role played by ecolabels such as Blue Angel and Energy Star in as signalling to customers that that IT artefacts are environmentally sustainable. This provides further evidence for the role of such standards in *diffusing* information; nevertheless, it is vital to note that when such labels appear on products they offer vital symbolic cues to customers and act to *frame* a product (and by extension its manufacturer) as Green.

Environmental concerns by citizens and consumers have given rise to a variety of social movements (Jennings and Zandbergen 1995), the most notable of which is Greenpeace (Doherty 2002). Previous reviews of the literatures on CSR and environmental sustainability indicates the role that NGOs such as Greenpeace play in shaping corporate environmental sustainability programmes directly, or by structuring societal and organizational fields (Jennings and Zanderbergen 1995; Campbell 2007; Reid and Toffel 2009). Social movements in the U.S. changed not only the *field frame* of the indigenous power industry, but to help institute another sector, wind power generation (Sine and Lee 2009; Sine and David 2003). Research also describes how social movements which concentrated on corporate social responsibility have persuaded investors to boycott the products of unsustainable organizations, to influence related stock market valuations, and have them switch to companies with more environmentally sustainable reputations. Recent research therefore finds evidence of the influence of social movements and activist investors in changing *field frames* directly and indirectly by influencing private and public politics. In this context, Greenpeace plays a highly visible role across several organizational fields through its influences in shaping public opinion, government regulations, and corporate perspectives on environmental responsibility (Doherty 2002).

Greenpeace employs their website to publish (*diffuse*) the results of studies and analyses of green and not-so-green products (*framing*) – including IT artefacts (Hojsik et al. 2008).Take, for example, that Greenpeace continuously monitors the environmental performance of 18 of the largest consumer electronics and ICT manufacturers globally, including Nokia, Hewlett Packard, Lenovo, Sony Ericsson, Samsung, and Apple. It publishes the results of its research on its website along with a detailed analysis in its Greening Electronics report. Targeted organizations have responded to such social pressure with varying degrees of success in Greening processes and products. Take, for example, that Greenpeace *coerced* Apple Inc. to improve the environmental sustainability of its products an Internet and media campaign that began in 2003 and ended in 2007 (the milestones are detailed in a webpage www.greenpeace.org/apple/itox.html). Apple's corporate culture always emphasized innovation and excellence in product design; other considerations were, for all intents and purposes, secondary. Nevertheless, Apple did maintain compliance with stringent environmental regulations like RoHS, WEEE, REACh and EuP. Greenpeace, however, sets higher standards than regulatory authorities and demands more from producers (cf. Hojsik et al. 2008). In 2005 it turned up the heat on Apple, namely, 'Apple products – sleek looks, amazing design, meticulous attention to detail. So what's with the toxic chemicals inside, short life spans and allowing their products to be dumped in Asia?' Greenpeace employed powerful symbols (images on its website) and metaphors to *frame* Apple's performance on the environment. Take, for example, that the images of Asian children sitting on waste electronic equipment in garbage dumps published on Greenpeace's website provided a powerful incentive for Apple to *re-frame* how it perceived its public image and to engage in *bricolage* (Campbell 2005), mimetically adopting and recombining environmental practices to socially construct a Greener Apple, as Steve Jobs put it. Thus, in response to the public campaign by Greenpeace, Apple launched its Greener Apple initiative in 2007. Significantly, by 2009 Apple had exceeded Greenpeace's expectations in terms of what it was putting into its products and how they were manufactured and disposed of. For a company that has tradition of secrecy and non-cooperation with other players in its organizational field, Apple's new policy of disclosure on all aspects of its activities, especially emissions reductions, is significant.

Greenpeace's focus on the IT sector and the response by members of this organizational field helps explain why the presentation by Greenpeace researchers Hojsik et al. (2008) at the Electronics Goes Green 2008+ Conference in Berlin was, perhaps, the best attended of all presentations at this conference. It is clear then that organizations are extremely sensitive to the way in which NGOs like Greenpeace can shape the public perception of them and their products. Greenpeace also influences regulators like the European Commission on all existing and planned directives and regulations. The latter type of influence was confirmed to the author as part of his ongoing research on Green IS by a former senior EC official who was instrumental in formulating the REACh, RoHS and WEEE regulations. The evidence from the Apple/Greenpeace case also supports Reid and Toffel's (2009) conclusion that a combination of regulatory *coercion* and activist *framing/diffusion/coercion* maximizes the likelihood of institutional change on environmental issues by organizations (cf. Mignerat and Rivard 2009, with respect to similar findings in IS research).

The media also *frames* public perceptions of corporate sustainabilty, as various publications, on-line and hard copy, are eager to report on (*frame* and *diffuse*) organizations if they engage in environmentally unsustainable practices (Baden et al. 2009). Alternatively, they also highlight organizations that are environmentally responsible. Take, for example, Canadian publisher McLean's Technology and Media section reported that Hewlett Packard's efforts in Canada at social responsibility received an A+ranking, while Dell and IBM achieved an A, NOKIA an A-, and Nortel a B+. However, the most influential example of *framing* and *diffusion* by the media is the UK *Sunday Times* 60 Best Green Companies List, which is published annually from the results of a comprehensive survey.

Finally, it is evident that while academic publications like the *Harvard Business Review*, and indeed academic institutions, are identified as exercising a normative influence (Campbell 2007; Watson et al. 2010), they also shape how corporate executives and business managers view the world (Ferraro et al. 2005). Thus academics through their research and teaching serve a dual role in terms of *diffusing* what is appropriate and moral, on the one hand, and culturally supported and conceptually correct, on the other (Scott 1995). It is significant that IS researchers are also being urged to take *strategic leadership* by *framing*, *diffusing*, *translating*, engaging in *network cultivation* and *bricolage* with a view to achieving 2020 objectives (Butler, Agerfalk, Murugesan, Donnellan, Capra, and Schmidt 2010; cf. Melville 2010; Watson et al. 2010).

19.4 Conclusions

In the first decade of the new millennium, IT manufacturers responded to *coercive* mechanisms from regulatory agencies to eliminate or reduce regulated and hazardous substances, minimize waste, maximize opportunities for recycling, and to design energy efficient products. During this period, the EU exercised *strategic leadership* through its application of *coercive* mechanisms to restructure the organizational field of IT manufacturers and, also, related organizational fields. The focus of IT manufacturers is now, however, undoubtedly on reducing GHG emissions. Firms like Apple Inc., Hewlett Packard, and so on, responded to institutional pressures by reducing or eliminating regulated substances and making their products more energy efficient. Regulative mechanisms account for some of the success in instituting change and deinstitutionalizing environmentally unsustainable structures, beliefs and patterns of activities across this organizational field. Institutional stakeholders and social movement/activist NGOs like Greenpeace *framed* the issue differently; regulatory compliance was insufficient, as many clearly felt that such regulations did not go far enough (Hojsik et al. 2008). Take, for example that Greenpeace instituted a campaign against Apple (and the other 17 corporations in its Greening Electronics initiative) that incorporated negative metaphors and symbols for the purpose of influencing public perception of it and its products. Greenpeace employed the Internet to *diffuse* its concepts of environmental sustainability and corporations like Nokia, Sony Ericsson and Hewlett Packard engaged with Greenpeace in order to improve the sustainability of their processes and products. Apple too realigned its position and elevated environmental issues to the same level as innovative design.

Major corporations in the organizational field of IT manufacturers employed the normative mechanism of *network cultivation* to form associations such as Global e-Sustainability Initiative (GeSI). Other organizations collaborated with NGOs such as the World Wildlife Fund (WWF) to institute the Climate Savers Initiative. *Mimetic* mechanisms are at play here, as both of the above emulated the CERES NGO. Such industry associations employed other mechanisms such as *translation* (from established already *diffused* environmental practices – for example, the Greenhouse Gas Protocol Initiative) and *bricolage* to develop innovative green concepts and employed *diffusion* to disseminate them. These associations and the organizations that populate them also exercise the mechanism of *strategic leadership* and institutional entrepreneurship to turn what many saw as a vice – IT-enabled globalization and economic growth – into a virtue – the direct and enabling effects of Green ICT (cf. GeSI 2008 and OECD 2009a, b).

19.4.1 Theoretical Development and Implications

Scott (1995) fuses the various perspectives in institutional theory into a conceptual framework that 'does not provide an integrated theory of institutions but points out directions for pursuing such a theory'. In building on this framework, this chapter draws on Putnam (1981, p. 78), who argues that 'we obtain our ideas – our correct ones and many of our incorrect ones – by close study of the World. Thus, he argues that theory building should be embedded in practice and draw primarily on researchers' experiential knowledge of the world (Putnam 1981; cf. Bernstein 1983).

This theoretical paper therefore employs both deduction (from concepts in institutional theory) and induction (from primary and secondary empirical data) to theorize on the institutional mechanisms that shape the comprehension, adoption, implementation and assimilation of Green IS. Figure 19.1 presents this study's theoretical framework or model. First, it indicates the range of social actors that shape the organizational field of interest. Second, it indicates that the mechanisms discussed above structure societal and organizational fields and underpin the process of institutionalization. Take, for example, the following explanatory statement: *Governments and state agencies operate from the regulatory pillar and implement regulatory policy using coercive mechanisms that confer on legal entities, such as business organisations, a range of legal obligations to others in their societal and organisational fields*. This formative theoretical statement may be transformed into substantive theory by specifying the type and scope of *coercive* mechanism(s) and the target action or desired outcome: for example, the UK Government's Carbon Reduction Commitment legislation specifies what needs to be achieved in terms of GHG emissions, not how these targets should be met. On the other hand, the UK Government's Greening Government ICT Strategy (Cabinet Office 2009), which targets all of the

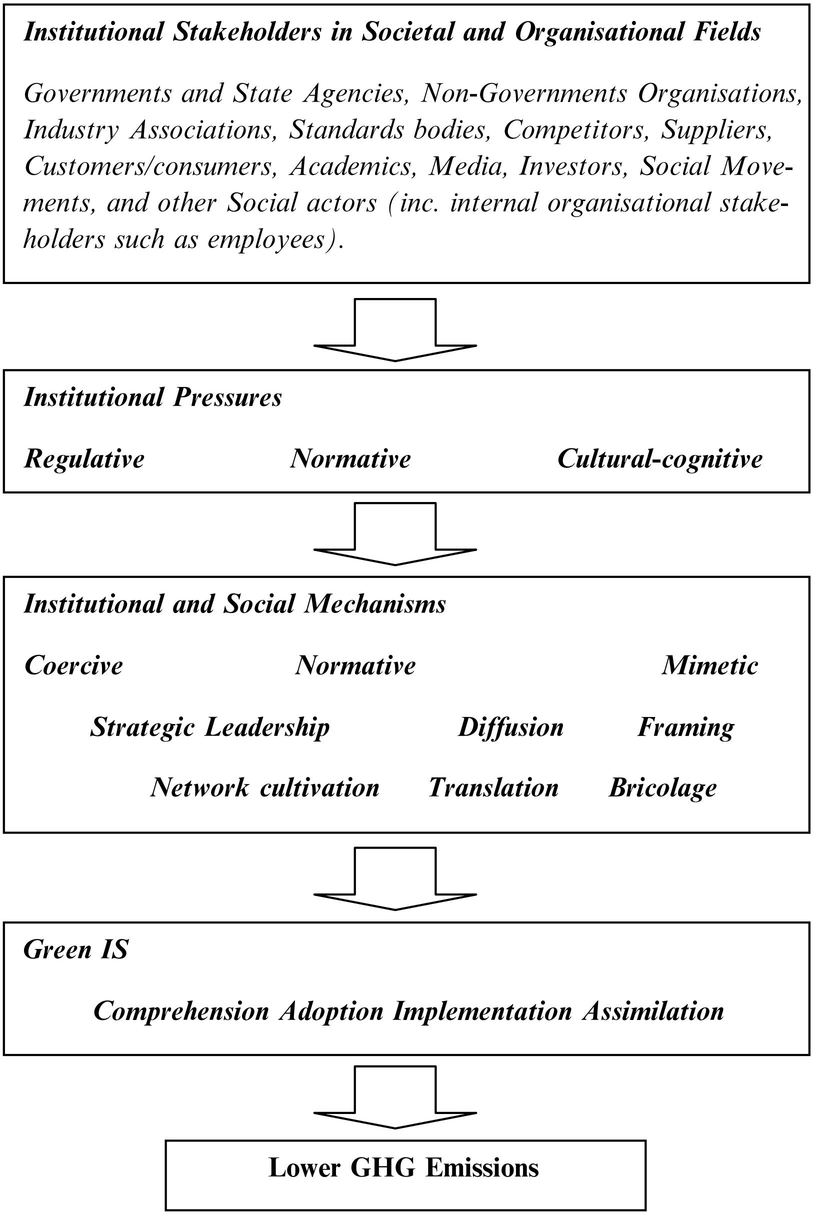

Fig. 19.1 Green IS theoretical framework

UK's public sector organizations, specifies what needs to be achieved and how (through the application of Green ICT). In this role, the UK government employs *normative* and *mimetic* mechanisms, but also the mechanisms of *framing, strategic leadership, network cultivation, diffusion, translation* and *bricolage* to achieve its aims. Thus this chapter extends the extant conceptualizations of the mechanisms that regulative entities such as governments can employ to achieve their ends. Previous sections of this chapter provide mechanism-based explanations of how other entities and social actors employ structure societal and organizational fields with the objective of having organizations act in environmentally sustainable ways. Of course, as Oliver (1991) indicates, organizations may not behave in expected ways and may implement strategies other than compliance. IS researchers may build on such mechanism-based explanations to provide fine-grained 'good enough' theory on the comprehension, adoption, implementation and assimilation of Green IS.

Unlike theory building on established natural or social phenomena, building theory on emergent social phenomena such as Green IS is problematic, as formal or substantive theory (cf. Gregor 2006) may not be testable or falsifiable. Mechanism-based theory may, however, be corroborated (cf. Putnam 1981; Davis and Marquis 2005). Thus, this chapter offers a theoretical framework for IS researchers to apply in future research in order to explain how progress towards environmental sustainability can be achieved – alternatively, it may be employed to explain why progress is not being made. Of course theory should have a practical prescriptive dimension, as is illustrated by progress in the natural sciences (Putnam 1981): thus, this chapter can help practitioners (and other social actors) understand how to transform policy into action.

In the years approaching 2020, it may be that regulative influences will become stronger and coercive mechanisms more evident as emissions targets are not reached and 2020 slips to 2025. Indeed, a study by Fujitsu (2010) does not hold out much promise that the 2020 targets set out in the GeSI (2008) report can be met. Increasing climate change may also see institutional stakeholders, social movements and NGOs employ the various social mechanisms at their disposal to change the way society looks at organizations that fail to reduce emissions. Thus, it may be that the confluence of such institutional influences will bring the deinstitutionalization of environmentally unsustainable business practices. However, institutional theory suggests that organizations may adopt legitimizing strategies that involve compromise, avoidance, defiance or manipulation – such strategies will clearly be counterproductive. Hence, this chapter concludes that regulative mechanisms involving monitoring and enforceable sanctions will have to be instituted and applied on a transnational basis. However, active social involvement may provide the key to success in ensuring that organizations leverage every opportunity to reduce the effects of climate change, particularly through the adoption, implementation and use of Green IS.

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Chapter 20
A Multilevel Social Network Perspective on IT Adoption

Heidi Tscherning

Abstract Adoption of technologies has long been a key area of research in the information systems (IS) discipline, and researchers have thus been interested in the *attributes*, *beliefs, intentions*, and *behaviors* of individuals and organizations that can explain information technology (IT) adoption. The focal unit of adoption has mainly been individuals and organizations, however, research at the group or social network levels as well as the interorganizational level has recently gained increased interest from information systems (IS) researchers. This recent focus views the world as being the sum of all relations. Various social network theories exist that seek to emphasize different proficiencies of social networks and explain theoretical mechanisms for behavior in social networks. The core idea of these theories is that social networks are valuable, and the relations among actors affect the behavior of individuals, groups, organizations, industries, and societies. IS researchers have also found that social network theory can help explain technology adoption. Some researchers, in addition, acknowledge that most adoption situations involve phenomena occurring at multiple levels, yet most technology adoption research applies a single level of analysis. Multilevel research can address the levels of theory, measurement, and analysis required to fully examining research questions. This chapter, therefore, adapts the Coleman diagram into the Multilevel Framework of Technology Adoption in order to explain how social network theory, at the individual and social network levels, can help explain adoption of IT. As Coleman (1990) attempts to create a link between the micro- and macro-levels in a holistic manner, his approach is applicable in explaining IT adoption.

Keywords Adoption • IT • Social network theory • Multi-level approach • MFTA

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Abbreviations

ICT	Information and Communication Technology
IOIS	Inter-Organizational Information Systems
IS	Information Systems
IT	Information Technology
TAM	Technology Acceptance Model
TPB	Theory of Planned Behavior
TRA	Theory of Reasoned Action
UTAUT	Unified Theory of Acceptance and Use of Technology
VoIP	Voice over Internet Protocol

20.1 Introduction

The adoption of information technologies (IT) has long been a central concern in the field of Information Systems (IS) as this type of research has great practical implications for value chain activities, from product discovery, and development to marketing and sales. Researchers have thus been interested in the *attributes*, *beliefs, intentions*, and *behaviors* of individuals and organizations that can explain adoption. Currently, several frameworks for individual-level adoption of technologies exist; for example, Theory of Reasoned Action (TRA) (Ajzen and Fishbein 1973; Fishbein and Ajzen 1975), Theory of Planned Behavior (TPB) (Ajzen 1985; 1991), and the Technology Acceptance Model (TAM) (Davis 1989; Davis et al. 1989). At the organizational level, a central theory is the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al. 2003).

Some of these frameworks add to the number of constructs in order to better explain adoption behavior; however, along with number of constructs, complexity also increases. Hence, lately there has been a diversion to the study of *relations* among individuals (Tscherning and Mathiassen 2010) and among organizations (Teo et al. 2003; Lyytinen and Damsgaard 2010) to explain how these units influence and are influenced in their adoption decision processes and how technologies are diffused in a system (Rogers 2003; Moore and Benbasat 1991). This supports the view of the society as being the sum of social relationships: *What exist in the social world are relations – not interactions between agents or inter-subjective ties between individuals, but objective relations, which exist independently of individual consciousness and will* (Bourdieu and Wacquant 1992, p. 97). In our daily lives we are linked to each other in many different ways; through marriage, friendship, work, advice, support, information transfer, and other types of relationship, and we influence and are influenced by each other through these relations. Some of them are intentional and some are oblivious.

Currently, only a few frameworks seek to provide explanations of IT adoption in social networks (Valente 1996; Rice et al. 1990). Prior studies have provided explanations of group-level adoption by computing the arithmetic mean of individual-level adoption of the same technology assuming that individual members' behavior can be aggregated to explain group behavior (e.g., Jung and Sosik 2003; Lapointe and Rivard 2005). Sarker (2006) found that aggregation of individual-level measures might, however, not be suitable for understanding behavior in a group or social network. Findings at one level of analysis do not generalize exactly to other levels of analysis, except under very restrictive circumstances (Firebaugh 1979). The adoption and diffusion of technologies sometimes occur as current users at the individual, group or organizational level share their newly acquired experiences with other individuals, groups, or organizations, hence providing a platform for IT adoption. The conception is that a heterogeneous group of individuals may adopt the same technology simply because they are part of the same social network and not because they are similar (though similarity may also explain similar adoption patterns in social networks; e.g., Aral et al. 2009; Gu et. al. 2008).

Social network theory emphasizes different proficiencies of social networks and explains theoretical mechanisms for behavior in social networks. The core idea is that social networks are valuable (Wasserman and Faust 1994), and the relations among actors affect the behavior of individuals (van den Bulte and Lilien 2001), groups (Oh et al. 2006), and organizations (Dodds et al. 2003). Different subcategories of social network theory address behavior at different levels, and some of these can therefore be applied in IT adoption research to explain the dynamics of, and the interaction between, individual-level and network-level adoption. The subcategories that have been applied in IT adoption are *social network analysis*, theories of *homophily*, *self-interest and collective action*, and *contagion*.

However, only few studies have investigated technology adoption in social networks (Lu et al. 2005; Dickinger et al. 2008; Tscherning and Mathiassen 2010). It is less complicated to understand adoption of IT at the individual level; nonetheless, individual adoption decisions seem to be influenced by social network dynamics, and hence, taking a multilevel approach can provide additional insight into IT adoption.

Past research in more conventional sciences, such as sociology and political science acknowledges that a paradox exists between the individual's capacity to make (adoption) decisions independently, and the discourse of a higher-level society, such as the individual's social network, which seems to influence or limit the choices and opportunities that individuals possess.[1] However, the field of IS has only conducted little research that takes a similar approach, for example, Poole and DeSanctis (1990). Most IT adoption situations involve phenomena occurring at multiple levels, yet most IT adoption research applies a single level of analysis. Multilevel research addresses the levels of theory, measurement and analysis required to fully examining research questions. It describes some combination of individuals, groups, organizations, industries, and societies thus bridging the micro–macro divide by integrating the micro-domain's focus on individuals with

[1] This is referred to as the ontological discussion of structure and agency on human behavior (Giddens 1984).

the macro-domain's broader focus, resulting in a richer depiction of the dynamics (Klein et al. 1999). Furthermore, it is well known that relationships that hold at one level of analysis may be stronger or weaker at a different level of analysis or may even reverse direction (Ostroff 1993).

Following these insights, and as the adoption studies in the IS field mature (Choudrie and Dwivedi 2005), the assumption is that a sole micro- or macro-stance provides an incomplete understanding of behaviors occurring at either level (Porter 1996) and that a multilevel approach will help in understanding the IT adoption decision made by individuals, social networks, and other units of adoption. This chapter, therefore, presents and adapts the Coleman diagram (Coleman 1990) in order to explain individual-level and network-level adoption of IT. As Coleman (1990) attempts to create a link between the micro- and macro-levels in a holistic manner, his approach may also be applied to IT adoption research.

This research contributes to the IS literature in a number of ways. First, it develops the Multilevel Framework for Technology Adoption, which adds to current explanations of human behavior in relation to adoption of IT. Second, based on a social network perspective, it becomes apparent that traditional social network theories can provide an in-depth understanding of the dynamics that occur at the individual and network levels and their mutual influence. Finally, this research promotes a qualitative approach to social networks and their analysis as opposed to the conventional quantitative approach.

The next section contains a literature review of multilevel research conducted on adoption of IT. Section 20.3 presents the multilevel approach and the Coleman diagram is adapted into the Multilevel Framework of Technology Adoption (MFTA). Section 20.4 presents the four social network theory subcategories; *social network analysis*, *homophily*, *self-interest and collective action*, and Section 20.5 discusses how the theories can explain adoption of IT.

20.2 Multilevel Research on IT Adoption

This research is based on the conceptual multilevel research in general and multilevel research on IT adoption in particular. The interest in analyzing and interpreting multilevel data is rooted in educational and sociological research, where a surge in theoretical and statistical discussions occurred during the 1970s. Sociology studies collective phenomena, and the study of relationships between individuals and their contexts; tracing back to Lazarsfeld and Menzel (1961), who developed a typology to describe relations between different types of variables, defined at different levels. Their typology is mainly conceptual and argues that related variables can be created by aggregation or disaggregation.

Originally, two research perspectives prevailed in the social sciences (Hitt et al. 2007). Research at the individual level takes a micro-perspective and is rooted in psychological phenomena. The focus is on understanding thoughts,

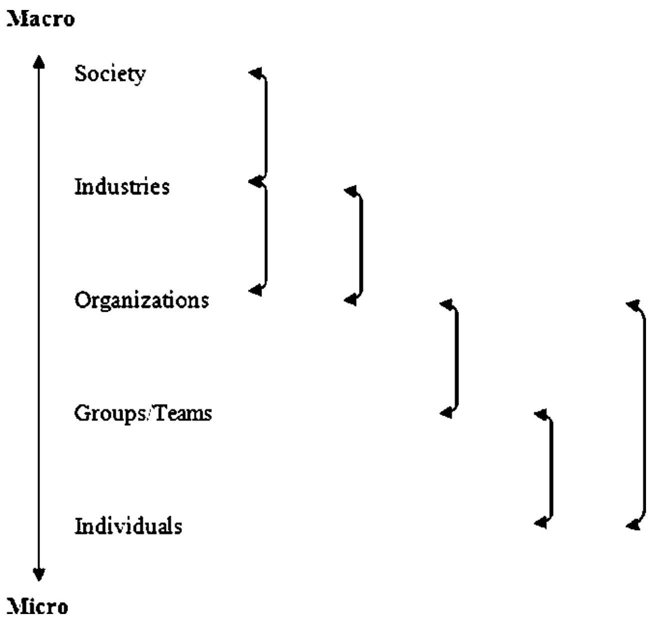

Fig. 20.1 Multiple levels of analysis in IT research

feelings, and behavior of individuals (Rousseau and House 1994). Research at the organizational level is considered macro and is rooted in sociology and economics. The focus is on understanding organizations and market dynamics (Dansereau et al. 1984).

Recently, several efforts to generate multilevel frameworks for organizational behavior research have been conducted. Dansereau et al. (1984) specify and test theories that involve two or more levels of analysis. Their framework aims to understand changes in multiple levels of analysis over time. In management research, Klein et al. (1994) investigate the underlying assumptions specifying levels of theory in organizational behavior. As no single framework has succeeded in establishing emergent common constructs, to be used more broadly in the social sciences, Klein and Kozlowski (2000) later identify what they find are critical choices and issues, when changing research focus from single-level to multilevel research. They provide guidelines for constructs and measurements, model specification, research design, sampling, and data analyses.

In today's networked society where social structures and activities are organized around electronically processed information networks, it is increasingly important that researchers take the level of adoption into account when conducting technology adoption research. Accordingly, multilevel research has been conducted within IS as depicted in Fig. 20.1.

20.2.1 Levels of Analysis: Society – Industries – Organizations

Gopalakrishnan et al. (2003) examine factors that influence adoption of Internet banking at three levels of analysis; the external context of the industry, the industry, and the organization. At the external context level, they analyze how a favorable external context facilitates the adoption of Internet banking. Different factors that impact the speed of Internet banking diffusion are analyzed at the industry level, and at the organizational level, differences in bank strategies and organizational designs, associated with the adoption of Internet banking as an added delivery channel versus as a separate business, are analyzed. Based on the multilevel analysis, they discuss the unique features in the emergence and adoption of Internet banking and its potential performance implications.

20.2.2 Levels of Analysis: Industries – Organizations

As interorganizational information systems have become available, a line of research investigates organizational IT adoption in industries. Gregor and Johnston (2000) find that strategies and policies for the adoption and development of interorganizational systems require further understanding of the theoretical background to these systems. They argue for the development of theory that is multilevel, processual, and has an emergent perspective, and, hence, develop a theory that deals with complex interactions between organizational activities at the micro-level and industry structure at the macro-level, and use structuration theory as a vehicle to advance further understanding.

Christiaanse and Rodon (2005) study, how new IS-standards, based on open technologies, increase the potential for interorganizational collaboration. They do this by raising the level of analysis to that of the constellations of organizations that are part of the industry network. They examine how the structural properties of the network impact on the adoption decision, and how the adoption in turn produces changes in the structure of the network.

Lyytinen and Damsgaard (2010) also propose an approach to studying interorganizational information systems (IOIS) adoption, which they call configuration analysis. The structure and the strategy of IOIS are interdependent, and researchers hence need to look beyond the single organization, when deciding on the appropriate unit of analysis. Lyytinen and Damsgaard (2010) consider what they call adoption configurations, and specify each type of configuration along dimensions, such as vision, key functionality, mode of interaction, structure, and mode of appropriation. They postulate that particular organizing visions assume certain interorganizational structures and, then propose a typology of configurations.

20.2.3 Levels of Analysis: Organizations – Groups/Teams

Other studies concern individual and group/team adoption in organizations. Lapointe and Rivard (2005) seek to explain resistance to IT implementation, by using a multi-level, longitudinal approach. Using semantic analysis on extant models of resistance to IT, they identify five basic components of resistance: behaviors, object, subject, threats, and initial conditions. They examine data from three case studies of clinical IS implementations in hospital settings, focusing on physicians' resistance behaviors. Their findings suggest that group resistance behaviors vary during implementation.

Scheepers et al. (2008) propose that psychological safety, a sense of interpersonal trust, and being valued in a work team, are important determinants of groupware technology adoption in educational settings. They develop and test a model of antecedents and consequences of psychological safety, which reveals positive effects.

20.2.4 Levels of Analysis: Groups – Individuals

Another set of studies examine individual- and group-level adoption of IT. van Dolen and de Ruyter (2002) investigate Moderated Group Chat, which is on-line, real-time interactions between groups of customers with an active coordinating role for a company representative and a commercial objective. They develop a conceptual framework and examine empirically which factors drive customer satisfaction with the chat sessions that involve multiple participants and interactions and take place within an electronic group environment. They, hence, test relationships between identified determinants and chat-session satisfaction using a multilevel model.

20.2.5 Levels of Analysis: Organizations – Individuals

Finally, a number of studies examine individual- and organizational-level adoption of IT. Frambach and Schillewaert (2002) identify and integrate variables that determine or influence organizational decisions on innovation adoption. They posit that two types of organizational adoption decisions can be identified; the decision made by an organization to adopt an innovation and the decision made by an individual within an organization to make use of an innovation. They formulate a multilevel model of organizational innovation adoption that incorporates determinants at both the organizational and the individual level, which serves as analytical tools that can be used in new product marketing planning.

Meyer and Goes (1988) study assimilation of innovations into organizations, a process unfolding in a series of decisions to evaluate, adopt, and implement new technologies in a longitudinal study. Their research, which concerns assimilation of medical innovations into community hospitals, focuses on discrete decisions about specific equipment. Assimilation is conceptualized as a nine-step process and measures 300 potential adoptions through organizations during a six-year period. The authors develop a model to suggest that organizational assimilation of technological innovations is determined by three classes of antecedents: contextual attributes, innovation attributes, and attributes arising from the interaction of contexts and innovations.

This study believes to its best knowledge that there is no significant study of multilevel research that can help explain the dynamics between individual-level and network-level adoption of IT. While previous research efforts have provided conceptual contributions to multilevel research (Lazarsfeld and Menzel 1961; Klein and Kozlowski 2000), their typologies are rooted in the quantitative stream and provide guidelines to make it clear to which level measurements properly belong, and how related variables can be created by aggregation or disaggregation. They do not consider the rich data about individuals, their mutual relationships and their interactions with other people, and information sources in social networks, teams, organizations, etc. This is a gap in the literature that limits our understanding of IT adoption.

20.3 Multilevel Framework for Technology Adoption

To explain the individual-level and social-network-level dynamics in the study of adoption of IT, this study draws on a diagram developed by Coleman (1990) in his *Foundations of Social Theory*. Coleman was a sociologist studying diffusion of innovations through networks (Coleman et al. 1966) and how social capital affects the productivity of individuals and groups (Coleman 1988a, b) among other things. He, moreover, developed a diagram in order to properly explain the requirements that social scientists have to meet. The diagram operates with two empirical levels; the macro-level and the micro-level. It identifies the challenges of existing macro-level empirical generalizations in social sciences that are presented as *true* explanations of macro-phenomena, and shows that crucial steps are missing in macro-level empirical generalizations. Coleman's diagram departs from Weber's *The Protestant Ethic and the Spirit of Capitalism* (1904) and argues that there are significant weaknesses in Weber's arguments as they remain at the macro-level (see Fig. 20.1). Weber claims that the religious values of a society contributed to the rise of the capitalist economic organization of a society. This corresponds to Coleman's macro-level empirical generalizations (arrow 4). Coleman (1990) argues that Weber's explanations leaves unclear how the religious values of a society affected the individuals, the macro-to-micro problem (arrow 1), and how the actions and interactions in turn contributed to a certain economic behavior (arrow 2), the rise of capitalism, displayed by the micro-to-macro problem (arrow 3) (Fig. 20.2).

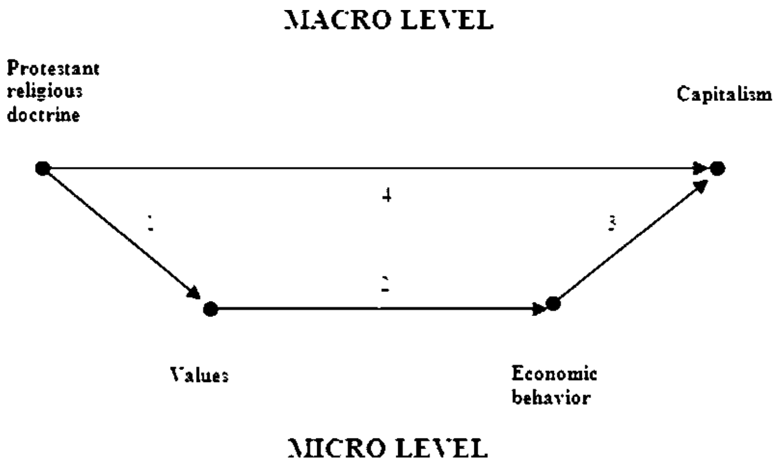

Fig. 20.2 The Coleman diagram, 1990 (Reprinted by permission of the publisher from foundations of social theory by James S. Coleman, Cambridge, MA: The Belknap Press of Harvard University Press, p. 8, Copyright © 1990 by the President and Fellows of Harvard College)

The diagram has been found to be a useful model for explaining similar macro-level empirical generalizations in the field of strategic management. Felin and Foss (2005), Foss (2007), and Abell et al. (2008) have adapted the diagram to justify that macro-explanations utilized in the capabilities view in strategic management neglects micro-foundations and are therefore incomplete. They argue that strategic management researchers usually posit a direct relation between capabilities and competitive advantage; however, this direct relation at the macro, or organizational, level can only be used under special circumstances as a shortcut for representing more complex underlying behaviors. They claim that *there are no conceivable mechanisms that directly take us from the organizational-level construct of capability to organization-level outcomes, such as competitive advantage* (Foss 2007, p. 35).

Within IS, a direct relation between individual attributes and beliefs on one side, and adoption intention and behavior on the other, is often observed; however, several examples of more complex underlying behaviors at the social network level exist. Lu et al. (2005) study the relationships between personal innovativeness and social influences on one side and intention to adopt wireless Internet services via mobile technology on the other, and find that a mobile user's social network influences the individual's adoption decision. Dickinger et al. (2008) analyze the effect of peers on individuals' adoption behavior of a VoIP (Voice over Internet Protocol) service, and find that with highly interactive services, social norms are strong drivers of usefulness and perceived enjoyment due to network effects. Finally, Tscherning and Mathiassen (2010), in a qualitative study of social-network-level constructs, find that adoption threshold, opinion leaders, social contagion, and social learning, reveal varying impact on individual iPhone adoption.

As accounted for above, individuals are often influenced by their social network in their adoption decisions, and the Coleman diagram can therefore also be used to explain IT adoption and the dynamics that occur between micro- and macro-levels.

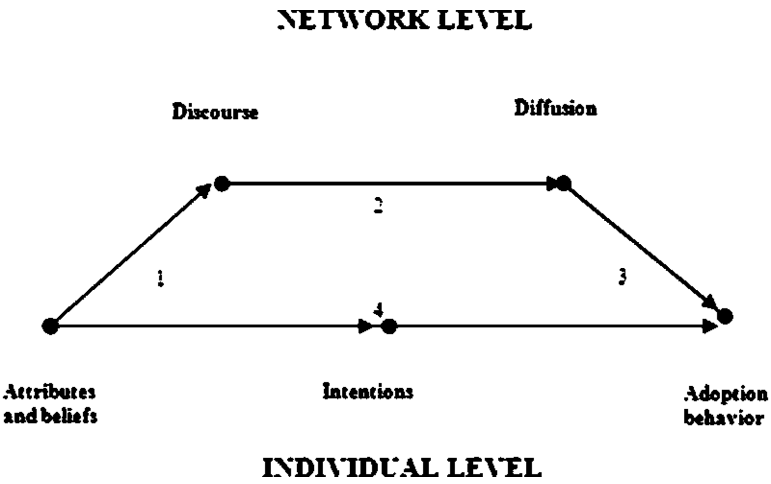

Fig. 20.3 The Multilevel Framework for Technology Adoption (Adapted from Coleman diagram, 1990)

In the following, the Coleman diagram is adapted into the Multilevel Framework for Technology Adoption (MFTA). The purpose of the MFTA is to add to current explanations of human behavior in relation to adoption of IT. The MFTA conjectures that the degree to which IT is adopted can be explained based on the interaction of individual- and network-level phenomena for which evidence can be found in the IT adoption literature. The Coleman diagram distinguishes between a micro- and macro-level; however, as the MFTA seeks to explain IT adoption based on individual- and network-level interactions, the model is therefore divided into these two levels. It should be pointed out that the network level here is a "higher" level and might as well refer to the organizational, industry, or society levels (Fig. 20.3).

In the following, the two levels in the Multilevel Framework for Technology Adoption is explained in detail.

20.3.1 Individual Level

An individual-level approach assumes that adopters are independent and do not take the structural context of the individual, such as communication relationships into account. A prevalent way of explaining IT adoption is by justifying that an individual's *attributes* and *beliefs* lead to an *intention* to adopt an IT, which subsequently results in a certain adoption *behavior*. This type of research has contributed to explaining adoption behavior in well-known models such as TAM, TRA, TPB, and other derived models. These models cover the adoption process as perceived at the individual level, and therefore take the viewpoint of the adopter. They typically contain a variation of the variables: *attributes, beliefs*, *intentions*, and *adoption behavior* (Table 20.1).

Table 20.1 Individual level variables in IT adoption

Concept	Definition	Reference	IT Reference
Attributes	The characteristics of an individual that contributes to a certain adoption behavior. Examples are socioeconomic status, personality values, and communication behavior.	Rogers (2003), Venkatesh et al. (2003)	Lu et al. (2005), Tscherning and Mathiassen (2010)
Beliefs	The psychological state in which an individual holds a proposition or premise to be true. Examples are behavioral, normative, and control beliefs.	Ajzen (1985)	Davis et al. (1989), Hsu and Lin (2008)
Intentions	Indication of an individual's readiness to perform a given behavior.	Ajzen (1988)	Venkatsh and Morris (2000), Gefen et al. (2003)
Adoption behavior	An individual's observable response in a given situation with respect to a given target.	Ajzen 1985	Davis (1989), Davis et al. (1989)

20.3.1.1 Attributes and Beliefs

Individuals in a social system do not all adopt an IT at the same time, but rather sequentially over time. Individual adopters can hence be described according to their characteristics, or attributes, and beliefs. Rogers (2003) use socioeconomic status, personality values, and communication behavior to characterize adopters of innovations, and Venkatesh et al. (2003) apply gender, age, experience, and voluntariness of use as modifiers of the adopters' intentions to explain organizational IT adoption.

Human behavior is directed by three types of beliefs: behavioral, normative, and control beliefs (Ajzen 1985). Behavioral beliefs concern the likely outcomes of a behavior and the evaluations of these outcomes. Normative beliefs involve the normative expectations of others and motivation to comply with these expectations, and finally control beliefs concern the presence of factors that may facilitate or impede performance of the behavior and the perceived power of these factors (Ajzen 1985). Previously identified beliefs include performance expectancy, effort expectancy, social norms, facilitating condition (Venkatesh et al. 2003), attitude toward behavior, and subjective norm (Ajzen and Fishbein 1980).

20.3.1.2 Intentions

Intention is an indication of an individual's readiness to perform a given behavior, and it is considered to be the most immediate antecedent of behavior. Intentions can be seen as behavioral dispositions until, at an appropriate time and opportunity, they are turned into action (Ajzen 1988). Hence, attitude and beliefs affect intention and subsequently adoption behavior.

20.3.1.3 Adoption Behavior

Adoption behavior refers to an individual's observable response in a given situation with respect to a given target. It is assumed, behavioral intention is a function of attributes and beliefs about the likelihood that performing a certain behavior will lead to a specific outcome. According to Fishbein and Ajzen (1975) external factors can only influence intention and behavior through beliefs.

Figure 20.4 shows a simplified version of the individual-level approach to IT adoption; the lower part of the MFTA.

20.3.2 Network Level

The second level concerns phenomena occurring at the network level, that is, the collective behavior of an individual's network. A network-level approach posits that networks are valuable and that the relations among individuals in the network affect the behavior of both the individuals and the network (Table 20.2).

20.3.2.1 Discourse

Each network is different and so their characteristics vary along dimensions such as relationship, distance, trust, information sharing, etc. (Ford 1980; Ford et al. 1986). Each network pertains to a certain discourse. A discourse is a formalized way of

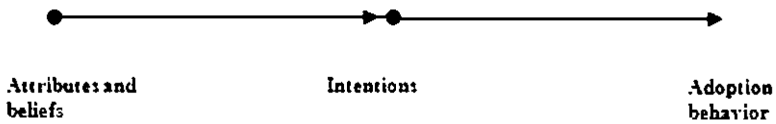

Fig. 20.4 Individual-level approach to IT adoption

Table 20.2 Network level variables in IT adoption

Concept	Definition	References	IS Reference
Discourse	A formalized way of thinking that can be manifested through language; a social boundary defining what can be said about a specific topic. Language is intertwined with symbols, rituals, and norms.	Foucault (1970, 1972)	Thompson (2002) Wilson (2003)
Diffusion	The process by which an innovation is communicated through certain channels over time among the members of a social system.	Rogers (2003)	Liebowitz and Margolis (1995) Shapiro and Varian (1999)

thinking that can be manifested through language; a social boundary defining what can be said about a specific topic (Foucault 1970, 1972). A discourse, however, is more than words that reflect topics, rules, and norms of behavior. It is a way of *knowing* in the network, as language is intertwined with symbols, rituals, and norms. Hence, discourses affect our views on all things, and it is not possible to escape discourses (Putnam and Fairhurst 2001). Individuals, who are part of a network, are shaped by the discourse in the network. They use similar language, and adhere to the rules and norms of behavior in the group. Within IS, discourse analysis has been widely used to demonstrate how technologies have become deeply involved in the conception and practice of socioeconomic development within less-developed countries (Thompson 2002), for policy makers (Wilson 2003).

20.3.2.2 Diffusion

Our social and professional lives are constituents of interactions with many individual actors linked together in network structures (Vigden et al. 2004) and a certain discourse is present in this network. These structures and the discourse can either favor or impede diffusion of IT in a network (Katz and Levine 1963; Rogers 2003). Diffusion is *the process by which an innovation is communicated through certain channels over time among the members of a social system* (Rogers 2003, p. 5). Diffusion of innovations theory has had considerable impact on the IS field and has therefore been a widely used instrument to explain and predict rates of IT diffusion (Moore and Benbasat 1991; Rogers 2003). It derives from theories of organisational existence and has since attempted to explain mainly individual adoption decisions (Lyytinen and Damsgaard 2001). The IT decision process is a five-step process through which an individual, group, or organization moves from gaining initial knowledge of an IT to forming an attitude about it, and finally making a decision whether to adopt or reject it (Rogers 2003).

Individuals may be unaware of a certain IT when being exposed to initial knowledge about it. The discourse in the network may reinforce an awareness process, and as an IT is diffused in the network, network effects[2] may occur (Liebowitz and Margolis 1995; Shapiro and Varian 1999). Research shows that network effects require a critical mass of adopters in the IT diffusion process, before the diffusion takes off in the widespread S-shaped curve of adoption (Markus 1987; Mahler and Rogers 1999). It may thus be derived that the network impacts each individual's decision to adopt or reject an IT.

Figure 20.5 shows that, at the network level, the upper part of the MFTA, a certain discourse exists. The symbols, rituals, norms, and debate influence the subsequent diffusion of IT in the network.

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[2] When the value of an IT to one user depends on how many other users there are, the IT is said to exhibit network externalities or network effects.

20.3.3 Individual Level and Network Level Interaction

Thus far, it has been accounted for that most adoption explanations remain at the individual level: phenomena and events are explained at the individual level and do not refer to what is going on at the network level. Figure 20.6 shows that the degree to which IT adoption can be explained is based on the interaction between individual- and network-level phenomena.

Individuals' attributes and beliefs regarding an IT may influence the discourse in their network. Rules, norms, and behavior in the network change accordingly and drive, or impede, diffusion of the IT in the network. When the network discourse is prevailing, beliefs, intentions, and adoption behavior, at the individual level, may be overruled, and the ongoing diffusion in the network influences the decision to adopt or reject an IT. Hence, individual adoption decisions are influenced by network-level phenomena.

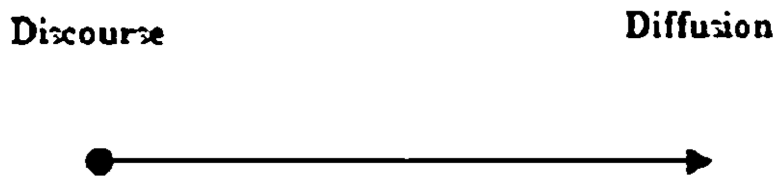

Fig. 20.5 Network-level approach to diffusion of IT

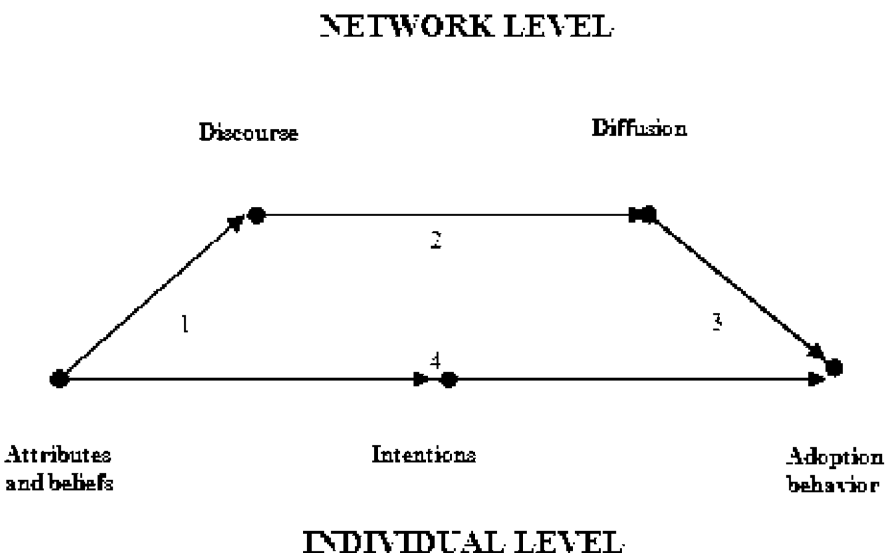

Fig. 20.6 The Multilevel Framework for Technology Adoption (Adapted from Coleman diagram, 1990)

Considering an example of early iPhone adoption (Tscherning and Mathiassen 2010), the attributes of five individual adopters in a social network, and their beliefs about the iPhone, demonstrate an influence from their social network and how the iPhone became a central topic of discussion prior to its release. At different times just after its US release, each individual acquired the iPhone and immediately observed an increasing interest within their common network. Consequently, the iPhone diffused in the network and became the prevalent mobile device. Prior to acquiring the iPhone, the respondents of the study were loyal to either Nokia or Sony Ericsson. The beliefs of the individuals in their social network, regarding required functional and aesthetic value, and not least symbolic value of a mobile device had been overruled by the discourse in the social network.

20.4 Social Network Theories

The use of social and media networks has reinforced the social nature of interpersonal relationships (Wellmann 1999). Individuals are organized in social networks, in which they socialize and share ideas and uses of IT. The current perception is that individuals change their feelings and behaviors as a result of the exerted influence from the network (Rashotte 2007). A combination of social and media networks shape important structures at all levels, and according to van Dijk (2005) the traditional split of the mass media, telecommunications, and data communication has dissolved in the process of media convergence. He uses the metaphor that *networks shape the nervous system of advanced high-tech societies* (van Dijk 2005, p. 1).

Social network theory has provided considerable insight into network structures, and phenomena occurring at all levels of analysis. However, as shown in Section 20.2, only little multilevel research has been conducted in the area of IT adoption. Monge and Contractor (1988, 2003) have provided an extensive overview and description of social network theories applied in the areas of communication and organizations. Based on their overview, four subgroups of social network theories are here presented along with examples of application of the theories in IS. The list of theories is not exhaustive, but rather the chosen theories have proven useful in IS research.

20.4.1 Social Network Analysis

The basic premises of social network analysis, is that relations are central to social networks as they affect behavior of all units of analysis. Relations possess a number of important properties, and these and other fundamentals of social networks are described in immense detail in existing literature – see, for example, Wasserman and Faust (1994), Brass (1995), Monge and Contractor (1988, 2003), and Scott (2000). Barnes (1954) was one of the first to use the social network term systematically when he discovered that, though a community shared cultural values, most individuals made decisions with reference to personal contacts. Social network analysis has since been further developed (Friedkin 1980; Burt and Minor 1983; Krackhardt 1987, 1990; Wasserman and Faust 1994) and expanded to other uses including, for example, technological networks and derived effects (Oh et al. 2006).

Researchers typically study either ego-networks, consisting of the ties that specific individuals hold, or complete networks consisting of all ties in a defined population. Brass (1995) and Monge and Contractor (1988, 2003) have summarized the major network measures and divided them into three levels: measures assigned to individuals, measures related to ties among individuals, and measures used to describe entire networks. Measures assigned to individuals include *degree* measures, *centrality* measures, *range*, and *prestige*. Brass (1995) notes that *it is important to remember that these measures are not attributes of isolated individual actors; rather, they represent the actor's relationships within the network. If any aspect of the network changes, the actor's relationship within the network also changes* (Brass 1995, p. 44). Contingent on the network measures each individual holds a role in the network: *stars* are centrally located, *liaisons* connect two or more groups without being a member of either, *bridges* are members of two or more groups, *gatekeepers* mediate between one part of the network and another, and *isolates* have no or few links in the network.

Social network measures that relate to ties between two actors include measures such as *indirect link*, the path between two actors mediated by others, *frequency*, how often a relation occurs, *strength*, amount of time, emotional intensity, intimacy, or reciprocal services, *direction*, and *symmetry* of relations. These measures can all be aggregated and assigned to a particular individual or used to describe the entire network; however, aggregation of tie measures does, however, not provide the complete story of the network. For example, an ego-network might consist of 50–50% strong–weak ties, and when aggregating the value for the whole network the numbers are 70–30% strong–weak ties. These numbers provide a general overview of the structure of the network; however, they do not provide details about the significance of the distribution of strong and weak ties.

Finally, the network measures describe entire networks, and include *size* of network, *inclusiveness*, the number of individuals minus the isolates, *component*, the largest connected subset of network individuals, and relations, where all individuals in the component are connected and have no other relations. *Density* measures the ratio of the number of actual links to the number of possible links in the network and network *centrality* the difference between the centrality scores of the most central individual and those of other individuals in the network. Other measures that describe entire networks include *connectivity*, *connectedness*, *symmetry*, and *transitivity* (Table 20.3).

Within IS, social network analysis is one of the most widely used social network theories. Oh et al. (2006) measure different network constructs in order to understand the characteristics and the role of social influence on the diffusion of user-generated content via the online network YouTube. Onnela et al. (2007) examine the communication patterns of millions of mobile phone users, allowing them to study both local and global structures. They find that a coupling between interaction strength and local structure of the network slows down the diffusion process resulting in dynamic trapping of information in communities, and that weak and strong ties are both simultaneously ineffective when it comes to information diffusion.

Social network analysis analyzes *both* individual-level measures and higher network-level measures as depicted in Fig. 20.7.

20.4.2 Homophily

Another group of social network theories concern theories of homophily. Homophily theories assume that it is a fundamental principle of human communication that the exchange of information and ideas occur more often between individuals who are similar, and hence researchers attempt to explain network relations on the basis of homophily; that is, an individual's tendency to select others who are alike (Lazarsfeld

Table 20.3 Social network measures at different levels of measurement (Summarized from Brass 1995)

Individuals	Roles	Ties	Networks
Degree measures, range, centrality measures, and prestige.	Stars, liaisons, bridges, gatekeepers, and isolates.	Indirect link, frequency, strength, direction, and symmetry of relations.	Size, inclusiveness, component, density, network centrality, connectivity, connectedness, symmetry, and transitivity.

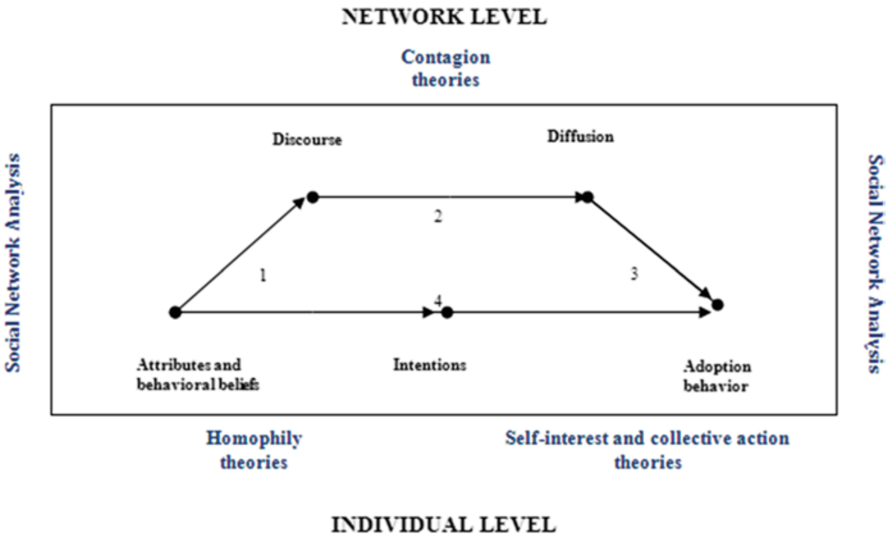

Fig. 20.7 Social network theories applied to the Multilevel Framework of Technology Adoption

and Merton 1964). Similarity is thought to ease communication, increase predictability of behavior, and promote trust and reciprocity (Brass 1995, p. 51; Monge and Contractor 2003). The consequence is, however, that personal networks become homogeneous with regard to attributes and beliefs. Homophily may accelerate the diffusion process but it limits the spread of innovations to those individuals connected in the immediate network, and therefore has great implications for the information received, the attitudes formed, and the interactions experienced in the network. Homophily is also referred to as assortative mixing.

Two subgroups of homophily theories have been identified*: social comparison* (Byrne 1971) and *social identity* (Tajfel 1974; Schacter 1959). Social comparison is based on a similarity–attraction hypothesis and supports the premise that similarity on attributes and beliefs will facilitate interpersonal attraction and liking, which in turn reduces the psychological discomfort, and thereby reduces potential conflicts in a relationship that may arise from perceived inconsistency (Monge and Contractor 2003). Social identity is part of an individual's self-concept, which derives from knowledge of the membership of a social group together with the emotional significance attached to that membership (Tajfel 1974). Schacter (1959) argues that similarity provides individuals with a basis for legitimizing their own social identity. The way individuals categorize themselves influences the extent to which they associate with others from a same category.

Within IS research, emphasis has been placed on social comparison studies. Agarwal and Prasad (1999) propose a theoretical model in which the relationship between individual differences and IT acceptance is hypothesized to be mediated by the constructs of TAM. They test the model on 230 users and find that individual differences influence the individual's beliefs about IT innovations. In another study, Gu et al. (2008) analyze individual interactions in virtual communities based on the cognitive dissonance theory. They argue that individual interaction decisions are motivated by the desire to decrease conflict between an individual's own opinion and the opinions of others in the community, and find significant support for the hypothesis about homophily in individual interaction decisions. Finally, Aral et al. (2009) develop a dynamic framework to distinguish homophily with influence-based effects in dynamic networks. They test their framework on data from a global instant messaging network of almost 30 million users, and find that homophily explains more than 50% of the behavioral contagion that occurs in the network.

As the above studies show, homophily-driven theories *originate* at the individual level, as social comparison and social identity is based on individual attributes and beliefs (see Fig. 20.7). However, homophily impacts network structures, network discourse, and hence diffusion.

20.4.3 Self-Interest and Collective Action

A third group of social network theories are *self-interest* and *collective action* theories. Theories of self-interest postulate that people make what they believe to be rational choices in order to acquire personal benefits. Theories of collective action focus on mutual interest and the possibility of benefits from coordinated action rather than on individual self-interests (Monge and Contractor 2003). The logic is that people motivated by self-interest avoid investing resources in a joint attempt leaving others to contribute instead even though all will benefit – this is also referred to as free-riding (Monge and Contractor 2003). Collective action theories suggest that individuals forego the tendency to free-ride due to social capital (Coleman 1990; Putnam 1993, 1995), the strength of weak ties (Granovetter 1973), and adoption thresholds (Granovetter 1978; Valente 1996).

The theory of social capital concerns the resources embedded in one's social network and how access to, and use of, such resources promote an individual's self-interest. Nahapiet and Ghoshal (1998) suggest three dimensions of social capital; the structural, relational, and cognitive dimensions. The structural dimension of social capital refers to the overall pattern of connections between individuals and how they reach each other. The relational dimension focuses on the particular relations people have, such as respect and friendship, that influence their behavior, and the cognitive dimension refers to those resources providing shared representations, interpretations, and systems of meaning among parties (Nahapiet and Ghoshal 1998, p. 244). Burt's (1992) concept of structural holes suggests that people accumulate social capital, which they invest in social opportunities from which they expect to profit. These investments are motivated by the return individuals expect to get on the social capital they invest. Network holes are the places in the network, where people are unconnected, and consequently, holes provide opportunities where individuals can invest their social capital. They do this by connecting to two or more unconnected others, thus creating indirect ties between the individuals to whom they link. They hence control the information that flows between others.

Granovetter (1973, 1983) developed the strength of weak ties theory as a counter-theory to the conventional assumption that individuals receive most of their crucial information from others with whom they communicate on a regular basis; instead he found that crucial information is received through weak ties, connections to others with whom they have occasional contact. Accordingly, Granovetter (1973, 1983) argues that the weak tie between two individuals becomes a crucial *bridge* between one individual's close network and another individual's close network, as relevant new information travels from one social network to another through this bridge. These weak ties are, therefore, fundamental to IT diffusion and adoption. It follows that *individuals with few weak ties will be deprived of information from distant parts of the social system and will be confined to beliefs and behaviors of their close friends* (Granovetter 1983, p. 202).

Finally, the theory of adoption thresholds has been used to examine adoption of IT. Thresholds are the proportion of adopters in a social system needed for an individual to adopt an innovation (Granovetter 1978). Adoption thresholds can hence be viewed as an attribute of adopters, and it is argued that the threshold levels of individuals determine whether a group as a whole can achieve the critical mass necessary for rapid and widespread collective action (Markus 1987; Valente 1996). An individual's threshold can be based on a norm of reciprocity in the network, which is a sense of mutual indebtedness so that individuals usually reciprocate the benefits they receive from others, ensuring ongoing supportive exchanges (Shumaker and Brownell 1984). Thus, when there is a strong norm of reciprocity in the network, individuals trust that their knowledge contribution efforts will be reciprocated, thereby rewarding individual efforts and ensuring ongoing contribution.

In IS research, Wasko and Faraj (2005) apply theories of collective action to examine how individual motivations and social capital influence knowledge contributions in electronic networks. They find that people contribute when they perceive that it enhances their professional reputations, when they have the experience to share, and when they are structurally embedded in the network. Furthermore, they find that contributions occur without regard to expectations of reciprocity from others or high levels of commitment to the network. Chiu et al. (2006) also investigate the willingness to share knowledge in the fostering of a virtual community and integrate the social cognitive and the social capital theories to construct a model for investigating motivations behind knowledge sharing in these communities. Their study supports that social capital influences individuals' willingness to knowledge sharing in virtual communities. Levin et al. (2004) propose and test a model of dyadic knowledge exchange to integrate multiple findings of the significance of strong and weak ties. They find evidence for the existence of knowledge sharing through strong and weak ties and that, especially strong ties, are important for receiving tacit knowledge.

The above studies show that social capital, weak ties, and adoption thresholds influence individual motivations for sharing in the network (Fig. 20.7), and thus theories of self-interest and collective action depart at the individual level though individual-level motivations stem from network-level benefits.

20.4.4 Contagion

Contagion theories are based on the assumption that networks serve as a mechanism that exposes individuals, groups, and organizations to information, attitudes, and behavior of others (Monge and Contractor 2003). This exposure increases the likelihood that an individual becomes "contaminated" by their network's beliefs and behavior. Contagion is therefore an outcome of the structural position in the network. Degree centrality calculates the number of direct ties an individual has in the network; a higher number of direct ties results in a greater chance of disseminating and receiving information about ITs (Granovetter 1973; Burt 1999).

Two network contagion mechanisms are social influence (Fulk et al. 1990; Fulk 1993) and social cognition (Bandura 1986). Social influence is a rather broad phenomenon referring to the extent that attitudes and behavior of other people significantly impacts individual behavior regarding IT use (Fulk et al. 1990). According to social cognitive theory, *watching* others performing a behavior influences the individual's perceptions of their own ability to perform the behavior, or self-efficacy, and what they expect the outcomes of the behavior to be (Bandura 1986).

IS research on contagion includes a study by Jasperson et al. (1999). They attempt to develop an understanding of the role played by social influence on an individual's IT use by examining the pathways through which social influence unfolds and impacts IT usage behaviors. They define and examine three appropriation moves. These moves are deliberate actions taken by individual users as they respond to the technology-directed social influence of their peers. They establish that individuals may utilize different modes of responding to social influence with respect to technology use. Compeau et al. (1999) develop a model based on social cognitive theory to test influence of computer efficacy, outcome expectations, affect and anxiety on computer usage. Using longitudinal data from almost 400 users during a 1-year period, their overall findings provide strong confirmation that both self-efficacy and outcome expectations impact an individual's affective and behavioral reactions to IT. Burkhardt (1994) also perform a longitudinal investigation using data from a federal government agency, to investigate alternative sources of social influence, the role of interpersonal beliefs, attitudes, and behaviors following a technological change. She finds that individuals' attitudes and use of a recently implemented computer network are significantly influenced by the attitudes and use of others in their communication network. Coworkers, with whom communication occurs directly, influence individuals' perceptions of self-efficacy with new IT – the theoretical mechanism of contagion by cohesion. The attitudes and behaviors of individuals are, however, affected more by structurally equivalent coworkers. Structural equivalence refers to the degree to which two individuals have similar relationships to other people in their network.

Contagion, hence, originates at the network level and influences the individuals in the network as depicted in Fig. 20.7.

20.5 Discussion

The following is a step toward explaining how research on the dynamics between the individual and the network level influences adoption of IT. As part of this effort, the problem of solely studying adoption behaviors at the individual or the network level was accounted for, as it provides an incomplete understanding of behaviors at either level (Firebaugh 1979). Analyzing IT adoption at one level is less complicated; however, as previous research has shown, individual adoption decisions are influenced by the dynamics of social networks (Lu et al. 2005; Dickinger et al. 2008) and taking a multilevel approach may, hence, provide additional insight into IT adoption.

As part of this effort, the Coleman diagram (Coleman 1990) was adapted into the Multilevel Framework of Technology Adoption (MFTA). The purpose of MFTA is to add to current explanations of human behavior in relation to adoption of IT, and it conjectures that the degree to which IT is adopted can be explained based on the interaction of individual-level (Ajzen 1985; Venkatesh et al. 2003; Rogers 2003) and network-level (Shapiro and Varian 1999; Putnam and Fairhurst 2001) phenomena for which evidence can be found in existing literature.

Drawing on the view of the society as being the sum of social relationships, this chapter provides a description of four social network subgroup theories; *social network analysis*, theories of *homophily*, *self-interest and collective action*, and *contagion*, as these theories have proved useful for explaining adoption in the IS field.

As a new contribution to our understanding of the multilevel social network perspective on IT adoption, evidence in previous research for the application of social network theories, at various levels of analysis, was identified. Table 20.2 contains an overview of social network theories, references, and level of origin. Social network analysis contains measures assigned at individuals, measures related to ties, and measures that describe whole networks and may therefore originate at all levels of analysis. Homophily theories depart from the individual level as social comparison and social identity theories are based on individual attributes. Similarly, self-interest and collective action theories show that social capital, weak ties, and adoption thresholds influence individual motivations for sharing in the network, and thus originate at the individual level though individual-level motivations stem from network-level benefits. Finally, contagion theories originate at the network level and may influence individuals directly in their adoption decisions (Table 20.4).

When applying the above social network theories to the MFTA, it becomes clear to which level the social network theories properly belong and how they influence other levels of analysis.

Figure 20.7 provides a visualization of the social network theories applied to the MFTA. It shows that homophily as well as self-interest and collective action theories depart at the individual level, whereas contagion theories describe network-level dynamics. Social network analysis measures originate at both levels of IT adoption. In the following, the interaction between the individual and network levels is visualized taking point of departure in each theoretical subgroup. The aim is to establish how social network theories affect adoption of IT's when looking at multiple levels. The originating constructs from the MFTA are highlighted as are the influences.

20.5.1 Homophily

It has been established that similar individuals communicate with each other, as similarity is thought to ease communication, increase predictability of behavior, and promote trust and reciprocity (Brass 1995). Networks may hence become homogeneous with regard to attributes and beliefs, and the discourse particularly preserved. This may act as a barrier to the flow of information and new IT in the network, which in turn delays the diffusion process as diffusion can only occur through communication links that are somewhat heterogeneous (Rogers 2003, p. 306). Homophily can, therefore, act to slow down the rate of diffusion in a system, and push individuals to reject an IT.

Table 20.4 Social network theories and level of origin

Social network group	Theory	References	Level of origin	Influences
Social network analysis	Social network analysis	Scott (1988), Wasserman and Faust (1994), Brass (1995), Wellmann (2001), Monge and Contractor (1988, 2003), Oh et al. (2006), Onnela et al. (2007)	Individual Network	Individual Network
Homophily	Social comparison	Byrne (1971), Agarwal and Prasad (1999); Gu et al. (2008); Aral et al. (2009)	Individual	Network
	Social identity	Schachter (1959)		
Self-interest and collective action	Social capital	Coleman (1990), Putnam (1993, 1995), Wasko and Faraj (2005), Chiu et al. (2006)	Individual	Network
	Strength of weak ties	Granovetter (1973, 1983), Levin et al. (2004)		
	Adoption thresholds	Granovetter (1978), Valente (1996), Wasko and Faraj (2005)		
Contagion	Social influence	Fulk et al. (1990), Fulk (1993), Jasperson et al. (1999)	Network	Individual
	Cognitive theory	Bandura (1986), Burkhardt (1994), Compeau et al. (1999)		

20.5.2 Self-Interest and Collective Action

While some individuals focus on self-interest and act to acquire personal benefits, the incentive of others is mutual benefit and the possibility of profiting from coordinated action. How they are motivated can be attributed to their belief system and the discourse in their network. If the network structure provides easy access to other individuals in the network as well individuals in other networks through structural hole positions, individuals are exposed to new and relevant information. However, as noted above, a homogeneous network deprives individuals of information from distant parts of the social system, hence, having the opposite effect on information and IT diffusion. Yet, if individuals' relations to other individuals are based on respect and trust and provide shared representations, interpretations, and systems of meaning, diffusion is enforced, and individuals will accumulate social capital to make use of in their IT adoption decision-making. Finally, diffusion in a network reveals how large a proportion of the network relations have adopted an IT and thus constitute the individual's adoption threshold. This attribute partially influences the individual's intention and, hence, subsequent adoption behavior.

20.5.3 Contagion

The contagion effect originates at the network level and serves as a mechanism that diffuses information, beliefs, and behaviors of others in the network to individuals. This exposure increases the likelihood of the individual being contaminated as a consequence of the discourse of the network, thereby changing the individual's belief system, intention to adopt, and adoption behavior.

20.5.4 Social Network Analysis

Social network analysis is the study of relations among all units of analysis and explains how units influence and are influenced in their adoption decisions and how IT diffusion takes place. Researchers typically study adoption in ego-networks consisting of the ties that specific individuals hold, and diffusion of technology in complete networks consisting of all ties in a defined population. Social network measures can hence be assigned to both levels depending on the research question in mind. Structural properties, such as an individual's centrality and prestige and strength of relations to other individuals, may influence diffusion in the network, while network size and density may impact diffusion and thereby an individual's adoption behavior.

The development of the framework and analysis of individual and network level dynamics assisted in informing us in the study of IT adoption by uncovering interesting dynamics that transpire between the two levels of adoption. Most studies take a quantitative approach showing relationships between different constructs at either level; however, exploring constructs in IT adoption prior to causal analysis may reveal origin of constructs and underlying assumptions that show which constructs in reality influence each other in a particular situation, and if aggregation of constructs may actually provide insight into network behavior.

20.6 Limitations and Future Research

The focus of this chapter has been to substantiate why IT adoption research performed at multiple levels should be emphasized in IS research. The Multilevel Framework for Technology Adoption was developed for this purpose and showed that different social network theories, applied in the IS field for explaining IT adoption, originate at different levels depending on the research question, but still influence all levels. The MFTA does, however, retain certain limitations.

First, the framework shows a simplification of the influences between the individual and the network level. In reality, influences may go both ways and cross from constructs at the network level to constructs at the individual level. It is, for example, possible to imagine that *diffusion* of IT influences *intention* and then adoption. Also it is widely accepted that network diffusion influences individual adoption of IT, and individual adoption similarly influences network diffusion of IT. However, being true to the effects in the original Coleman diagram, and keeping the MFTA simple, makes it possible to explore the dynamics when applying social network theories to adoption of IT.

Furthermore, only a subset of social network theories is used in this research. The chosen theories have all been applied in the IS field; however, the comprehensive list of social network theories used in the field of communication and organization (Monge and Contractor 2003) could provide new approaches to IT adoption as well and could hence be applied to the MFTA.

The findings in this chapter have implications for academics interested in IT adoption. It prompts researchers to conduct additional multilevel research in the area of diffusion and adoption. There are, however, several barriers to conducting multilevel research (Klein et al. 1999). There is a vast amount of potentially relevant research at both the individual and organizational level of adoption that researchers should take into account when developing multilevel models; however, research at the social network level and interorganizational level is still relatively small. It is necessary to understand the dynamics that take place at either level of analysis when conducting multilevel research. Also researchers may have interest and skills in conducting either micro- or macro-level research and they may, therefore, not be interested in taking the view of both levels, and finally the scoping of the research may pose a problem. However, when researchers decide to take on multilevel research, benefits will also appear as this chapter has clarified; multilevel research describes some combination of individuals, groups, organizations, industries, and societies, thus integrating the micro-domain's focus on understanding thoughts, feelings, and behaviors of individuals with the macro-domain's broader focus on understanding higher levels' dynamics resulting in a richer depiction of the adoption process.

20.7 Conclusion

This chapter outlines a multilevel social network perspective on adoption of the IT. The Coleman diagram (Coleman 1990) was adapted into the Multilevel Framework for Technology Adoption (MFTA) to explore how different subcategories of social network theory can be applied in IT adoption research to explain the dynamics of individual- and network-level adoption behavior.

The MFTA suggests that the degree to which IT is adopted can be explained based on the interaction of individual- and network-level phenomena. An individual-level approach to IT adoption typically contains a variation of the variables: *attributes*, *beliefs*, *intentions*, and *adoption behavior*, whereas a network-level approach posits that the relations among individuals in a network affect the behavior of both the individuals and the network. At the network level, a certain *discourse*, based on individual attributes and beliefs, can be observed that may favor or impede *diffusion* of IT in the network. The rate of diffusion thus influences individual adoption behavior in the network.

Though social network theory has provided considerable insight into network structures, and phenomena occurring at all levels of analysis, limited multilevel research has been conducted in the area of IT adoption. The application of four different subcategories of social network theory provides the following results: (1) *Social network analysis* analyzes both individual-level measures and network-level measures. (2) *Homophily*-driven theories originate at the individual level but impact network structures, network discourse, and hence diffusion. (3) Theories of *self-interest and collective action* depart at the individual level though individual-level motivations stem from network-level benefits. Finally (4) *Contagion* originates at the network level and influences the individuals in a network.

The development of the MFTA is an attempt to create awareness of the benefits of applying a multilevel approach when studying IT adoption. The framework is a simplification of the influences between the individual and network level; however, the insights from this research demonstrate that multilevel research can provide additional insights into adoption behaviors.

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Chapter 21
Expectation–Confirmation Theory in Information System Research: A Review and Analysis

Mohammad Alamgir Hossain and Mohammed Quaddus

Abstract Understanding the antecedents and their effects on satisfaction is crucial, especially in consumer marketing. Most investigations in marketing research have used the Expectation–Confirmation Theory (ECT) which is used by the IS researchers too, with a few modifications and have taken the name Expectation–Confirmation Model (ECM). ECM is broadly applied to examine the continuance intention of IS users rather than just to explain satisfaction. Though the name of the model still contains *expectation* but practically the pre-consumption *expectation* is replaced by post-consumption expectations, namely, *perceived usefulness* which is believed to contribute a more meaningful dimension to theory. In IS research, though the dependent variable, *continuance usage intention*, is quite consistent but the independent variables, logically, are multi-varied as they are considered from contextual perspectives. Consequently, there is no general agreement concerning the definition, relationship, and measurement methods of the constructs neither in ECT nor in ECM. This chapter, therefore, tries to provide a comprehensive and systematic review of the literature pertaining to "expectation–confirmation" issues in order to observe current trends, ascertain the current "state of play," and to promising lines of inquiry. Findings of this study suggest that positivist and empirical research is predominantly used with most of the samples being university students. Besides, technology acceptance model (TAM) and theory of planned behavior (TPB) are also integrated with ECT and ECM to have a better understanding of consumer behavior. The trend toward integrating and/or incorporating associated variables and constructs from various theories to ECM has a better fit in related areas of applications. Moreover, active researches are highly concentrated in USA, Hong Kong, and Taiwan. Finally, this study proposes research implications for the future.

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Abbreviations

CS	Consumer satisfaction
DSS	Decision support system
ECM	Expectation–confirmation model
ECT	Expectation–confirmation theory
EDT	Expectation–disconfirmation theory
GPS	Global positioning system
GSS	Group support system
IDT	Innovation diffusion theory
IS	Information system
IT	Information technology
PBC	Perceived behavioral control
RFID	Radio frequency identification
TAM	Technology acceptance model
TPB	Theory of planned behavior

21.1 Introduction

Consumer satisfaction (CS) is a fundamental and crucial concept in marketing studies since the early 1950s to the modern era. CS has been studied extensively and often been treated as the single most important construct that determines consumers' subsequent behavior (Oliver 1999). The real intention of the researchers over the years is not to evaluate CS but to study the underlying rationale for *customer retention*; because it is believed that the more satisfied the consumers are, the more loyal they will be which in turn develops a more likelihood of repurchasing that product/service. While dissatisfied consumers, either discontinue its use or find a substitute product/service or both. Question remains as to why the *repurchase intention* is that important? Because, it is evident that acquiring new customers may cost as much as five times than retaining existing ones; which justifies that satisfying customer needs is the key to generate customer loyalty and ultimately to retain the customers. Therefore, exploring the antecedents and measurement techniques of *satisfaction* is vital in marketing research. To study *consumer satisfaction* and their *repurchase intention*, Expectation–Confirmation theory (ECT) has been used extensively as one of the primary theories in marketing literature.

Satisfying and retaining the users for Information System (IS) products and services is also important because it involves numerous costs (including setting up advertising strategies, initiating new customers, and setting up new accounts) to acquire a new user than retaining an existing one (Parthasarathy and Bhattacherjee 1998). Therefore, recent research in the IS area has emphasized *satisfaction* as a fundamental prerequisite to establish *customer loyalty* and *continuance usage intention* (Shankar et al. 2003). However, Sørebø and Eikebrokk (2008) argued that *satisfaction* is a more important factor than *IS continuance intention*, in a mandatory environment. However, as IS marketing is different than traditional marketing, IS researchers adapted the ECT according to the contextual need to quest for *user satisfaction*. The most popular modification was made by Bhattacherjee (2001a) who proposed the Expectation–Confirmation Model (ECM) which is now being used as one of the most popular models to explain *satisfaction* and *continuance intention* behavior of IS users.

A number of reviews about *consumer satisfaction* are available in marketing (e.g., Yi 1990) and in IS *satisfaction* literature (Khalifa and Liu 2004; Au et al. 2002). But to the best of our knowledge, no study has been performed to comprehensively review the literature about *continuance intention,* particularly in IS field. This study intends to fill this gap by performing a comprehensive literature review in order to ascertain the current "state of play" of ECT and ECM in IS area.

In order to realize the above objective, a comprehensive review of 43 papers appearing in 30 different peer-reviewed journals during a 10-year period (2000–2010) was conducted. The review explores the related important and interesting issues with ECT and ECM research. The remainder of this chapter is structured as follows. The next section presents a brief discussion on ECT and then ECM, followed by a section which includes the anomalies of both theories. Finally, it reviews the current trend of using these theories and then proposes a general inquiry for future study.

21.2 A Review of ECT and ECM

This section first presents the elementary Expectation–Confirmation theory (ECT), then quests the rationale to develop a new but related theory in IS context and then presents the Expectation–Confirmation model (ECM). Finally, this section presents various anomalies of ECT and ECM as evident from the literature.

21.2.1 The Expectation–Confirmation Theory (ECT)

It is believed that consumers' overall satisfaction or dissatisfaction forms their post-purchase intention; whether to complain, repurchase, not to purchase, or a combination of any. Therefore, measuring satisfaction accurately is very important because, companies can predict consumers' behavior and then deploy necessary marketing strategies based on the consumer-satisfaction status. Marketing literature has gone beyond the traditional *satisfaction*-related research and developed extended models which take other factors, such as emotions, into account (Oliver 1993; White and Yu 2005). Among those, theoretically and empirically, Expectation–Confirmation Theory (ECT), also known as Expectation–Disconfirmation Theory (EDT), is believed to provide an explanation on consumers' repurchase intention. ECT is thus widely used in the marketing area, particularly in consumer behavior literature, to study consumer satisfaction and post-purchase intention (Oliver 1980; Oliver 1981; Anderson and Sullivan 1993; Oliver 1993; Patterson and Spreng 1997; Dabholkar et al. 2000). In the marketing literature, ECT has been used to demonstrate the repurchase intention of the consumers for many different products and services including durable and nondurable products (Churchill and Surprenant 1982), automobile repurchase (Oliver 1993), restaurant service (Swan and Trawick 1981; Kivela et al. 1999), camcorder repurchase (Spreng et al. 1996), photographic products (Dabholkar et al. 2000), and business professional services (Patterson and Spreng 1997). ECT has also been used in other research areas including sociology to measure the *satisfaction level* of, for example, the citizens with actual performance of police in USA (Reisig and Chandek 2001), in public policy area to evaluate citizen satisfaction with urban services (Ryzin 2004) or even in social psychology explaining the development and maintenance of prejudicial attitudes and accompanying social stereotypes (Stangor and Ford 1992).

ECT framework, originally in marketing, demonstrates that consumers reach a repurchase intention in the following manner (Oliver 1980). First, consumers form initial *expectation* about a specific product or service prior to purchase; mainly based on prior experience and existing knowledge (Zeithaml and Berry 1990) as well as through interactions with different members of the communication channels (Rogers 1995). By means of mass-media channels, consumers acquire product information/knowledge through advertising, package information, media reports, and media interviews. Interpersonal communication channel includes personal selling, feedback from prior users, advice from opinion leaders, and formal or informal discussions among peer consumers (Premkumar and Bhattacherjee 2008; Rogers 1995). For a same product, the quality of *expectations*, therefore, may vary across consumers (Tse and Wilton 1988) depending on the quality and reliability of the communication channel and/or information source. Unrealistic expectations can be generated because of wrong and misleading information and by lack of product knowledge. For example, based on the product information, a consumer may perceive the performance level of the product (Boulding et al. 1993; Oliver 1980), but if the information itself is misleading or overstating, the *expectations* will be unrealistic, which would affect the whole satisfaction-intention process (Spreng et al. 1996). Second, if they perceive the product as useful, they accept, purchase, and use it. Following a period of initial consumption, they form perceptions about its *performance*. Third, they assess the *perceived performance* of the product/service based on their initial expectation and determine the extent to which their expectation is confirmed (*confirmation*, also called as *disconfirmation*). If the product performs better than expected (i.e., perceived performance is greater than expectation), a positive disconfirmation is expected to occur. Alternatively, if the consumers' evaluation about the product falls below the expectation (i.e., perceived performance is less than expectation), a negative disconfirmation occurs. And of course, if the product performance *just* matches with the expectation a "simple confirmation" is expected to occur. Fourth, based on their confirmation of the expectation the consumers form a level of *satisfaction*. Positive disconfirmation (performance > expectation), even *simple* confirmation (performance = expectation) strengthens consumers' attitude toward the product and forms a sense of *satisfaction* (Oliver and DeSarbo 1988; Erevelles and Leavitt 1992). However, negative disconfirmation (performance < expectation) leads to weaken the positive attitude toward the product and form a sense of dissatisfaction. Finally, some satisfied consumers might form a *repurchase intention* while dissatisfied users might discontinue its subsequent use and/or search for a substitute product. Studies also find that dissatisfied consumers would still repurchase due to lack of alternatives, convenience, etc. (Brady and Cronin 2001; White and Yu 2005). Furthermore, a number of satisfied consumers may still not repurchase (Reichheld 1993).

21.2.2 The Evolution of Expectation–Confirmation Model (ECM)

The fundamental limitation about using ECT in IS studies is the "expectation generation" processes. In ECT, the process of *expectation* generation is derived from expectancy theory (Tolman 1932). Expectancy theory is also used by Oliver and Winer (1987) and Oliver and Burke (1999) in proposing the "expectancy disconfirmation with performance model." In line with these studies, literature finds that *expectation* can be generated from many sources including prior experience, desire, attitude to a particular product/service, and both personal and commercial communications. For a consumer product, even without having any specific and defined expectations, a customer may intend to and purchase a product. The same thing might happen to mandatory IS users (Khalifa and Liu 2004). But generally, it is quite unlikely to purchase an IS without having a set of *expectations*. To make the things even more complicated, the novelty element of IS may cause to form a distinguished set of expectations which vary significantly from user to user (e.g., online shopping). Hence, the traditional ECT has the limitation in explaining IS expectation formation process (Khalifa and Liu 2004). Moreover, ECT mainly focuses on consumers' repurchase intention of product/service, dealing with the *belief* about and *attitude* toward a product/service's attributes or performance (Olson et al. 1979). It cannot capture the IS products'/services' *quality factors* (system quality, information quality, and service quality) and hence cannot fully explain the notion of end-user satisfaction of IS systems (for detail, see Khalifa and Liu 2004).

Also ECT needs to be modified in defining the *subject* as ECT deals with *consumers* rather than with *customers* (though sometimes these are used interchangeably), as traditionally, *customer* pays for a product/service whereas *consumer* consumes/uses the product/service; though both can be the same person. However, in IS context, it needs to be the "user": the actual *consumer* of an IS.

In order to study users' *continued usage behavior* of IS products/services, Expectation-Confirmation model (ECM) was first proposed by Bhattacherjee (2001a). The model is predominantly concentrated on post-acceptance variables (such as "post-usage expectations" which the author named as "perceived usefulness") rather than on "pre-use expectations" because ECM posits that "the effects of any pre-acceptance variables are already captured within the confirmation and satisfaction constructs" (Bhattacherjee 2001a, p. 355). However, as the "perceived usefulness" is often misinterpreted and confused with the pre-usage "perceived usefulness" of technology acceptance model (TAM) (Davis 1989), in proposing the extension of ECM, Bhattacherjee et al. (2008) suggested using "post-usage usefulness" which reflects a long-term belief aggregated from prior usefulness perceptions. ECM also emphasizes that post-consumption expectations are more important because expectations are changed or get modified with time as is often the case of IS use. Therefore, ECM replaced the *expectation* construct of ECT by post-usage *perceived usefulness*. ECM also took the IS context and renamed the *repurchase intention* to *continued usage intention*. Moreover, and more importantly, ECM defined *confirmation* as "the congruence between expectation and actual performance" (Bhattacherjee 2001a, p. 359) and removed the *performance* construct of ECT because ECM assumes that the influence of *perceived performance* is already explained by *confirmation*.

ECM posits that an individual user's intention for continued use of an IS is dependent on three variables: the user's level of *satisfaction* with the IS, the extent of user's *confirmation* of expectations, and post-usage *perceived usefulness*. The process by which IS users reache a *continued use* decision is as follows (Bhattacherjee 2001a). First, after using a particular IS for a period of time the users form a conception of *perceived usefulness*, which is expected to be the most salient ex-post factor influencing user's post-acceptance effect (e.g., satisfaction) about that particular IS. Second, the users determine to what extent their perception of usefulness about that IS has been confirmed, by comparing the performance of the IS to the perception of usefulness. If the user finds that the product/service is as useful as he/she perceived, he/she forms a *notion* of satisfaction. Finally, satisfied users intend to continue the usage of that IS whereas dissatisfied users *intend* to discontinue the service; though sometimes they cannot really discontinue because of some external factors (e.g., mandatory use). However, users' perception on usefulness also drives them directly to *continuance intention* because when they find a product/service is useful to their needs, they do not bother to go though the *confirmation* process, rather they form a *direct* intention toward reusing the product/service; and vice versa. Moreover, the *confirmation* has an immediate effect on users' *satisfaction* as well as a longer-term effect on their *post-usage usefulness* perception (Bhattacherjee et al. 2008).

21.2.3 The Anomalies of ECT and ECM

Notwithstanding its use in multidisciplinary areas to measure consumer satisfaction, there is a lot of disagreement and criticism about the definition, relationships, measurement process, and the inter- and intra-effects of the constructs and variables of ECT. This section briefly summarizes those anomalies.

21.2.3.1 Definition Anomaly

Most of the efforts in consumer marketing research are invested to measure the consumer satisfaction but there is no agreed definition ever of *satisfaction* (Rogers et al. 1992). Some scholars tend to define it as the *perception* (Oliver 1999; Shankar et al. 2003) or an *emotion* (Locke 1976; Oliver and Linda 1981) of pleasurable fulfillment of a product/service while others suggest that it is the *evaluation of an emotion* (Hunt 1977) as well as the evaluation of certain measures (e.g., profit). However, the definition of *satisfaction* to a group-based product/service (e.g., the satisfaction toward using PC in an organization) is the sum of the user's weighted reactions to a set of factors (Wanous and Lawler 1972) as shown below:

$$S_i = \sum R_{ij} W_{ij}$$

where R_{ij} is the reaction to factor j by individual i, and W_{ij} is the importance of factor j to individual i.

However, to understand the components of satisfaction, scholars often disintegrate the term, such as Shankar et al. (2003) distinguished two different but related terms as *service encounter satisfaction* (transaction-specific) and *overall customer satisfaction* (relation-specific; the cumulative effect of a set of discrete service encounters or transactions over a period of time). Whereas, Spreng et al. (1996) decomposed overall satisfaction into *attribute satisfaction* and *information satisfaction*. Therefore, the meaning of *satisfaction* is different from person to person (Oliver 1980) and one must seek a contextual definition.

A similar definition problem exists with *expectation*. *Expectation* has become the central construct of consumer satisfaction and is considered as a baseline to measure *confirmation*, and thus *consumer satisfaction* but the definition of *expectation* is yet to be finalized (Spreng et al. 1996). Szymanski and Henard (2001) defined the role of expectation as *anticipation* and *comparative referents,* while Spreng et al. (1996) defined *expectation* as individual belief (B_i) about a product's attributes or performance (Westbrook and Reilly 1983; Spreng et al. 1996), or the summation of such beliefs (ΣB_i) (Oliver and Linda 1981), whereas, mathematically, it is a summation of the multiplication of likelihood of an event (probability of occurrence) and an evaluation of the goodness or badness of the event ($\Sigma B_i e_i$) (Oliver 1980; Churchill and Surprenant 1982; Tse and Wilton 1988). However, like defining *satisfaction*, *expectation* has been viewed from different perspectives which include "will expectation," "should expectation," "normative" or "ideal expectation" (Liao et al. 2007), predictive expectation, "minimum" expectations, "rational" expectations (Au and Kauffman 2003), active and passive expectations, and short- and long-term expectations (Oliver and Winer 1987). Spreng et al. (1996) integrated *desire* and *expectation* in the ECT framework which is supported by Khalifa and Liu (2003). They distinguished that *expectations* are future-oriented and relatively malleable, whereas *desires* are present-oriented and relatively stable. Spreng et al. (1996, p. 17) also define *expectation* as the belief about the likelihood that a product is associated with certain attributes, benefits, or outcomes, whereas *desires* are evaluations of the extent to which those attributes, benefits, or outcomes lead to the attainment of a person's value. More importantly, *desire* and *expectations* are not mutually exclusive, both *expectation* as well as *desire* may be generated simultaneously (Chin and Lee 2000).

ECT assumes that *expectation* is relatively a constant construct which takes care of only the pre-consumption expectations. In reality, *expectation* changes with time (Bhattacherjee and Premkumar 2004); the pre-consumption expectations may differ from "during" and "post-consumption" expectations (Oliver and Burke 1999) because consumers' expectation is often "colored" by their first-hand experience. Therefore, scholars argue that post-consumption expectation (perceived usefulness) are more realistic and should be taken into account (Bhattacherjee 2001a).

It is well accepted that *confirmation* is a main construct of ECT and a significant determinant of *satisfaction* (Chiu et al. 2005; Roca et al. 2006, among many). But the concept of *confirmation* also is not clear in ECT framework. Studies demonstrate *confirmation* construct as discrepancies between prior expectations and actual performance (Oliver 1980). Presumably it is the *magnitude* of the disconfirmation effect that establishes satisfaction or dissatisfaction decision (Churchill and Surprenant 1982, p. 492; Yi 1990). But in behavioral science, magnitude does not always guarantee a correct level of measurement. Moreover, it seems like *confirmation* does not qualify to be a genuine construct but is rather a measurement step which just calculates the discrepancy between *expectation* and *performance.* Studies urged to use *confirmation* as an intervening variable affecting *satisfaction* whereas some others argue that the effect of *confirmation* is already adequately captured by *expectation* and *perceived performance*. Yüksel and Rimmington (1998), therefore, argue that *performance* dimensions alone can predict behavioral intentions and therefore the *confirmation* construct can be deducted from the model; *when a service or product performs well, the consumer will be satisfied regardless of any confirmation-disconfirmation effect* (Yüksel and Rimmington 1998, p. 63). However, the *confirmation* construct is explained in more detail in innovation diffusion theory (IDT) which explains that during the confirmation stage an adopter makes an evaluation on his/her adoption decision and tries to avoid a state of dissonance (for details, see Rogers 1995, pp. 180–185). The evaluation, normally, is based on his or her experience along with the influence on the change agents' interaction, and the experience and feedback from communication channels. Therefore, IDT argues that *confirmation* is merely not a measurement step but is a stage of adoption diffusion. Moreover, other studies emphasized that *confirmation* exerts the strongest effect on *satisfaction* (e.g., Au et al. 2002). Depending on the "perceived performance," *confirmation* construct is decomposed into *subjective confirmation* (the difference between *expectations* and *perceived performance*) and *objective confirmation* (the difference between *expectations* and *objective performance*). Though, once again, there is no consensus but *subjective confirmation* is believed to be more explanatory of satisfaction judgment process than *objective confirmation* (Ha 2006).

Another anomaly lies in using too many different types of **performances** including *perceived performance* (Tse and Wilton 1988)*, actual performance, perceived* *actual performance*, *subjective performance*, *objective performance*, and *expected performance* (Tse and Wilton 1988). However, *perceived performance* is suggested by most scholars (Yüksel and Rimmington 1998).

21.2.3.2 Relationship Anomaly

There is a consensus that *performance* is primarily a function of *confirmation* (Tse and Wilton 1988; see Yi 1990 for detail; Susarla et al. 2003; Premkumar and Bhattacherjee 2008) and thus has an indirect effect (via *confirmation*) on *satisfaction*. But some researchers empirically validated that *performance* has also a direct effect on *satisfaction* (Churchill and Surprenant 1982; Oliver and DeSarbo 1988; Tse and Wilton 1988; Oliver and Burke 1999); while Hossain and Quaddus (2010) proposed that *performance* has a direct effect on *continuance intention*. However, some researchers did not find a positive relationship between *performance* and *satisfaction* (Westbrook and Oliver 1981; Gilly and Gelb 1982; Swan and Oliver 1991). Similarly, most studies posit that *expectation* has a direct effect on *confirmation,* while Oliver (1980, 1981) argued conceptually and proved empirically that *expectation* and *confirmation* are unrelated. In a later extension of ECT, named as "the Expectancy Disconfirmation with Performance Model," Oliver and Burke (1999) found a direct and strong relationship between *expectation* and *performance* and also reestablished a direct effect of *expectation* on *satisfaction*. However, to make the situation even more complicated, in proposing ECM, Bhattacherjee (2001a) developed a relation between *perceived usefulness* (expectation) and *satisfaction* which is supported by other studies too (Bhattacherjee and Premkumar 2004; Ha 2006, for example). But in a recent study, Bhattacherjee et al. (2008) dropped the direct association between post-usage *perceived usefulness* and *satisfaction* from the ECM.

21.2.3.3 Measurement Anomaly

Two basic methods have been used to investigate and measure *confirmation*; namely, an inferred approach and a direct method (Yüksel and Rimmington 1998). The inferred approach involves computing the discrepancy between expectations of performance and evaluation of outcomes. The direct approach requires the use of summary-judgment scales to measure *confirmation* (e.g., a Likert-type scale). The danger of using the former approach (inferred approach) is the misleading interpretations of arithmetic deduction. Moreover, it forces the consumers to pretend and assume some sorts of expectations which might not exist in reality (Au et al. 2002; Khalifa and Liu 2004). The latter approach, direct method, is more reliable and offers valid measure of *confirmation*, whereas deriving a score for *confirmation* as the difference between customers' rating of predictive *expectations* and *perceived performance* is the least reliable (Yüksel and Rimmington 1998). However, using the direct confirmation–disconfirmation scale is also questionable and of little use for diagnostic analysis as it cannot indicate the magnitude of confirmation level (e.g., high–low). Moreover, as the expectations are often colored by the experience (Bhattacherjee 2001a) which leaves the argument about which *expectation* is to be taken into account for the analysis and when to measure it; during pre-purchase or post-purchase, both have problems though. However, Oliver and Burke (1999) suggest that *expectations* need to be measured before consumption though most ECM studies use the post-adoption expectation including perceived usefulness, perceived ease of use, and perceived enjoyment (Bhattacherjee 2001b; Thong and Hong et al. 2006). Finally, there are different ways of measuring *satisfaction*, both with their advantages and disadvantages. The direct survey method is most widely used while other methods include collecting data on consumers' complaints, word-of-mouth, and observing the repurchase trend (for details, see Wanous and Lawler 1972).

21.2.3.4 Additional Variables

ECT holds that consumers' intention to repurchase a product or service is determined primarily and solely by their *satisfaction* with prior use of that product or service (Oliver 1980; Swan and Oliver 1991; Anderson and Sullivan 1993; Oliver 1993). However, *satisfaction* is obviously a primary condition for a *repurchase intention*, but some other variables also have direct and indirect effect on *repurchase* or *continuance intention*. ECM is more dynamic to handle this limitation because it includes *perceived usefulness* as a direct antecedent of *continuance intention*. Some other studies include other variables too including *self-efficacy* as internal behavior control (Hsu et al. 2004; Bhattacherjee et al. 2008), *trust*, *enjoyment* for the website (Qin 2007; Kang et al. 2009), *perceived ease of use* (Hong, Thong et al. 2006; Thong, Hong et al. 2006), *belief*, *attitude* (Bhattacherjee and Premkumar 2004; Hsu et al. 2006; Liao et al. 2009), loyalty incentive (Bhattacherjee 2001b) and *perceived behavioral control* (PBC) (Hsu et al. 2006; Liao et al. 2007), among many others, to form a *continuance intention*.

However, merely the *intention* does not drive to *decision;* instead, along with *intention* some other factors also affect the real repurchase/continuance *decision*. To examine *usage behavior* (not *intention*), Venkatesh et al. (2003) introduced *facilitating conditions* as external control, often called PBC, though they did not find any influence of it on *usage behavior*, although later Bhattacherjee et al. (2008) did. Some other significant factors are *social norm* (Kim 2010), *habit*, *prior behavior* (Limayem et al. 2007; Limayem and Cheung 2008), *subjective norm* (e.g., opinions from important individuals) and intuitively, *prior conditions* which include need, desire, and innovativeness (Rogers 1995) as more important especially for IS products/services.

On the other hand, an user's *intention* as well as *decision* toward adopting and reusing a product/service also depends on the *organization factors* including available resources (Mathieson et al. 2001), management attitude, *personal factors* including knowledge and skill level, *financial factors* including incentive to reuse the product or service, positive cost–benefit, value for money, positive return on investment, and quick payback period and *environmental factors* including culture, external pressure, and exposure (Cheung et al. 2005; Hossain and Quaddus 2010a, b).

21.2.3.5 Other Limitations

Neither ECT nor ECM explains the *continuance intention* of a unique product/service. Without being satisfied consumers may accept and repurchase a unique product/service that does not have substitute. Similar argument can be applied to a mandatory product or IS where the consumer/user does not bother to form any sense of *satisfaction* whatsoever.

ECT suffers also from logical inconsistency and inadequacy in the case of extremely high/low *expectations* and *performance* (Khalifa and Liu 2004). Higher than expected performance still results in dissatisfaction which cannot be explained by ECT (Au et al. 2002). Interestingly, Premkumar and Bhattacherjee (2008) argued that consumers may also be happy without experiencing a positive disconfirmation, even if they had high expectations to begin with and if such expectations were not met in practice. Suh et al. (1994), however, argued that *perceived performance* exceeding *expectations* does not lead to *satisfaction* if it falls below *desires* and thus proposed to replace *expectation* with *desire*.

21.3 Literature Analyses

In this section we present a detailed literature analysis to portray the state of the art of ECT and ECM research. It includes the methodology and relevant findings from ECT and ECM literature and researches.

21.3.1 Research Methodology

For the purpose of conducting literature analyses we made use of various journals' database during the year of 2000–2010. Our research started from retrieving publications from online databases including Google Scholar, ABI-Inform, ScienceDirect, Wiley InterScience, Emerald Management Xtra, and Proquest. In order to identify publications specific to the Expectation–Confirmation theory and model, four terms were sought in this study: "expectation," "confirmation," "continuance," and "satisfaction." The search was restricted to occurrences of any of these keywords appearing in the article title and/or in the keywords in order to avoid locating publications where any of these keywords might have been used as casual words in the main text. Among those articles, the *articles of interest* were determined solely based on using any of these theories, either ECT or ECM or both in an IS context; ignoring the articles which dealt with the *satisfaction* and *continuance* behavior using other theories. It should be mentioned here that the search was not an exhaustive one. The objective of this study is only to provide an organized view of how the ECT diffused into IS studies through ECM and raise the awareness that some issues need to be looked at deeply in the IS field.

21.3.2 Results and Findings

Our comprehensive search resulted in 43 studies on ECT and ECM in the IS field (see Table 21.1). In most of these studies, *continuance intention* constitutes a substantial portion of research. In other words, *intention to continued use* has been used either as an independent or a dependent variable, or analyzed in detail to develop the hypotheses or propositions and empirical supports. Alternatively, *expectations* construct has been modified in various ways, most popularly as *perceived usefulness*. Most of the researches have been performed empirically using university students as subjects. Along with other behavioral theories, TAM (Davis 1989) and TPB (Ajzen 1991) are the most used theories in this context. The following sections provide detailed findings from our review.

21.3.2.1 Research Type Used

We first categorize the 43 studies into empirical and nonempirical studies and then the nonempirical was recategorized into critical review, analytical, and qualitative studies (Table 21.1). The dominant research method is empirical as 33 fall in this category, and the remaining 10 fall in the category of nonempirical. The nonempirical researches include critical reviews (5) conceptual analysis analytical (3) and qualitative (2). Among the 33 empirical researches at least 15 have taken university students as subjects. Most of the nonempirical studies presented a number of propositions, research questions, and possible research in this arena. Future research will, therefore, be suggested with field studies, field experiments, and case studies (both positivist and interpretivist).

21.3.2.2 Research Concentration

Similar to ECT most ECM studies concentrated on individual-level decision (e.g., intention to continued use of a specific computer application) rather than organizational decision (e.g., will repurchase a specific software or IS) or national-level decision (e.g., whether to go for electronic voting more extensively). Every empirical study dealt with the individual-level *satisfaction* or individual-level *continuance intention* behavior rather than study the organization-level variables. Most studies (29) are concentrated on "online services" including online banking, e-services, virtual communities, and so on rather than on "offline services" (14) including IS implementation, IT adoption, and managing satisfaction during an IS/IT project development and implementation. Moreover, just a single study was found dealing with compulsory IS use (Sørebø and Eikebrokk 2008).

21.3.2.3 Relevant Theories Used

To study the continued usage intention of IS product/services, literature largely depends on the ECT and its successor, ECM; along with a large body of research theories.

Table 21.1 Literature analysis of ECT and ECM use in the IS/IT area

Reference	Research type	Discipline area	Independent constructs	Dependent construct	Theories used	Brief finding
Mahmood et al. (2000)	Critical review	IT end-user satisfaction	Perceived benefit, perceived usefulness, ease of use, expectation	End-user satisfaction	NA	User involvement in system development, perceived usefulness, user experience, organizational support, and user attitude toward IS are most significant
Bhattacherjee (2001a)	Empirical	Online brokerage	Confirmation, satisfaction, perceived usefulness, loyalty incentives	Continuance intention	ECT, ECM	Distinguishes between users' acceptance and continuance behavior and explains the factors for IS continuance and then proposed the ECM
Bhattacherjee (2001b)	Empirical	Online banking	Perceived usefulness, confirmation, satisfaction	IS continuance intention	ECT, TAM, Agency theory	Satisfaction, perceived usefulness, and interaction between perceived usefulness and loyalty incentives are key determinants for continuance intention. Confirmation of expectations directly affects satisfaction and perceived usefulness
Staples et al. (2002)	Empirical	Library IS	System usefulness, ease of use, information quality, knowledge, personal benefits, attitude	Perceived net benefit	ECT	Established relationship between pre-implementation expectations and perceived benefits based on post-implementation experience. Three expectation categories including system usefulness, ease of use, and information quality are to be managed for a successful IS implementation

(continued)

Table 21.1 (continued)

Reference	Research type	Discipline area	Independent constructs	Dependent construct	Theories used	Brief finding
Au et al. (2002)	Critical review	End-user IS	Expectation, performance, disconfirmation	Satisfaction	ECT, equity theory, needs theory	Suggests to redesign the procedures for users to exploit the advantages of IS so that their needs and expectations can be fulfilled better. Proposed an integrated conceptual model based on equity theory and needs theories
McKinney et al. (2002)	Empirical	Online shopping	Expectation, perceived performance, disconfirmation	Satisfaction	ECT	Using Information quality and service quality concepts in the context of Web customers' satisfaction, proposed a model named expectation disconfirmation effects on web-customer satisfaction (EDEWS)
Erevelles et al. (2003)	Empirical	ISP services	Expectation, confirmation	Consumer satisfaction	ECT, attribution, affective, and competitive model	Low expectation does not ensure more satisfaction. Building customer relationship is more important for ISPs to achieve more customer satisfaction. Also provides an understanding of the underlying processes involved in switching behavior in case of dissatisfaction with an ISP
Susarla et al. (2003)	Empirical	Application service provider service	Experience, disconfirmation, expectation, perceived performance	Satisfaction	ECM	ASPs need to evaluate prior experiences and should have a close integration with existing IT in client organizations

Khalifa and Liu (2003)	Empirical	Online services	Expectation, disconfirmation, perceived performance, desire disconfirmation	Satisfaction at adoption, and at post-adoption	ECT	Both *expectations* and *desires* need to be considered simultaneously in explaining *satisfaction* at adoption. Also differentiate *satisfaction* at adoption and at post-adoption
Tesch et al. (2003)	Empirical	IS development projects	Expectation of skill and perceived skill	Satisfaction	ECT	Discrepancy between expectation of skill and perceived skill self-proficiency affects career satisfaction. IS manager's perception provides better job performance evaluation
Hsu et al. (2004)	Empirical	WWW	Prior perceived confirmation, satisfaction with prior use, outcome expectation, self-efficacy	WWW continuance intention	ECM	Differentiates acceptance and continuance. Intention for continued WWW use depends on users' satisfaction with prior use, Internet self-efficacy, and outcome expectations
Hayashi et al. (2004)	Conceptual	Database application	Perceived usefulness, confirmation, satisfaction, computer self-efficacy	IS continuance intention	TAM, ECM	There is *no* significant relationship among computer self-efficacy, perceived usefulness, confirmation, and satisfaction.
Khalifa and Liu (2004)	Critical review	IS satisfaction	NA[a]	IT satisfaction	NA	Described the evolution of IS satisfaction research and emphasized for further research to strengthen explanatory power of ECT in IS area.

(continued)

Table 21.1 (continued)

Reference	Research type	Discipline area	Independent constructs	Dependent construct	Theories used	Brief finding
Bhattacherjee and Premkumar (2004)	Qualitative and empirical	Computer-based training, rapid application development	Usefulness, attitude, confirmation, satisfaction	Continued use intention	ECT	Examined both antecedent variables and outcome variables of customer satisfaction in an electronic environment. Disagreed with Oliver's attribution process model and proposed as satisfaction drives to attribution which drives to repurchase.
Wu et al. (2006)	Analytical	Internet search engines	Performance	Satisfaction	ECT	Developed a direct comparative framework (DCF) for satisfaction evaluation and measurement.
Lin et al. (2005)	Empirical	WWW	Perceived usefulness, confirmation, perceived playfulness, satisfaction	Continuance intention	ECT	Includes "playfulness" and found as more important than perceived usefulness in the context of continuance use of website.
Cheung et al. (2005)	Critical review	Online consumers	Intention, adoption	Continuance	ECT, TPB	Argued that researchers are more concentrated on online intention, on online adoption rather than on continuance behavior, and then proposed a research framework.
Chiu et al. (2005)	Empirical	e-learning	Satisfaction, perceived usability, perceived quality, perceived value	e-learning continuance intention	ECT	Extended ECT, decomposed and empirically validated perceived performance into perceived usability, perceived quality, perceived value, and usability.

Ha (2006)	Empirical	Online services	Expectation, confirmation, performance, satisfaction	Repurchase, loyalty, word-of-mouth	ECT	Perceived information relevance, disconfirmation of information accuracy, and disconfirmation of information relevance have significant influence on user information satisfaction.
Roca et al. (2006)	Empirical	e-learning service	Perceived quality, confirmation, perceived usability, subjective norm, perceived control, satisfaction	e-learning continuance intention	TAM, ECT	*Perceived quality* (information quality, service quality, and system quality) has a strong influence on *confirmation* and *satisfaction. Perceived usefulness* is sturdily influenced by *confirmation*
Hong et al. (2006)	Empirical	Mobile Internet	Perceived usefulness, confirmation, perceived ease of use, satisfaction	Continued IT usage intention	ECM, TAM	Extended ECM in IT context while used TAM too and argues that TAM is the most parsimonious and generic model to explain both initial and continued IT adoption.
Thong et al. (2006)	Empirical	Mobile Internet	Perceived ease of use, perceived enjoyment, perceived usefulness, confirmation, satisfaction	Continued IT usage intention	ECM, TAM	Satisfaction and post-adoption expectations have significant influence on continuance intention of IT use. Strongly warranted to include satisfaction in understanding IT adoption and usage behavior.
Hsu et al. (2006)	Empirical	Online shopping	Pre- and post-use interpersonal influence, external influence, attitude, behavioral control, disconfirmation, satisfaction	Continuance intention	TPB, ECT	Integrated TPB with confirmation and satisfaction constructs from ECT. *Perceived behavioral control* and *satisfaction* have significant effect on online shopping *continuance intention*.

(continued)

Table 21.1 (continued)

Reference	Research type	Discipline area	Independent constructs	Dependent construct	Theories used	Brief finding
Qin (2007)	Empirical	Online shopping	Perceived usefulness, disconfirmation, perceived risk, satisfaction, trust, shopping environment	Continued intention	ECM	Perceived risk has a stronger effect on *satisfaction* than *perceived usefulness*. *Trust* and *satisfaction* together has more effect than *shopping enjoyment* on *continuance intention*.
Liao et al. (2007)	Empirical	e-learning services	Subjective norm, perceived usefulness, satisfaction, PBC, disconfirmation, perceived ease of use	Behavioral intention	ECT, TPB	An integrated model of TPB and ECT can increase the accuracy and predict and explain customers' behavioral intentions more precisely.
Nevo and Wade (2007)	Analytical	IT products	Expectation	Satisfaction	ECT	Relevant stakeholders should be engaged in designing and producing organizational information systems so that customers generate accurate expectations.
Limayem et al. (2007)	Empirical	WWW	Perceived usefulness, confirmation, satisfaction, IS continuance intention, habit	IS continuance usage	ECM	Incorporated *habit* into IS research and found that *habit* acts as a moderating variable between *IS continuance intention* and *IS continuance*.
Chen (2007)	Empirical	Virtual community	Contextual factors, technological factors, satisfaction	Continuance intention	ECM	Users' *attitude* and *perceived usefulness* changes with time and more prevalent in the early stage of IT use than in the later phase.

Premkumar and Bhattacherjee (2008)	Empirical	IT, online tutorials	Perceived usefulness, perceived ease of use, expectation, confirmation, performance, satisfaction	Intention	TAM, ECT	TAM and ECT together provide a better explanation of IT usage intention, than a single individual model/theory.
Brown et al. (2008)	Analytical	IS implementation	Expectation, experience	Satisfaction	TAM, ECT, polynomial modeling	Empirical comparison between three models. Did not find ECT as an important theory to explain *satisfaction*, rather the "experience only" model provides better explanation about *ease of use*.
Doong and Lai (2008)	Empirical	e-negotiation	Perceived usefulness, disconfirmation, satisfaction	Continuance intention	ECM	Post-use factors are important for e-negotiation systems (ENS) and therefore ECT is an effective theory to analyze ENS. Monitoring users' disconfirmation continuously is important for ENS.
Limayem and Cheung (2008)	Empirical	Internet-based learning	Perceived usefulness, confirmation, satisfaction, IS continuance intention, habit, prior behavior	IS continuance use	ECM	Introduced "IS habit." Both *satisfaction* and *prior behavior* have significant impact on *IS continuance* and *habit* is a moderator.
Sørebø and Eikebrokk (2008)	Empirical	Mandatory IS use	Confirmation, ease of use, perceived usefulness	User satisfaction	ECM	*Ease of use* and *confirmation* are significant antecedents of satisfaction while *perceived usefulness* is not. For a mandatory environment, therefore, authority should concentrate on these two factors more closely.

(continued)

Table 21.1 (continued)

Reference	Research type	Discipline area	Independent constructs	Dependent construct	Theories used	Brief finding
Petter (2008)	Qualitative	IS projects	Expectation, confirmation, satisfaction	Net benefits	ECT, service quality	User involvement, leadership, and trust are three important strategies to software managers to manage user expectation.
Yen and Lu (2008a)	Empirical	Online auction	Confirmation, satisfaction, perceived net benefits	Loyalty intention	ECM	Perceived net benefits and confirmation are directly related with online auctioneers' satisfaction. Loyalty intention is dependent only on satisfaction.
Yen and Lu (2008b)	Empirical	Online auction	Expectation, confirmation, satisfaction	Repurchase intention	ECT	Supports fundamental ECT. Bidders evaluate sellers' recent performance not the prior expectation or feedback comments.
Jin et al. (2008)	Empirical	Knowledge-based virtual community	Information quality, disconfirmation	Information satisfaction	ECM	Perceived switching cost moderates the decision for continuance decision along with *satisfaction* and *perceived usefulness*.
Bhattacherjee et al. (2008)	Empirical	IT adoption and continuance	Post-usage usefulness, disconfirmation, satisfaction, IT self-efficacy, satisfaction, PBC	Continuance behavior	ECM	Proposed an extended model of ECM by introducing *continuance behavior* where the *perceived usefulness* construct was renamed as *post-usage usefulness*. Also explained the PBC construct in detail.

Liao et al. (2009)	Empirical	IT adoption	Confirmation, satisfaction, perceived usefulness, perceived ease of use	IS continuance intention	TAM, ECT, Cognitive model	Combines *attitude* and *satisfaction* into continuance model and proposes a new theory, Technology Continuance Theory (TCT) which claims that it has capability to explain user attitude at different stages of adoption life cycle.
Kang et al. (2009)	Empirical	Online services	Confirmation, past use, perceived usefulness, satisfaction, self-image congruity, regret	Continuance intention	ECM	Self-image congruity plays a key role in forming post-adoption beliefs (perceived usefulness and perceived enjoyment). Also finds that *regret* is an important antecedent of continuance intention.
Kim (2010)	Empirical	Mobile data service	Confirmation, perceived usefulness, perceived enjoyment, perceived fee, social norm, PBC, satisfaction	Continuance intention	ECM, TPB	For mobile data service (MDS) continuance analysis, an integrated model of ECM and TPB explains more perfectly than either single model. Necessary resources and capabilities are perceived as important antecedents.
Lankton et al. (2010)	Empirical	IT use	Prior IT use, satisfaction, importance, task complexity	Continued IT use	ECM	Integrated "habit" and "prior IT use" to "continued IT" use and tested empirically with a software application pertaining to four different IT activities.
Hsieh et al. (2010)	Empirical	Web blogs	Confirmation, perceived performance, expectation	Satisfaction	ECT	Identified and measured key constructs of blog quality to blog users' satisfaction using expectation confirmation paradigm.

[a]Not applicable

Our review found at least 11 different theories or models or theoretical perspectives that have been used in IS/IT contexts to examine users' *satisfaction* and/or *continuance intention*. The most used theory is the technology acceptance model (TAM) (8) (Davis 1989), which is followed by theory of planned behavior (TPB) (4) (Ajzen 1991).

21.3.2.4 Dependent Variables

The choice of both dependent and independent variable depends on the research contexts and research objectives (Tung and Quaddus 2002). Equally, the impacts of the dependent and independent variables provide information and indication regarding the current trends of a particular area of research. Our research finds that most of the researchers are interested in explaining *users' continuance intention* (20) rather than the actual *continuance behavior* (5) toward a particular IS product/service, 13 articles studied *satisfaction* as a dependent variable while some other studies used *repurchase loyalty* (3) and *perceived net benefit* (2) to IS.

21.3.2.5 Independent Variables

As discussed earlier, many researchers integrated ECM with other behavioral theories including TAM and TPB and therefore the independent variables from those theories are used with the independent variables of ECT and ECM. A number of independent variables have been used in the reported studies as can be seen from Table 21.1. The most used independent variable is *(dis)confirmation* (31) followed by *satisfaction* (20), *perceived usefulness* (20), *expectation* (12), and so on.

21.3.2.6 Other Findings

Table 21.1 presents the list of the articles we analyzed, specifically to study ECT in IS/IT context. It is found that compared to marketing research IS research is more inclined to go beyond measuring the user satisfaction, not just to predict the intention but to investigate the *actual* reuse of an IS. For example, Khalifa and Liu (2004) address the process of *satisfaction* formation instead of merely investigating the reasons which lead to satisfaction. Khalifa and Liu (2003) examine the determinants of *satisfaction* at different adoption stages; at adoption and at post-adoption. Sørebø and Eikebrokk (2008) study the user acceptance of IS in a mandated environment.

In terms of other findings, this research found that the researches were conducted in 11 countries. By far, the largest amount of research activity have taken place in USA (46), followed by Taiwan (29), Hong Kong (16), and Korea (7). It also revealed that the research trend in this context suffers from an inconsistency;

there was a gradually increasing trend of research from 2000 to 2008 and it then suddenly fell down. To date, the largest number of articles were published in 2008 (11) followed by 2004 and 2007 (4). Table 21.1 also lists the authors involved in conducting and publishing related research. It appears (in our analysis) that the most productive author (in terms of journal publication) is Anol Bhattacherjee with five publications followed by Christy MK Cheung, Chia-Hui Yen, and Moez Limayem with three publications each. Among them the most cited author is Anol Bhattacherjee with 643 citations for his popular ECM. The *MIS Quarterly*, *Information & Management*, and the *International Journal of Human-Computer Studies* came up with same largest number of publications in this area, publishing four articles in each.

21.4 Promising Inquiry for the Future

In the previous sections we have explained how the *users' satisfaction* and their *continued use intention* are affected with the users' need and circumstances. In the next decade it will be an important issue particularly in the IS area in order to deal more closely with the dynamic needs of the users. Moreover, there is a huge difference between *continuance intention* and actual *continued use* because merely the *intention* does not guarantee the actual use as many other factors to determine the actual use. Most IS studies are concentrated more on the former than the latter issue, though the factors for actual *continued use* should get more attention. Moreover, similar to the marketing literature, IS research has the scope to move further by integrating emotions, for example, in studying the users continuance usage intention.

It is understood that *culture* plays an important role in IS research because an IS can be accepted by a society whereas the same IS can be rejected by another society (Straub 1994). In the same way, culture plays an important role, especially in Web-based products/services and applications (e.g., online actions in eBay) and online-based group applications (like Facebook or dating sites). Recently, many of the regular Facebook users quit using this social networking site because of religious and cultural controversies. It is, therefore, predicted that culture will become a dominant factor particularly in a group-based decision-making system (for a detail review, see Tung and Quaddus 2002).

All of the papers examined in this study are concentrated on individual-level satisfaction process. Literature is inadequate in examining group-level satisfaction process, especially when the group-level satisfaction research has started quite early (Wanous and Lawler 1972). When an organization (a company or even a government) evaluates the satisfaction level of the users of a particular product/service, it would build confidence to the organization to set up its further strategy toward that product/service. For an example, radio frequency identification (RFID) technology is mandatory in identifying cattle in Australia, though many farmers and a few farm associations are against using it (Hossain and Quaddus 2010a). However, if the government could evaluate the overall industry-wide *satisfaction* and *continuance intention* of the farmers, it would be useful to the government agencies to evaluate the effectiveness of this system, finding the problems, and then set up policies for the future. Meanwhile, Johnson et al. (1995) proposed the determinants and measurement of market-level satisfaction.

ECT and ECM do not respond to the continuance intention of a mandatory product/service. When a product/service is made mandatory (by external environment including legislation, organization, and market) to its end users, there is no such luxury to discontinue its use. In that situation, the users do not bother to judge their confirmation or satisfaction level but just keep using the product/service (Hossain and Quaddus 2010b). However, the imposing authorities (government or the organization) can examine users' satisfaction status and make their future strategies and policies in order to better diffuse such product/service. Mandatory use of IS/IT products and services is an interesting area of future research using ECT/ECM or their modified versions.

ECT as well as ECM proves that, the more the *expectation* the less the *satisfaction* is and vice versa (Staples et al. 2002). It generates a new argument to the researchers whether to suggest companies to provide less information to the potential customers so that they do expect less. What are the solutions: to increase the *performance* or not to overemphasize *expectation*s in determining *satisfaction* (Irving and Meyer 1999; Brown et al. 2008)?

Though a number of IS/IT areas are examined, a major area has yet to be explored to measure continuance intention of the users; for example, the continued usage intention of individuals and/or organizations using RFID (Hossain and Quaddus 2010b), Decision Support System (DSS), Global Positioning System (GPS), Group Support Systems (Tung and Quaddus 2002), online service deliveries, online check-in for airlines, and so on; which needs to be addressed in the future.

21.5 Conclusions

IS research has a long tradition of developing new theories as well as adopting and adapting theories from various areas. In doing that, whatever the epistemological and ontological processes are adopted, the main research intention concentrated into understanding the behavior of the IS developers and users to make ISs more effective and efficient for the human; a subset of the society which is nowadays widely called "the digital society." However, this digital society cannot thrive if the users do not use the ISs in a continued manner; and, therefore, it is required to research on the *continued usage intention* of the IS users toward a particular IS product/service. Keeping this objective in mind, predominantly, along with some other behavioral theories, ECM became the most popular theory in IS studies which has been adapted from ECT. However, both theories have enough anomalies and ambiguities to confuse the IS researchers, which needs to be addressed in future. This is one of the limitations, and beyond the capacity, of this study to propose any sort of solution to resolve these issues but to raise the issues. But this study will contribute to the IS practitioners to adapt and use ECT and ECM in their contextual areas and also, in future, the IS researchers may contribute to the unresolved issues, discussed in this study.

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Chapter 22
Stakeholder Theory and Applications in Information Systems

Alok Mishra and Yogesh K. Dwivedi

Abstract Stakeholder theory is widely used in management in examining organizational environment, strategic management, ethical issues, business planning process, e-government, project management, environment management, etc. Recently stakeholders are also seen as a means to more successful information and communication technologies and information system development and implementation issues. In this chapter, stakeholder theory, its origin and applications in Information Systems field in literature are discussed.

Keywords Stakeholder theory • Stakeholder model • Stakeholder • Information systems

Abbreviations

AIT	Advanced information technology
CBR	Case-based reasoning
IC	Information centers
IS	Information systems
IT	Information technology
NEO	Net-enhanced organization
SMSS	Stakeholder management strategy support system
SISP	Strategic information systems planning

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22.1 Introduction

Stakeholder management has become an important tool to transfer ethics to management practice and strategy. Few management topics have generated more debate in recent decades than the underlying notion, the model, and the theories surrounding stakeholders (Donaldson and Preston 1995; Gibson 2000; Wolfe and Putler 2002; Friedman and Miles 2006). The visual power of the stakeholder model and its very simplicity are seen as contributing to the success of the stakeholder concept (Fassin 2008). An increasing interrelation is observed between the concepts of stakeholder theory, corporate responsibility, and business ethics (Valor 2005; Garriga and Melé 2004).

The term stakeholder has a relatively recent history (Pouloudi 1999) and has become an increasingly popular term in management vocabulary, "almost a cliché" (Willetts 1997). Freeman (1984) traces it back to 1963, when it was introduced to define "those groups without whose support the organization would cease to exist." Freeman argues that references to stakeholders have been made since in the areas of corporate planning, systems theory, corporate social responsibility, organization theory (Pouloudi 1999) and later on integrated with strategic management and approaches to help managers in improving their organization's strategic position (Eden and van der Heijden 1993; Flood and Jackson 1991; Gilbert et al. 1988). Different researchers defined stakeholder differently with their own perspectives, depending on different views of their roles. For instance, stakeholders have been defined as differently as "groups of constituents who have a legitimate claim on the firm" (Hill and Jones 1992), "participants in corporate affairs" (Ackoff 1974), those that "will be directly impacted by the decisions" (Friend and Hickling 1987), those who "hold a stake" about the decisions made by an organization (Eden and van der Heijden 1993; Wagner 1993). In general, the most widely known definition has been proposed by Freeman (1984) which states: "A stakeholder in an organization is (by definition) any group or individual who can affect or is affected by the achievement of the organization's objectives."

Freeman (1984) divided his broad stakeholder groups into internal (customers, employees, suppliers, owners) and external (governments, competitors, special interest groups, etc.). Although the internal groups are seen as "key," in some situations the external stakeholders are more important and they cannot a priori be relegated to a subsidiary position (Bailur 2007). There is further division between primary and secondary stakeholders. Clarkson (1995) defines primary stakeholders as those "without whose continuing participation the corporation cannot survive as a going concern." If these primary stakeholders withdraw or become dissatisfied with the system, "the corporation will be seriously damaged or unable to continue." He further argued the support of primary stakeholders can be lost if the organization is either unable to create and distribute sufficient wealth or value to satisfy them or if more wealth or value is given to one primary stakeholder group at the expense of another group, which would cause them to withdraw from the system. On the other hand, secondary stakeholder groups are those who have the "capacity to mobilize public opinion in favor of, or in opposition to, a corporation's performance."

Pouloudi (1999) argued that stakeholders are not passive environmental elements but act according to their interests and use their power to influence the organization in the direction they desire and in this context the word "or" is significant as according to Freeman it indicates two directions of influence (between organization and stakeholder) along with provision of future stakeholders.

This chapter introduces stakeholder theory and its various applications in the IS and ICT field toward organizational, strategic, ethical, cultural, and other related issues.

22.2 Stakeholder Theories of Management

22.2.1 Origin of Stakeholder Theory

Stakeholder theory has its origins in management literature. Donaldson and Preston (1995) traces the notion of stakeholders back to the Great Depression in the USA (1929–1941), when General Electrical Company defined four major stakeholder groups – shareholders, employees, customers, and the general public. Freeman (1984) indicated its origin as linked to research conducted by the Stanford Research Institute which defined it in 1963 as "those groups without whose support the organization would cease to exist" (Freeman 1984). Freeman (1984) recommended managerial perspective which identifies four key stakeholders of the firm – owners, customers, employees, and suppliers – and also found that during late twentieth century, owners of a corporation were no longer focusing just on return on investment, but were also interested in "shareholder activism" and promoting social justice.

The framework of the stakeholder model illustrates the relationships among the various groups of actors in and around the organization. Based on extensive literature review on organizational theory and corporate strategy along with vast amount of research and observation, Freeman provided the notional view of organization in a new and simplified view. Freeman originally presented the stakeholder model as a map in which the organization is the hub of a wheel and stakeholders are at the ends of spokes around the rim (Frooman 1999). It consisted of one central circle, or oval, representing the firm, surrounded by a variable number of other circles or ovals with bidirectional arrows toward and from the central oval, each oval representing a group of stakeholders. Freeman's original framework included 11 stakeholders on a non-exhaustive basis (Freeman 1984). The most common version of the model (Fig. 22.1) includes seven stakeholders.

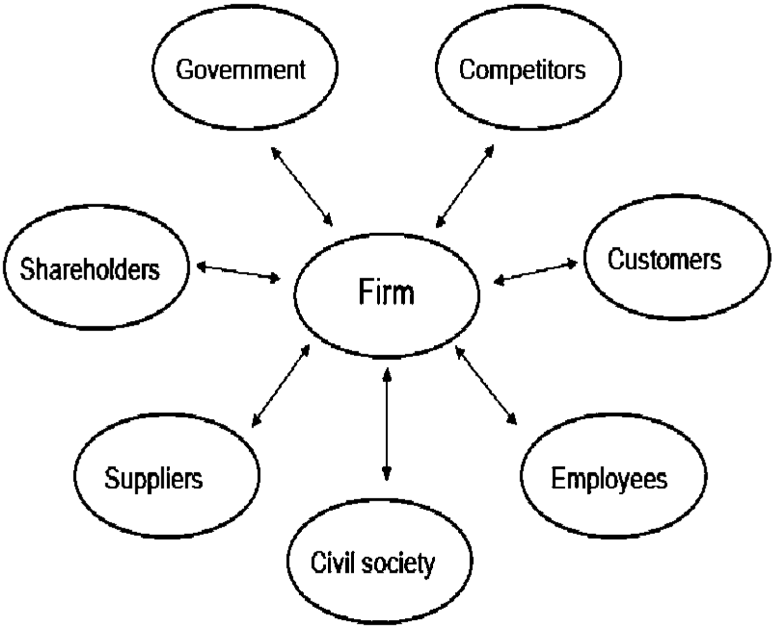

Fig. 22.1 The original stakeholder model (Freeman 1984)

22.2.2 Descriptive, Instrumental and Normative Views of Stakeholder Theory

Donaldson and Preston (1995) described the descriptive, instrumental, and normative views of stakeholder theory to facilitate in understanding different features of this theory as follows:

(a) Stakeholder theory is *descriptive* in the sense that "it describes the corporation as a constellation of cooperative and competitive interests possessing intrinsic value."
(b) Stakeholder theory is *instrumental* because "it establishes a framework for examining the connections, if any, between the practice of stakeholder management and the achievement of various corporate performance goals."
(c) Finally, "the fundamental basis" of stakeholder theory is *normative* and involves acceptance of the following ideas: "stakeholders are persons or groups with legitimate interests in procedural and/or substantive aspects of corporate activity" and "the interests of all stakeholder are of intrinsic value."

Further, Donaldson and Preston (1995) justify their claim that the normative aspects is at the core of the stakeholder theory by exemplifying how the justifications for favoring stakeholder theory over other management theories ultimately rely upon normative arguments. They suggest that these three aspects can be viewed as nested circles (Fig. 22.2).

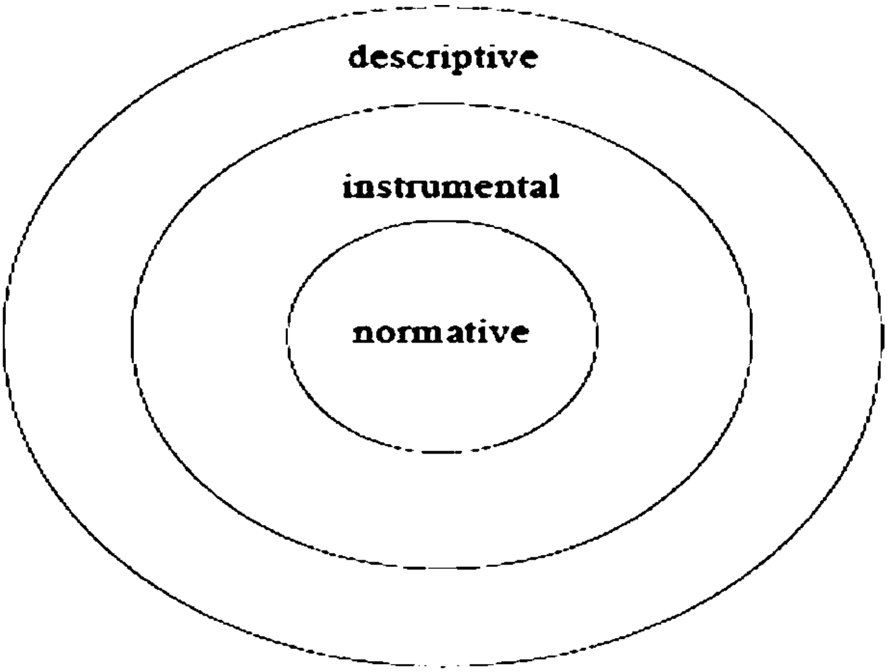

Fig. 22.2 Aspects of stakeholder theory (Donaldson and Preston 1995)

Donaldson and Preston (1995) also suggested four central theses related to stakeholder theory.

(a) Stakeholder theory is descriptive in that it offers a model of the corporation.
(b) Stakeholder theory is instrumental in offering a framework for investigating the links between conventional firm performance and the practice of stakeholder management.
(c) Although stakeholder theory is descriptive and instrumental, it is more fundamentally normative. Stakeholders are identified by their interests and all stakeholder interests are considered to be intrinsically valuable.
(d) Stakeholder theory is managerial in that it recommends attitudes, structures, and practices and requires that simultaneous attention be given to the interests of all legitimate stakeholders.

22.3 Stakeholder Theories in Information Systems

Most references to stakeholders in the information systems literature refer primarily to individuals or groups within the organization, contrary to the stakeholder literature in strategic management (Pouloudi 1999). Mumford and Weir (1979) is one of the early researchers in supporting the involvement of end users as a component of effective information systems development and implementation, using essentially the stakeholder concept in this domain. It has been proven that end users and managers are very important toward successful system implementation. As more interorganizational information systems are developed, which usually involves strategic decisions, a yet wider range of stakeholders needs to be involved (Pouloudi 1999). In these systems the attention may switch from end users and focus on those parties that are external to the organization but can associate in decision making at a managerial or strategic level (Pouloudi and Whitley 1997). According to Pouloudi (1999), it is important to note there is some confusion in information systems research about the notion of stakeholders and some researchers do not offer a specific definition (Benjamin and Levinson 1995; Eden and Ackermann 1996; Galliers 1994; Lee and Gough 1993). For instance, Boddy and Buchanan (1986) explained that "organizations can be viewed as comprising different 'stakeholder' groups whose interests in promoting or resisting change, or apathy to innovation, may be explained by identifying their respective perceived interests and by examining how the will be effected by new technology." Willcocks and Mason (1987) define the stakeholders of a computer system similar to Freeman as "people who will be affected in a significant way by, or have material interests in the nature and running of the new computerized system."

Ahn and Skudlark (1997) had given an extended definition of stakeholder: "[T]he stakeholders are a group of people sharing a pool of values that define what the desirable features of an information system are and how they should be obtained." Lederer and Mendelow (1990) observed the "environment" of an information system department, which includes the host organization's environment as well as "everything within the organization that lies beyond the borders of the IS department." Checkland in the soft systems methodology mentioned the requirement for stakeholder identification and the significance of underlining different stakeholders' perspectives, mainly by using the "CATWOE"(customer, actor, transformation process, Weltanschauung, system owner, environmental constraints) elements (Checkland 1981; Checkland and Scholes 1990). This approach has the advantage that it can be used to provide a holistic representation of information system whether as part of the organization or interorganizational system in broad aspect as "human activity system." One of the most common instrumental approaches to stakeholder analysis in the information systems field addresses one of the key issues of information systems practice (Brancheau et al. 1996; Galliers and Baker 1994; Knights et al. 1997), that is the development of an information systems strategy and its alignment to business strategy (Pouloudi 1999). According to Lacity and Hirschheim (1995), a major obstacle for the alignment of information systems and business strategies are the conflicting expectations and perceptions of information systems that different organizational stakeholders have. Senior management is mostly concerned with cost whereas users are mostly concerned with service. Information system managers are "caught in the middle" of a hostile environment and find that they need to justify the agreement made to these groups.

Benjamin and Levinson (1995) proposed a seven-step stakeholder analysis approach (Table 22.1) that will support the management of change enabled by information technology. They expect these steps will help the organization to determine whether the change is feasible and what change strategy would have better results.

Table 22.1 Stakeholder analysis (Benjamin and Levinson 1993)

Step 1	Identify a vision or objective
Step 2	Describe a number of future states in terms of goals understandable by the stakeholder group
Step 3	Break the goals down into the process, technology, and organization and culture steps necessary to balance the organizational equilibrium
Step 4	Identify the stakeholders groups whose commitment is necessary to achieve each goal
Step 5	For each type of stakeholder, describe the needed changes, perceived benefits, and expected kind of resistance
Step 6	Analyze the effort required to gain the necessary commitment from the stakeholder group
Step 7	Develop action plans for those stakeholder groups that are not committed enough

Table 22.2 The use of stakeholder concept in information systems research (Pouloudi 1999)

Examples of instrumental uses		Examples of normative uses
Stakeholder analysis can be used to assist IS planning and strategy formulation	Stakeholder analysis can be used to assist IS development and implementation	• It is ethical to consider stakeholders • Stakeholder analysis can be used to study ethical issues
• Organizations need to consider IS stakeholders (Earl 1989)	• Failure is contingent on the capability of an IS to meet different stakeholder expectations (Lyytinen 1988; Lyytinen and Hirschheim 1987)	• Obligations of IS professionals toward stakeholders: to minimize harm to others (Rackley et al. 1996)
• Dynamics of key stakeholder groups need to be addressed (Ruohonen 1991)	• Information centers need to consider key stakeholders when developing IS (Bento 1996)	• Ethical decisions regarding the privacy of medical information are made in a context of complex stakeholder relations (Introna and Pouloudi 1998) (Pouloudi 1997)
• Misalignment of IS strategies can be addressed by considering the stakeholder agendas Lacity and Hirschheim (1995)	• Management of conflicting stakeholder interests is important for IS implementation (Ahn and Skudlark 1997)	

One of the most thorough investigations of the stakeholder concept in information systems research that relates information systems stakeholders with implementation failure has been made in the early work by Lyytinen (1988), Lyytinen and Hirschheim (1987). They argue that failure is conditional on the capability of an information system to meet the expectations of different stakeholders (an information system may be considered successful by some stakeholder but a failure by others).

Whilst the stakeholder management literature concentrates on debating the normative use of the stakeholder concept, the information system literature has remained focused on the instrumental perspective of stakeholder theory (Pouloudi 1999). This is summarized in Table 22.2.

22.4 Applications of Stakeholder Theory in Information Systems

Boddy and Buchanan (1986) define organizational information system stakeholders as "all those who have a practical concern for the effective application of new technologies, and who are in a position to take or to influence decisions about why and how they are used." There are number of applications of stakeholder theory in Information and Communication Technology (ICT) and Information Systems (IS) related areas. The stakeholder theory and its applications in information system and allied areas along with main results are summarized (see Table 22.3).

22.5 Discussion

A stakeholder theory provides the benefit of identifying who is key in the project, and if and how they can be managed. Bailur (2007) observed that stakeholders analysis involves the use of categorization that is quite subjective, as it matters who conducts the analysis and makes the distinction between "important and/or influential" or "primary or secondary" in her project case. She argued that it is difficult to know how to identify stakeholders, whether they are primary or secondary, what their interests might be, how they might work together, and if and how they can be managed. Further, stakeholders change all the time throughout a project which makes it difficult to label them. Freeman (1984) explained this through what he calls the "snail darter fallacy." Chung et al. (2009) also supported that stakeholders type classifications as limitation of their study and include this in their future work plan to automate such analysis in business stakeholder analyzer prototype. The management of competing stakeholders has emerged as an important weapon for strategic management and stakeholders need to be categorized for the better utilization of rules for generating appropriate strategies (Lim et al. 2005). Rowley (2010) stressed that there is need to do more works toward understanding of e-government stakeholder roles and benefits in e-government with the help of stakeholder benefits analysis tools. Flak and Rose (2005) observed that there is no serious conceptual mismatch between stakeholder theory and government's objective of providing policy and services for citizens and organizations – society's stakeholders. Islam and Grönlund (2007) found stakeholder theory useful to understand e-services but lacks in adaptation to stakeholder preferences, needs, capabilities, as well as in project resources such as staff supply and qualifications. Vidgen (1997) proposed future work in terms of IS requirements framework in the context of the wider IS development process based on stakeholder analysis. The stakeholder theory claims that managers should resolve ethical quandaries by balancing stakeholder interests without violating the rights of any stakeholder (Smith and Hasnas 1999). Stakeholders are more broadly and emotionally involved in systems development process, they may be more likely to embrace the outcomes of these systems as when system users

Table 22.3 Applications of stakeholder theories in IS

#	Study	Area	Purpose	Main results
1.	Leidner et al. (2009)	IT usage	Role of IT in crisis management	1. Developed a model of crisis response resource deployment 2. Analysis found the existing assets of information technology infrastructure, leadership, and collaborative network and the existing capabilities of the ability to build and apply IT, the ability to recognize signals and the ability to see the big picture are central to the crisis response
2.	Yuthas and Dillard (1999)	Business ethics	Ethical development of advanced technology	1. Proposed a stakeholder theory of enabling as one way to make the risks and moral concerns associated with business AIT (Advanced Information Technology) systems more visible 2. Applying the principles of affirmative postmodern ethics through an enabling stakeholder-oriented system development process explicitly allows for the examination of moral concerns which might otherwise be overlooked, ignored, or silenced
3.	Rowley (2010)	E-government	Development of tools and approaches for understanding the benefits sought by a wide range of stakeholder groups in e-government	1. Successful e-government requires that engagement of all stakeholders, and that a preliminary to that engagement is a shared understanding of the interests, perspectives, value dimensions, and benefits sought from e-government by the various stakeholders roles 2. Study proposed typologies of stakeholders roles, and stakeholder benefits, and embedding these in the stakeholder benefits analysis tool (SBAT). This is designed to be used to support: (a) The identification of stakeholders (b) The recognition of differing interests amongst stakeholders (c) The development of strategies to align stakeholder interests so that participation in e-government can be self-governing

(continued)

Table 22.3 (continued)

#	Study	Area	Purpose	Main results
4.	Chung et al. (2009)	Business intelligence systems	Proposes a framework for designing business intelligence (BI) systems to identify and to classify stakeholders on the Web	1. Framework proposed for designing business intelligence systems to identify and to classify stakeholders on the Web, incorporating human knowledge and machine-learned information from web pages 2. Based on the framework a prototype called business stakeholder analyzer (BSA) developed which helps managers and analysts to identify and to classify their stakeholders on the Web 3. Research results provide a better understanding of how to integrate information technology with stakeholder theory toward enriching the knowledge base of business intelligence system design
5.	Islam and Grönlund (2007)	E-government	To assesses an e-government project using design–reality gap analysis and stakeholder theory	1. It used stakeholder analysis and a gap analysis technique to assess an e-government project crucial for almost all developing countries – providing information to agriculture market information 2. The research suggests use of mobile technologies in combination with call centers and locally available human resources as the most important factors for e-government success
6.	Bailur (2007)	Telecenter projects	Applying stakeholder theory to analyze telecenter projects	1. Analyze the applicability of a stakeholder perspective in development informatics 2. Provides preliminary framework for identification and management of stakeholders 3. Involving stakeholder is a much more complex activity than many of the telecenter analysts cited earlier
7.	Lim et al. (2005)	Strategies for stakeholders management	Proposes a methodology for formulating strategies for stakeholder management by the use of these RDAP (reactive, defensive, accommodative, or proactive) strategies	1. Paper presents a holistic way to integrate the most critical tasks of stakeholder management 2. It employs a case-based reasoning (CBR) technique and proposes a methodology to help formulate the stakeholder management strategies 3. A system called the stakeholder management strategy support system (SMSS) is implemented to put proposed methodology to work

8.	Chua et al.(2005)	E-commerce	The evolution of e-commerce research: a stakeholder perspective	1. This paper surveys seven of the top nine e-Commerce journals to test the proposition that stakeholder theory suggests that, as an emerging research discipline, e-commerce research is likely to focus primarily on specific stakeholders and ignore others 2. Academic e-commerce researchers concentrate their attentions on two stakeholder groups, specifically customers and the internal organization (i.e., managers and employees) of the net-enhanced organization (NEO)
9.	Flak and Rose (2005)	E-government	Adapting stakeholder theory to e-government	1. Apart from its original profit focus, there is no serious conceptual mismatch between stakeholder theory and government's objective of providing policy and services for citizens and organizations – society's stakeholders 2. The paper discusses how information technology impacts a stakeholder model of governance
10.	Dimovski and Škerlavaj (2004)	Effect of ICT on organizations	A stakeholder theory approach to the organisational performance and influence of ICT	1. Higher-level organizational learning leads to improved organizational performance from employee perspective 2. Companies which invest efforts into the systematic approach to organizational learning profit in terms of an augmented level of employee trust in the leadership, improved efficiency of work organization, a more committed workforce, decreased costs of work per employee, increased employee satisfaction, and increased employee flexibility
11.	Zhang et al. (2005)	E-government	Exploring stakeholders' expectations of the benefits and barriers of e-government knowledge sharing	1. There is significant differences among stakeholders groups based on the types of organizational membership 2. Local government stakeholders are considerably less optimistic in achieving goals, and more concerned about a variety of organizational, technological, and financial barriers 3. Research results indicated that key participants' expectations were similar to those of general participants/users

(continued)

Table 22.3 (continued)

#	Study	Area	Purpose	Main results
12.	Scott et al. (2004)	E-government	Implementation strategies for e-government: a stakeholder analysis approach	1. Public sector organizations in particular present unique challenges to the implementation process and implementation strategies often require particular attention to the social and political elements inherent in organizational change 2. In e-government implementation, the main barriers are not technical but social and cultural. Implementation strategies should therefore support the process of managing stakeholder relations in order to reduce the risk of stakeholder conflict and ensure the success of e-government initiatives
13.	Pouloudi (1999)	Information system	Aspects of the stakeholder concept and their implication for information system.	1. The study investigated different perspectives of the stakeholder concept that have been discussed in the literature along with shortcomings 2. Stakeholder analysis can provide multiple and mutually supportive approaches to the study and practice of information systems development, particularly if descriptive, instrumental, and normative aspects are taken into account
14.	Smith and Hasnas (1999)	Information systems	Study of relationship between ethics and information systems	1. Information system had paid great use of technology in past 2 decades but the growing number of ethical dilemma also grew during the same time frame but received much less attention 2. Future research should clarify obligations for individuals in nonprofit or public sector organizations for similar context
15.	Vidgen (1997)	Information system	Stakeholders, soft systems, and technology in the analysis of information system requirements	1. The application of stakeholder analysis and soft systems thinking for an investigation of information system requirements 2. A framework for investigating IS requirements is proposed that contrasts the current situation with the future situation and the real world with conceptual thinking about the real world

16.	Cheng and Wang (2009)	Corporate governance	To study significance of establishing the independent director system	1. As a system arrangement in corporate governance, implementation of the independent director will help improve structure of corporate governance, maintain interests of all stockholders, and protect rights and interests of small-and-medium sized investors 2. There is need to strengthen and optimize the independent director system with a Chinese characteristic
17.	Ruohonen (1991)	Strategic information system	To examine intra-group and intergroup relationships in the context of strategic information systems planning (SISP)	1. Strategic information systems planning (SISP) requires the participation and involvement of different managerial groups and the key stakeholder groups in this process are top management, user management ,and IT/IS management 2. Management education is needed to integrate the different views of managers concerning the use of IT 3. Successful SISP requires sound communication and the interpretation of these different views
18.	Lacity and Hirschheim (1995)	Information system	Presented a framework to understand the context of misalignment which can assist stakeholders clear out their differences to reach a general strategy	1. Present a framework to understand the context of misalignment which can help stakeholders flush out their differences to arrive at a common strategy for the portfolio of IS activities 2. In the context of a shared strategy, benchmarks targeted at a performance improvement – rather than turf- protection – can be achieved

(continued)

Table 22.3 (continued)

#	Study	Area	Purpose	Main results
19.	Bento (1996)	Information centers	Analysis of information centers from major stakeholders perspective	1. A conceptual model, based on role theory, is presented to explore the special challenges of "life in the middle," such as different expectations about the roles that should be performed by information centers (IC) professionals, different criteria for evaluating their performance, and different perceptions of their success 2. These special challenges were empirically studied through in-depth interviews with users, IS managers and IC managers, in a random national sample of 47 Fortune 500 companies 3. The results indicate that, given the multiple expectations surrounding information centers, IC professionals need to be flexible in adopting different roles, skilled in coping with different sets of performance criteria, and keenly aware of the highly subjective nature of the evaluations received from their diverse constituents
20.	Benjamin and Levinson (1993)	Managing IT-enabled change	Framework for managing IT-enabled change	1. Develop a framework for managing IT-enabled change 2. Proposed framework provides a common language for managers implementing IT-based change and shows how technology, business process, and organization must be adapted to each other for such change to be effective
21.	Boonstra (2006)	ERP-implementation	ERP implementation affects on stakeholders	1. Different stakeholders can view ERP-systems in different ways, according to their own histories, interests, self-images, prospects, and views 2. ERP-implementation is a dynamic process, and therefore, views held by stakeholders at one point in time, may change during the project due to various reasons including cognitive, political, and opportunistic ones

are involved in development, these systems are more likely to better meet the needs and concerns of the stakeholders (Yuthas and Dillard 1999). Chua et al. (2005) argued that at least four stakeholder groups, namely investors, suppliers, regulators, and indirect stakeholders, will increasingly demand the attention of NEOs, and therefore should be attracting the interest of IS and e-commerce academics. Boonstra (2006) illustrated that ERP-implementation affects the interests of stakeholders and can be perceived as a negotiation process where various parties try to use the ERP project to defend or to advance their individual or group interests. According to him there are some directions of future research to turn the stakeholder approach into a comprehensive ERP/ICT project analysis.

22.6 Conclusions

Concept of stakeholder represents a progression from developer- and user-centered problems to organization-wide and interorganizational information system problems. This is a sign of maturity of information systems research to show how holistic representation of the parties involved in the more complex systems currently developed (Pouloudi 1999). Stakeholder theory proposes an ethical use of stakeholder concept in information systems as ethical considerations and professional conduct is a significant issue in information system.

From an IS perspective, it provides insights on the organizational, strategic, ethical, and project levels for:

- *Managers* – in understanding multilateral stakeholder relationships in organizations. Stakeholder analysis will help in study of interorganizational systems and information system planning and strategy formulation.
- *Service providers* – in identification of stakeholders and development of stakeholder typologies.
- *Users* – where they can understand managerial attitudes, structures, and practices adopted in information system development and implementation.
- *Developers* – in choosing the early correct perspectives on stakeholder management to ensure success of a project. Good stakeholder management can also lead to higher project performance.

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