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Information Systems Theory

Explaining and Predicting Our Digital Society, Vol. 2

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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 am delighted to provide the foreword for the second volume of this book. A book providing a comprehensive treatment of the various theories that are used in the field of information systems (IS) will become a valuable resource for all information systems scholars.

It is my view that the information systems field has made remarkable progress as an academic discipline in a relatively short period of time. The field has made progress, not by ignoring other fields, but by borrowing, learning, and building on the theories, methods, and exemplars of good research in other fields (such as computer science, economics, and psychology). But we have not just used these theories slavishly or unthinkingly; rather, IS scholars have adapted them and modified them for use in this new field. We have also come up with some of our own theories in an attempt to explain IS phenomena.

Right now we are seeing an explosion of interest in the development, use, and application of information systems and technologies. There is increasing interest in the development, use, and application of information technology and systems by scholars in many different fields. And so this book may also be of interest to scholars in many other disciplines besides information systems, particularly if these scholars are interested to find out which theories have proved to be relevant to the field of information systems, and how such theories have been used. For IS practitioners, the book might prove valuable as a resource to help identify which theories have proved helpful in understanding how information systems can be effectively deployed in today's digital world.

This book demonstrates that many different kinds of theories have been used to help understand and explain IS phenomena. Volume 1 looks at information systems lifecycle theories and economic and strategic theories, whereas Volume 2 looks at socio-psychological and methodological theories. Of course, some of these theories have been borrowed (such as the theory of the diffusion of innovation), but others have been developed within the IS field (such as the DeLone and McLean IS success model).

The true value of this book is that it brings together, for the first time, all these various theories into one convenient location. This book not only describes various theories and models applicable to studying information systems/ information technology management issues, but it also provides a critical review of how these theories and models have been used in IS.

Auckland, New Zealand Michael D. Myers

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 provide 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, each further broken down into two sections.

The first section of Volume 1 presents detailed descriptions of a set of theories centered around the IS lifecycle, 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 Multi-level 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 toward the completion of this work.

First of all, we would like to thank the series editors – *Professor Stefan Voß* and *Professor Ramesh Sharda* – for including this title under Springer's *Integrated Series in Information Systems*. We would also like to thank the dedicated people at Springer, USA, namely, *Mr. Neil Levine* (Editor, Operations Research & Management) for handling the book proposal and finalizing the contract, and *Mr. Matthew Amboy* for skillfully managing the project, and keeping the book (and us) on schedule.

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 *Prof. 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 cooperation enabled us to reach this milestone.

Happy theorizing!

Yogesh, Mike, and Scott

Contents

Chapter 1
Employing Personal Construct Theory to Understand Information Systems: A Practical Guide for Researchers

M. Gordon Hunter, Peter Caputi, and Felix B. Tan

Abstract This chapter presents a description of Personal Construct Theory and how the theory may be employed in information systems research. Within the purview of Personal Construct Theory, the Repertory Grid technique is also described, which is an interview technique employed to elicit and document a research participant's system of personal constructs. The concept of laddering is also presented which facilitates delving into the detailed meanings attributed by a research participant to their construct system. Examples of information systems projects are also included in this chapter to further elucidate Personal Construct Theory and the Repertory Grid technique.

Keywords Personal construct theory • Repertory grid • RepGrid • Constructs • Laddering

Abbreviations

PCT	Personal Construct Theory
RepGrid	Repertory Grid
PCP	Personal Construct Psychology
IS	Information Systems
PM	Project Manager

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1.1 Introduction

There are a plethora of research situations when the researcher would like to know what a research participant (common generic term employed in research involving in-depth interviews) thinks about a particular topic. The researcher might want to know what research participants think about another significant person in their lives; or what a customer thinks about a particular product. If the researcher wants to attempt to understand why a research participant thinks about a topic in a particular way, it becomes incumbent upon the researcher to delve into the meanings that a research participant attributes to the concepts employed to describe their thinking. That is, a research participant will have developed a personal system to employ, which helps to interpret and respond to specific situations. The investigation of this personal system provides a deeper understanding not only about what the research participant thinks about a particular topic but also provides insight into why. This understanding is facilitated through the documentation of the meanings that a research participant attributes to the words and terms used to describe their thinking.

Personal Construct Theory (Kelly 1955, 1963, 1970) describes the system held by individuals which they employ to help them make sense of their world. The documentation of an individual's personal construct system is accomplished through the use of the Repertory Grid (RepGrid, or Repgrids) technique.

In the study of information systems (IS), there is interest in determining how stakeholders think about the development and use of various processes and technologies (Barley 1986; Compeau et al. 1999; DeSanctis and Poole 1994; Griffith and Northcraft 1996; Lind and Zmud 1991; Nelson et al. 2000; Orlikowski and Gash 1994). Investigations into how stakeholders think about an entity, revolves around identifying individual cognitive processes. A technique for documenting individual cognitive processes is Kelly's (1955, 1963, 1970) RepGrid. The technique supports the description of how stakeholders think about a specific phenomenon. In association with Personal Construct Theory, an internally consistent theoretical base is formed for exploring cognition within the IS field.

The presentation of this chapter is organized in the following manner. To begin, Personal Construct Theory is described. Within this context, the use of the RepGrid is explained. This technique is employed to elicit and document research participant's personal construct systems. Following this discussion, examples are presented where the technique has been employed in IS research. Finally, conclusions are presented which describe in general terms how the theory and its supporting technique may be employed to facilitate future research.

1.2 Personal Construct Theory

George Kelly developed Personal Construct Theory (Kelly 1955, 1963, 1970) as a way to help his clients to deal with their interpersonal relationships. Kelly's theory about human behavior resulted from his work as a clinical psychologist and his ideas supporting the concepts of Personal Construct Psychology. He developed the theory and consequent technique to serve as a guide for other practitioners in his profession. This manuscript focuses on Kelley's theory and its technique.

The theory is based upon the idea that individuals act as scientists in their attempt to gain or maintain control of their personal environment. Thus, they develop a system which aides their ability to interpret and predict how to respond to events and/or situations.

Individuals develop constructs which support their interpretation of evidence about an event or entity. The evidence may be employed by the individual to support a decision about similarity or difference. Thus, new evidence is categorized by the individual as the same as an already developed category or different. The difference may lead to the creation of a new category or the modification of an existing category. In order to gather this evidence, individuals must interact with others in their personal environment. The consequence is the development of a personal construct system which is explained by Personal Construct Theory, and is outlined in Appendix A.

The main tenant of Kelly's Personal Construct Theory is the process of "construing" and permeates the various corollaries of the theory. This process involves individuals gathering evidence and discriminating the data surrounding the evidence in order to substantiate or modify current categories, or create new categories. This discrimination process involves the creation of dichotomous constructs which represent the individual's assignment of data as similar or different in the categorization of the evidence. This assignment process is represented in Personal Construct Theory by the *Dichotomous Corollary* which states, "A person's construction system is composed of a finite number of dichotomous constructs."

While the discrimination process described above represents an individual's system of personal constructs, the system may be influenced by other individuals who, as a group, share common experiences and potentially similar perspectives. Kelly addresses this seeming contradiction in the following corollaries stated within Personal Construct Theory.

To begin, the *Individuality Corollary* states, "Persons differ from each other in their construction of events." Thus, two individuals observing the same evidence may reach differing interpretations. Their personal construct systems based upon past experiences may facilitate their categorization of the same evidence into different constructs. However, the *Commonality Corollary* states, "To the extent that one person employs a construction of experience which is similar to that employed by another, his psychological processes are similar to those of the other person." Thus, groups of individuals may share similar personal construct systems because of common experiences. This similarity is further related to the *Sociality Corollary* which states, "To the extent that one person construes the construction processes of another, he may play a role in a social process involving the other person."

Taken together, these corollaries suggest that individuals attempt to make sense of their experiences through the development of a personal construct system. But this system may be affected through social interaction with other individuals. After all, humans are social in nature and tend to be influenced through their relationships with other individuals. This is the basis for the formation of groups and even cultures when considered from a broader perspective.

Through gathering evidence and assigning to categories, individuals observe repeating patterns. Kelly's *Construction Corollary* states, "A person anticipates events by construing their replications." So, evidence related to a repeating pattern will facilitate how an individual will respond to an event either when it occurs or in anticipation of its occurrence.

Kelly also suggested that constructs are hierarchical. The *Organization Corollary* states, "Each person characteristically evolves, from his convenience in anticipating events, a construction system embracing ordinal relationships between the constructs." Thus, subordinate constructs are specific in nature while hierarchically related superordinate constructs are more abstract. For example, the superordinate construct "communication" may be related hierarchically to subordinate constructs involving forms of communication such as "writing", "speaking", or "presenting."

An individual's personal construct system can change. As above, the individual may be influenced by others in a group. Kelly's *Experience Corollary* states, "A person's construction system varies as he successfully construes the replication of events." Thus, the experience of a particular event may lead to the modification of current constructs or the generation of new constructs. Through attempting to make sense of evidence, individuals rely on their personal construct system. When the evidence cannot be categorized by the current personal construct system, this tends to lead to a modification of the current system.

In summary, Personal Construct Theory outlines how individuals rely upon their past experiences to construe their own system to aid themselves to interpret a current situation. Given the appropriate experience, a research participant will prove a valuable resource for investigating the interpretations held on a particular topic. This valuable resource may be elicited and documented using the Repertory Grid technique which is outlined in the following section.

1.3 The Repertory Grid Technique

In order to elicit and document an individual's personal construct system, Kelly (1955, 1963, 1970) devised the RepGrid technique. This name is based upon Kelly's idea that an individual possesses a repertory of constructs. The technique facilitates data gathering, serving as an interview guide, and supports subsequent analysis of the data. The discussion of how to employ the technique is presented in this section in the chronological order of steps that a researcher would follow when conducting an investigation using the RepGrid. At each step, the available alternatives are described. These steps include initial project decisions; nominate elements; document and explain constructs; relate elements and constructs; and analysis.

1.3.1 Initial Project Decisions

As with any investigation, the researcher selects the topic and becomes familiar with the knowledge domain. A clear statement of the research question will facilitate conducting the investigation. It is important at the outset that the researcher realizes there are research questions that may not be addressed by employing the RepGrid technique. Recall that the RepGrid technique facilitates the elicitation and documentation of an individual's personal construct system. Thus, the researcher will employ the technique to determine what a research participant thinks about a particular knowledge domain. Further, because the technique elicits the research participant's thoughts on a topic through a process of comparison, the elements (described later) that will be employed to facilitate the elicitation must be distinct. For instance, elements may be personas of objects. The RepGrid technique should not be employed to document a process that involves activities or tasks carried out over a period of time.

Also, the appropriate research participants must be identified. They should possess the necessary experience to have formed an opinion about the research question. Their understanding of the knowledge domain, as reflected in the personal construct system, should provide a valuable response to the research question.

A generic issue in all investigations is convincing research participants to become involved in the project. The research participant must be convinced there is a benefit to them to give their time to the researcher. Initial contact may be made via a brief research statement sent directly to the appropriate individuals or a message of introduction sent by a mutually respected intermediary who knows both parties. The interview location should be at a place and time convenient to the research participant. Potential interruptions should be minimized.

Early in the interview, the researcher should inform and obtain approval from the research participant to record the conversation. This request usually does not cause a concern if it is made specifically clear that the researcher will maintain confidentiality regarding access to any interview material. The recording device should be placed in an unobtrusive location.

At the beginning of the interview, the research participant is made to feel comfortable with the topic of discussion and the process to be followed both during the interview and afterwards. It needs to be explained by the researcher that the research participant has the relevant experience concerning the research question and can provide valuable comments. The research participant is told that there are no wrong answers but that their opinion on the topic is the only correct answer. An overview of the process is followed by a general discussion of the research participant's background. This discussion usually includes education and work experience. Further, this discussion generally serves to relax the research participant as they are the experts regarding their personal background.

1.3.2 Nominate Elements

In general, the nomination of elements should meet certain criteria. First, the elements should relate to the area under investigation (Beail 1985; Easterby-Smith 1980). Second, the elements must be related to the personal experience of the research participant (Beail 1985; Easterby-Smith 1980). Third, evaluative terms, such as Leadership or motivation, should not be used (Stewart and Stewart 1981) because of the potential differing interpretations by research participants. Fourth, the elements should relate to the same source category (Easterby-Smith 1980). Fifth, the elements must be unique and discrete (Stewart and Stewart 1981).

Elements may be nominated by either the researcher or the research participant. In either case, the elements must relate to the research question knowledge domain of the research participant. Further, the elements must be unique, discrete entities.

The researcher may nominate the elements (Reger 1990) if the objective of the investigation is to learn more about a specific set of elements. This approach represents the initial step in creating what is known as a "common" grid, which also consists of researcher-nominated constructs. A discussion of common grids is included later in the analysis subsection, regarding the quantitative use of the technique.

If the research participant nominates the elements, it is incumbent upon the researcher to provide appropriate guidance for the nomination process. This approach represents the initial step in creating what is known as a "unique" grid, which also consists of research participant-nominated constructs. A discussion of unique grids is included later in the analysis subsection regarding the qualitative use of the technique. Note that the research participant must possess sufficient knowledge of the elements to be able to form an opinion about the elements in relation to the research question.

The guidance provided by the researcher for research participant-nominated elements may be in the form of a role description or pool definition. If the researcher provides a role description, then the research participant will nominate specific entities that fit the role. For example, the role "significant other" will result in the nomination of a specific entity unique to each research participant. Alternatively, the researcher may define a pool of candidates from which the research participant may nominate specific entities. For example, the pool may be "systems analysts" and the research participant will identify specific individuals. Again, as above, each specific entity will be unique to each research participant.

The nomination of elements should attempt to ensure a broad range of entities within the source category. If the researcher wants to know the research participant's views on effective subjects then, "… obviously you will ask him to construe elements that include effective [subjects], but to know how he differentiates between effective and less effective one, you must include some less effective ones in your element list" (Stewart and Stewart 1981). Thus some research (Crudge and Johnson 2004; Hunter 1994; Hunter and Beck 2000; Stewart and Stewart 1981; Whyte and Bytheway 1996; Young et al. 2005) has employed "anchors" where the research participant is asked to think of the concept of an element which is "ideal" and "nonideal."

Specific occurrences of elements are documented in either automated or manual form. Many versions of computerized RepGrid processes exist. If a manual approach is employed, identifiers of each element are written one per card. These identifiers may be individual's names or nick names; or object labels. It is important that the identifiers are meaningful to the research participant and not necessarily to the researcher.

1.3.3 Document and Explain Constructs

Constructs represent the ways in which research participants discriminate the elements. As with elements, constructs may be nominated by either the researcher or the research participant.

If the researcher nominates the constructs, this suggests the investigation relates to identifying how specific constructs may be employed by the research participant to discriminate elements. This approach represents the final step in creating a common grid, which will facilitate statistical comparison of individual grids. Again, a discussion of common grids is included later in the analysis subsection.

If the research participant nominates the constructs, it is again incumbent upon the researcher to provide the appropriate guidance through the selection of one of the following elicitation processes. The approach of eliciting the constructs from the research participant represents the final preparatory step in creating a unique grid. The discussion of unique grids is included later in the analysis subsection. To facilitate an understanding of an elicited construct, the research participant will also be asked to provide a contrast. This construct/contrast dichotomy is employed to assist in the exploration of the meanings that the research participant attributes to both the construct and its contrast.

One approach to construct elicitation is called "full context form." In this case, the research participant is presented with all of the elements and asked to sort them into two piles based upon similar and dissimilar discrimination. Once completed, the research participant is asked for a verbal description of each pile. The verbal descriptions become labels for a dichotomous construct and contrast. Meanings attributed to the labels may be explored via laddering which is discussed later in this subsection. The above sorting process is repeated until no further meaningful constructs can be elicited.

The other construct elicitation approach is called "minimum context form." In this case, the research participant is presented with a randomly chosen subset of the elements. This subset may be two or three elements. When two elements are presented, this is referred to as dyadic elicitation. The research participant is asked to provide labels describing how the two elements differ. These labels become the dichotomous construct/contrast, which are explored further through laddering. When three elements are presented, this is referred to as triadic elicitation. The research participant is asked to describe how two elements are the same yet different from the third. As above, this generates dichotomous construct/contrast labels which are further explored via laddering.

It is noted that triadic elicitation produces more meaningful constructs (Caputi and Reddy 1999; Hagans et al. 2000). Further, asking the research participant for differences rather than opposites also produces more meaningful constructs (Hagans et al. 2000).

Sometimes an elicitation will generate a multiple construct (Curtis et al. 2008). That is, the contrast actually represents the dichotomous pole of another construct. A skilled researcher will identify this conundrum and facilitate a discussion with the research participant to create two single constructs. In these situations, it is very important that the researcher not bias the research participant about the revised labels to be assigned to the restructured multiple construct.

Past research has shown that most investigations generate between 10 and 25 constructs (Bannister 1968; Fransella et al. 2004), and that between 7 and 10 triadic elicitations will generate the most relevant constructs (Reger and Huff 1993).

Constructs may be documented and explained in groups (Stewart and Stewart 1981). A group approach may be adopted if a less time-consuming data collection method is desired. Also, through research participant interaction, different interpretations may be encountered, contributing to increased understanding and an appreciation for the views held by other group members. To begin, all research participants are gathered together in a workshop setting. The research participants may be briefed on the research question and process individually before the workshop or collectively at the beginning of the workshop. As described above, the elements and constructs may be nominated either by the researcher or by the research participants. If the researcher nominates the elements and constructs, a brief discussion is held to ensure that all the research participants understand the meaning to be attributed to each element and construct. Then, the workshop continues to the process of relating the elements and constructs which is explained in the following subsection. If the research participants are going to be asked to nominate the elements, this process may be conducted either individually or as a group. If each individual is asked to nominate their own elements, the process to be followed is the same as that described above in the Nominate Elements subsection. If the elements are going to be nominated by the group, one step is necessary before proceeding to documenting and explaining the constructs. This step involves developing a group consensus about the elements to be employed.

Finally, laddering is a technique that facilitates the exploration of the meanings of labels that the research participant attributes to the constructs (Banister and Fransella 1980; Hinkle 1965; Rugg and McGeorge 1995; Reynolds and Gutman 1988). This process is employed when the research participant nominates the constructs and it allows the researcher to develop a better understanding of what the research participant means with their chosen words. Laddering facilitates the elicitation of hierarchical knowledge (Rugg et al. 2002). This relates directly to Kelly's (1955, 1963) *Organization Corollary* which states, "Each person characteristically evolves, for his convenience in anticipating events, a construction system embracing ordinal relationships between constructs." Thus, laddering may be employed to explore the meanings of labels attributed to constructs by a research participant. This exploration may be conducted upward as well as downward, and sideways, in the research participant's hierarchy of meanings.

Laddering upward elicits higher-level meanings. In general, the question posed is structured as "why." This question then attempts to elicit why a research participant has chosen a specific label for a construct. Here, again the research participant chooses the descriptors and the researcher attempts to understand what the research participant means by the descriptors. Research has shown that laddering upward approaches a discussion of a research participant's core beliefs and can very quickly "top out" (Rugg et al. 2002). The term "top out" means that the research participant cannot provide any further upward elucidation regarding the descriptors.

Laddering downward provides further detail about the meanings of labels attributed by the research participant. In general, these questions are structured as "what" or "how." The researcher probes for more detail in order to understand what the research participant means. As above, this probing finishes when the research participant "bottoms out" (Rugg et al. 2002) and can no longer provide further detail.

Sideways laddering may be employed to elicit examples the research participant might use to describe the meanings of labels, or to further explore the contrast of a construct.

1.3.4 Relate Elements and Constructs

In order to complete the RepGrid, the elements and constructs are linked. This linkage reflects the way in which the research participant discriminates the elements relative to the meanings they attribute to the constructs. There are three ways of creating the relationship.

The most basic method is dichotomizing, where the research participant is asked to associate each element with either the construct label of the contrast label. Usually, the research participant is instructed to use a check mark for the construct label and an "X" for the contrast label. While this method is the simplest, it does not allow for element variability along the continuum formed by the construct and its contrast.

The second method involves ranking the elements. Thus, the research participant places the elements in rank order along the construct–contrast continuum. If there are eight elements, the research participant assigns a value of 1 to the element judged to be closest to the construct; then 2 for the next closest element; and so on for the remainder of the elements. While ranking allows the research participant more leeway in discriminating the elements than dichotomizing, two issues remain. The research participant will be forced to differentiate elements which they may consider to be equal. The other issue relates to a forced allocation of elements along the construct–contrast continuum. That is, there may be instances when the research participant would prefer to group elements in one section of the continuum.

The third method, which resolves the above issues, involves rating the elements. This method allows the research participant the greatest freedom in relating the elements and constructs. Thus, along the construct–contrast continuum, the research participant may assign equality to any number of elements; or may group several elements within a section of the continuum. As with the ranking method, once the elements have been placed along the construct–contrast continuum, rating values are assigned to the elements. The rating scale to be employed should offer the research participant as much flexibility as possible. A heuristic for the rating scale which may be employed is, "the next largest odd number greater than the number of elements." Thus, if eight elements are involved, the minimum rating scale should be set at nine. First, this would allow the research participant the opportunity to assign a separate rating value to each element. Second, an odd-numbered rating scale provides a midpoint reference for the research participant along the construct–contrast continuum. This midpoint reference facilitates the research participant's decision-making process when determining element rating values.

1.3.5 Analysis

When the interview is completed, the documentation includes a matrix of element names; construct–contrast labels along with detailed notes resulting from laddering; and numbers (or dichotomous indicators) which relate the elements to the construct–contrast labels. Analysis of this rich and extensive data may proceed qualitatively or quantitatively. Usually, unique grids are analyzed qualitatively and common grids quantitatively. While this is not a strict guide, it relates to the value of the information to be garnered from the data. At the RepGrid level, unique grids do not produce much meaningful information across a number of RepGrids. There are ways, however, of comparing the data across grids qualitatively (Hunter 1997). It is possible to analyze common grids quantitatively because of the ability to directly relate elements and constructs at the RepGrid level. The remainder of this subsection describes how RepGrids and the accompanying data may be analyzed from a qualitative and quantitative perspective.

1.3.5.1 Qualitative

At the end of the interview, the researcher should request that the research participant confirm the RepGrid. This confirmation includes a review of the elements; the constructs and laddering comments; and the scores used to relate the elements to the constructs. Once this brief discussion is completed, one more confirmatory activity is conducted, which is referred to as "visual focusing" (Stewart and Stewart 1981). Recall that Stewart and Stewart (1981) suggested that when selecting elements, "anchors" should be employed which represent the extremes of the topic under investigation. For instance, Hunter (1993) used "ideal" and (currently practicing) "incompetent" concepts for systems analyst elements beyond a listing of specific individuals. So, when conducting visual focusing, the researcher will select the RepGrid column representing a real element which is closest to either anchor. What is identified is the element which, based upon the research participants personal experience, is the most positive or most negative in their interpretation. The researcher simply confirms with the research participant that element X represents the most positive and element Y represents the most negative.

Content analysis involves the identification of comments within narratives. Thus, the researcher will thoroughly review interview notes or transcripts in order to identify emerging themes. It is at this level that data gathered from the administration of unique grids may be compared.

Table 1.1 List of elements and constructs

Construct label	Element label
1. Friendly/unfriendly	1. Me as trainer
2. Competent/incompetent	2. Trainer who influenced me the most
3. Nonjudgmental/judgmental	3. Ideal trainer
4. Empowers others/dominates others	4. Trainer I don't admire
5. Genuine/false	
6. Like me/unlike me	

Table 1.2 Hypothetical RepGrid

	Elem 1	Elem 2	Elem 3	Elem 4
Con 1	5	4	4	2
Con 2	5	4	5	3
Con 3	4	5	5	2
Con 4	3	4	5	1
Con 5	4	3	4	2
Con 6	4	4	3	2

1.3.5.2 Quantitative

As mentioned earlier, the RepGrid technique provides a way of capturing aspects of an individual's construct system. The technique involves sorting a set of elements using a collection of constructs, using either a binary, ranking, or rating method. Rating of elements along constructs is the most commonly used approach in the Personal Construct Psychology (PCP) literature, and results in a two-way matrix of data.

Traditionally, there are two commonly used methods of representing the relationships between elements and constructs in a RepGrid (Caputi et al. 2011). Kelly (1955) described a nonparametric factor analysis method in *The Psychology of Personal Constructs*. However, component-based representations did not become popular until in the 1960s, and in particular, Slater's (1964) work presented in *The principal components of a repertory grid*. Slater used singular value decomposition to provide a joint representation of elements and constructs of a grid. Loadings can be determined for the rows (constructs) and columns (elements) of a RepGrid. These loadings can then be used to derive individual or joint spatial maps of elements and constructs. Multidimensional scaling can also be applied to RepGrid data to obtain a joint representation of constructs and elements.

Cluster analysis represents the second common method of analyzing RepGrid data. It can be used to identify similar groupings of elements or constructs. These groupings or clusters can be represented in a dendrogram.

To illustrate these two methods, consider the following hypothetical RepGrid, which is a modified version of an example presented in Bell's (2009) GRIDSTAT package. The scenario is that an IS trainer is asked to complete a grid using four supplied elements and six supplied constructs (see Table 1.1). A five-point scale is used to rate elements on constructs. The Repgrid is presented in Table 1.2.

Table 1.3 Results of GRIDSTAT analysis

Elements	Point	Singular Value Decomposition Loadings 1	2	3
Me as trainer	a	0.90	0.02	0.45
Trainer who influenc	b	-0.41	-0.86	-0.16
Ideal trainer	c	-0.81	0.66	0.02
Trainer I dont admir	d	0.69	0.25	-0.66

Constructs	Point	Singular Value Decomposition Loadings 1	2	3
friendly/unfriendly	A	0.48	-0.18	0.57
competent/incompeten	B	0.42	0.55	-0.38
nonjudgemental/judge	C	-0.52	-0.35	-0.32
empowers others/domi	D	-1.08	0.13	0.23
genuine/false	E	0.25	0.50	0.14
like me/unlike me	F	0.44	-0.72	-0.14

```
Dimension  2 is Horizontal, Dimension  3 is Vertical
          +-------------------------------+-------------------------------+
  0.6 +                            A                                     +
      |                                                                  |
  0.4 +                                    a                             +
      |                                                                  |
  0.3 +                                                                  +
      |                                                                  |
  0.2 +                                        D                         +
      |                                                       E          |
  0.1 +                                                                  +
      |                                                                 c|
  0.0 +                                                                  +
      |                                                                  |
 -0.2 +b      F                                                          +
      |                                                                  |
 -0.3 +                                                                  +
      |                    C                                             |
 -0.4 +                                                          B       +
      |                                                                  |
 -0.5 +                                                                  +
      |                                                                  |
 -0.7 +                                            d                     +
      ++-----+-----+-----+-----+-----+-----+-----+-----+-----+-----++
     -0.9  -0.7  -0.6  -0.4  -0.3  -0.1   0.1   0.2   0.4   0.5   0.7
```

The data in Table 1.3 were analyzed using GRIDSTAT (Bell 2009). The clustering dendrograms for constructs and elements are presented in Figs. 1.1 and 1.2, respectively. Clusters were based on city-block distances using Ward's Method.

The dendrogram for constructs suggests two clusters. The first cluster is comprised of "genuine/false", "like me/unlike me", and "friendly/unfriendly." The remaining three constructs make up the second cluster.

The dendrogram for the elements suggests one cluster (comprising "trainer who influenced me the most", "Ideal trainer", and "Me as trainer"), and a singleton element, "Trainer I admire."

The singular value decomposition of the hypothetical RepGrid using GRIDSTAT is presented below. A joint representation of elements and constructs based on dimensions 2 and 3 is also presented. The joint spatial map allows us to examine how elements and constructs are related to each other. For instance, "trainer who influenced me the most" is related to the construct "like me/unlike me."

```
genuine/false       .+-----+
 like me/unlike me   .+     |----------------------------------------+
 friendly/unfriendly .------+                                        |
 nonjudgemental/judge.----------------+-----------+                  |
 empowers others/domi.----------------+           +------------------+
 competent/incompeten.----------------------------+-
```

Fig. 1.1 Clustering dendrogram for constructs

```
trainer who influenc.+---------+
 Ideal trainer      .+          |-------------------------------------+
 me as trainer      .-----------+                                     |
 Trainer I don tadmir.------------------------------------------------+
```

Fig. 1.2 Clustering dendrogram for elements

1.4 Examples

The following section includes the description of two examples of the use of RepGrids in IS research. The first example relates to investigations about the skills of "excellent" systems analysts and involves a series of projects conducted in Canada and Singapore. The second example involves an investigation of the skills of successful project managers.

1.4.1 Example One: Systems Analysts

In a series of projects, Hunter and colleagues employed the RepGrid technique to investigate the skills of "excellent" systems analysts. Initially, Hunter (1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999) conducted investigations in Canada. Subsequent research was carried out with replications in Singapore and again in Canada (Hunter and Beck 1996a, b, 2000). Further, a series of overview publications with a focus on RepGrids reports on these earlier investigations (Tan and Hunter 2002, 2004, 2005).

1.4.1.1 Research Objective

Hunter's initial objective was to determine the skills of "excellent" systems analysts in Canada. The term "excellent" is in quotes to signify the objective to have the research participants determine what "excellent" means to them. A subsequent Singapore replication allowed the determination of cross-cultural aspects. Within each company at each location, research participants were allocated to one of five audiences. Figure 1.3 describes each audience.

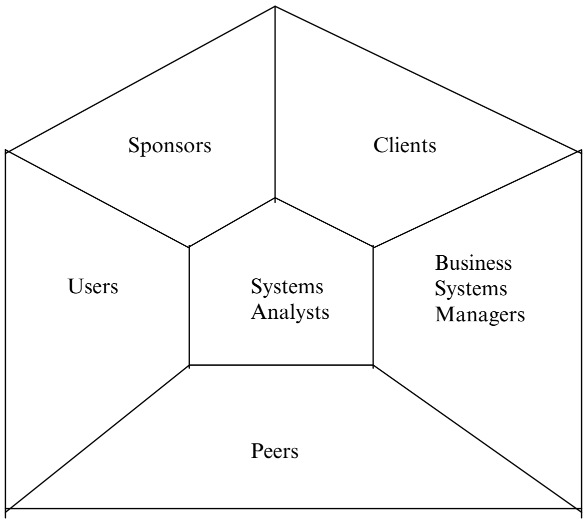

Fig. 1.3 Systems analysts audiences. **Peers:** Those individuals who perform the same or similar function as "Systems Analysts" within the organization. **Business Systems Managers:** Those individuals responsible for the administration of the corporate unit to which the functions of "Systems Analysts" is assigned. **Users:** Those individuals who interact directly with the information system as developed or maintained by "Systems Analysts." **Sponsors:** Those individuals whose corporate budget includes the development or maintenance cost of the information system, or who are responsible administratively for the Users, but do not interact directly with the information system. **Clients:** Those individuals who interact directly with the information system, and whose corporate budget includes the development and maintenance cost of the information system, but who are not responsible administratively for users

1.4.1.2 Elements

Each research participant was asked to identify six systems analysts with whom they had sufficient experience to be able to form an opinion about their performance. Because each research participant nominated their own list of systems analysts, the result was the construction of a unique grid. Also, anchors of "ideal" and "incompetent" were added as concepts to the element list creating a total of eight elements.

1.4.1.3 Constructs

The elicitation process employed the triadic method. The research participant was presented with three elements randomly chosen from their nominated elements list and asked, "… with regards to the skills of an "excellent" systems analyst, how are two the same yet different from the third?" The responses to this question were structured as dichotomous construct–contrast with the positive (decided by the research participant) as the construct label and the negative (again, decided by the research participant) as the contrast label. Laddering produced interview notes

AUDIENCE: Systems Analysts PARTICIPANT: Name

CONSTRUCTS	ELEMENTS 1	2	3	4	5	6	7	8
1. Delegator - Does Work Himself	7	2	5	4	2	6	1	9
2. Informs Everyone - Keeps to Himself	8	2	3	3	8	6	1	9
3. Good User Rapport - No User Rapport	5	2	4	2	4	2	1	9
4. Regular Feedback - Inappropriate Feedback	6	1	5	3	5	3	1	9
5. Knows Detail - Confused	2	1	4	3	5	1	1	9
6. Estimates Based on Staff - Estimates based on Himself	8	3	4	6	4	6	1	9
7. User Involvement - Lack of User Involvement	6	2	5	5	3	3	1	9

Fig. 1.4 RepGrid

resulting from the research participant's further elaboration of the meanings they attributed to the construct–contrast labels. Once the construct–contrast labels were thoroughly discussed, all eight elements were given to the research participant and placed along the continuum represented by the construct–contrast. Then the research participant was asked to rate each element. A nine-point rating scale was employed with 1 representing the construct and 9 the contrast. The elicitation was repeated until the research participant could offer no further meaningful constructs. A completed RepGrid is included in Fig. 1.4.

At the end of the interview, visual focusing was employed as a form of confirmation. Invariably, the "ideal" concept was assigned 1 and the "incompetent" a 9. Further, the element with the closest column numbers across all the elicited constructs was judged by the research participant to represent their interpretation of the systems analysts closest to "ideal"; and conversely for "incompetent."

1.4.1.4 Analysis

Content analysis was employed to review the extensive data obtained in the laddering process. Emerging themes were identified within each interview and then across all of the interviews.

1.4.1.5 Findings

Overall, universal themes emerged, such as: communication, attitude, knowledge, investigation, and experience. However, "local" interpretations of the level of importance of these themes also emerged. For instance, when Users, Sponsors, and Clients were grouped together as Business Professionals, the emphasis related to content such as knowledge. However, the IS Professional group of Systems Analysts and Business Systems Managers emphasized more on process, such as investigation.

The replication in Singapore suggested the emergence of an occupational community which transcends cultural boundaries. There was a commonality of emerging themes across the cultures. This suggests the emergence of an international occupational community. There was, however, a difference in how the role may be performed. In summary, the Singapore systems analyst would tend to rely more on expertise to dominate the direction of a project. However, the Canadian systems analyst would act more as a coach encouraging participation throughout the project.

1.4.1.6 Contribution

The research participants determined their own list of elements and also were able to decide upon their own constructs, as well as indicate their interpretation of the elicited constructs. This research employed elements representing systems analysts who were known by the research participant. Thus, it was possible to offer the research participant the fullest amount of freedom to comment on the topic, yet also maintain a structured method for gathering data. The emergence of the general commonality and the divergent specificity was made possible through the use of the RepGrid.

1.4.2 Example Two: Project Managers

Using the RepGrid technique, Napier et al. (2009) interviewed practicing information technology (IT) project managers (PMs) in order to identify skills that successful IT PMs demonstrate as well as to explore any distinct skill patterns that represent archetypes of successful IT PMs.

1.4.2.1 Research Objective

The objective of this research was to elicit the insights of IT PMs concerning successful project management practice. To that end, the authors first identified relevant emerging skill categories which characterized the ideal IT PM. Individual RepGrids were then analyzed to form IT PM archetypes that describe the combinations of these skill categories that are associated with successful project management practices. The study's research questions were:

1. What do IT PMs construe as skills necessary for successful project management practice?
2. How do IT PMs group these skills to reflect successful project management practice?

1.4.2.2 Elements

Nineteen practicing IT PMs were interviewed. Each IT PM was asked to name six IT PMs they had interacted with in the current or a previous organization – both successful as well as unsuccessful ones. Two additional elements were also added as anchors, one labeled "Ideal", the other "Incompetent" – giving eight elements in total.

1.4.2.3 Constructs

The minimum context elicitation method (Tan and Hunter 2002) was employed. This involved a triadic elicitation process, where each research participant was asked to randomly select three elements from the eight identified earlier (six named IT PMs + the Ideal and the Incompetent) and was then asked the question: "With regard to the skills of successful IT Project Managers, how are two of these PMs the same and yet different from the third?" To clarify the meaning of the elicited construct, the study used the laddering technique. The research participant was then asked to provide a brief label that best described the construct and its contrast (bipolar). These labels and their underlying meanings were uncovered during the laddering process and placed on the RepGrid (see Fig. 1.5).

The research participant then placed the three elements with the rest and the exercise was repeated. The process of selecting triads and eliciting constructs and their underlying meaning continued until either no further new constructs were identified or they became noticeably tired. The research participants selected between 5 and 8 triads each. At the end of each interview, the research participants ranked the identified skills according to their importance to successful IT project management.

Ideal IT PM		Rank	Incompetent IT PM	
Construct	*Ladder*		*Construct*	*Ladder*
Theoretical understanding of PM	Knows tools to use on projects. Understands steps and mechanics of PM.	3	Not as theory based	Projects not as tightly controlled. Doesn't follow set process.
Level-headed and calm	Better flow of communication.	2	Angry & emotional	Communication stops when you get emotional.
General knowledge of PM	Knows how to manage relationships.	6	Lacks PM knowledge	Didn't understand how to do a project plan.
Willing to change approach	Doesn't compromise over objectives. Manages stakeholders.	5	Lacks flexibility	Set in their ways.
Executive presence	Ability to read environment and match it	1	Excessive levity	Not serious enough when required.
Motivating others	Knows how to drive people. Knows when to balance being hard and soft.	4	Not motivating	

Fig. 1.5 Meanings of elicited constructs

1.4.2.4 Analysis

The interviews yielded 19 RepGrids with 147 elicited raw constructs. Raw constructs that had the same underlying meaning were consolidated into the same unique construct. This resulted in 46 unique constructs or skills.

To answer the first research question, content analysis was used to create thematic categories from the constructs elicited from the IT PMs (Neuendorf 2002; Krippendorff 1980). The inductive and iterative process for content analysis of RepGrids outlined by Jankowicz (2004) involving the identification of the categories and allocation of constructs to them, the establishment of the reliability of the category system, and summarization of the categories, was followed. Based on the judgments of two authors, their knowledge of project management concepts, and familiarity with the interview data, the 46 unique constructs were sorted into groups on the basis of the similarities among the skills. The resulting nine categories were then named and defined. Internal and external plausibility of the category system (Guba 1978; Patton 1990, p. 404) as well as its usefulness were evaluated to establish the study's reliability. An internal plausibility check (i.e., the relatedness of the unique constructs making up each category) was achieved by the third author independently verifying that the categories made conceptual sense and suggested changes where needed. As the study's categories included all IT PM skills previously identified in the literature (El-Sabaa 2001; Jiang et al. 1998), external plausibility (i.e., extent to which the categories represent a relevant body of IT PM skills) was demonstrated.

To answer the second research question, clustering was used to examine patterns of skills that were deemed to be important across research participants' individual

RepGrids resulting in four archetypes of successful IT project management practice. This involved including the nine skill categories as rows and each of the 19 IT PM research participants as columns in a table. 0s and 1s were used with 1 indicating that the IT PM's elicited constructs had included that skill category and a 0 indicating otherwise. Research participants who listed the same skill categories were grouped together. Using this process, the 19 RepGrids were grouped into the four IT PM archetypes.

1.4.2.5 Findings

From the 19 RepGrids and 147 raw constructs, 46 unique constructs and nine skill categories emerged – client management, personal integrity, communication, planning and control, general management, leadership, systems development, problem solving, and team development. The study also described four different ways in which practicing IT PMs coalesce these categories to form skill archetypes of effective IT PMs – general manager, problem solver, client representative, and balanced manager.

1.4.2.6 Contribution

While this study contributed significantly to the understanding of the skills associated with successful IT PMs by confirming the importance of many skills identified in the literature (e.g., communication, general management, leadership, planning and control, and systems development), it also provided a richer understanding of some skills that were previously narrowly defined (e.g., client management, planning and control, and problem solving). The study highlighted two other skill categories not discussed at all in the prior IT PM skills research: team development and personal integrity. The four archetypes represented the required combination of skills associated with successful IT PMs as construed by the study's practitioner participants and symbolized a portfolio of skills that an IT PM could possess. These findings have laid a strong foundation for future research into IT PM skills and the relationship between those skills and IT PM effectiveness.

1.5 Conclusions

The Theory of Personal Constructs (Kelly 1955, 1963, 1970) is based upon the assumption that individuals develop a means of interpreting, predicting, and thus, responding to their environment. Kelly has suggested that individuals act as scientists by analyzing their past experiences and attempting to interpret specific current or anticipated situations. In order to study individual Personal Construct Systems, Kelly devised the Role Construct Repertory Test, which is more commonly referred to as the RepGrid.

Stewart and Stewart suggest, “At its simplest, Grids provide a way of doing research into problems – almost any problems – in a more precise, less biased, way than any other research method.” (Stewart and Stewart 1981, p. vii). These authors also suggest the RepGrid technique, “… enables one to interview someone in detail, extracting a good deal of information … and to do this in such a way that the input from the observer is reduced to zero.” (Stewart and Stewart 1981, p. 5). Further, Pervin states, “There have been studies of the reliability of the Rep Test and the evidence to date suggests that the responses of individuals to the role title list and constructs used are reasonably stable over time.” (Pervin 1989, p. 271). Thus, RepGrids have proven to be a reliable data-gathering technique. They have been used to investigate general or specific problem construction and market research (e.g., Bannister and Mair 1968; Corsini and Marsella 1983; Eden and Jones 1984; Eden and Wheaton 1980; Fransella 1981; Shaw 1980). RepGrids have also been employed to investigate various aspects of knowledge acquisition in relation to the development of expert systems (Botten et. al. 1989; Latta and Swigger 1992; Phythian and King 1992).

RepGrids bring structure to an interview while allowing flexibility and reducing researcher bias. As suggested by Pervin, “One of the remarkable features of the Rep Test is its tremendous flexibility. By varying the role titles or instructions, one can determine a whole range of constructs and meanings.” (Pervin 1989, p. 246). When developing unique RepGrids, the research participants determine their own list of elements and are also able to decide upon the label for their personal constructs, and to elaborate upon their interpretation of the construct. Thus, it is possible to allow the research participant the fullest amount of freedom while still maintaining a structured method for gathering qualitative data.

The construct elicitation process should randomly consider triadic elements to elicit dichotomous constructs. The elaboration of the research participants’ interpretations may be obtained via the technique of Laddering (Stewart and Stewart 1981) whereby the researcher probes for more detail regarding a research participant’s interpretations of a general comment. The technique incorporates a series of “how” questions to elicit more detail and to increase the researcher’s understanding of the terms employed by the research participant to elaborate upon a construct. The subsequent application of the process of laddering will allow the researcher to probe further into the research participant’s interpretation of the elicited construct.

Finally, the RepGrid technique may be employed in many domains. Thus, it is important to consider the research objectives in relation to both element selection and construct elicitation. Element selection relates to identifying the entities, which will ground the domain of discourse for each research participant. The research participants should have sufficient experience within the domain of discourse to be able to enunciate and elaborate upon their chosen elements. Further, each selected element must be unique so that the research participant will be able to compare and contrast mutually exclusive entities. Depending upon the research objectives, element categories seem to be limited only by the researcher’s creativity. The researcher should determine the element categories in concert with the objectives of the project. The specific entities will be contingent upon the research participant's experience within the domain of discourse.

1.6 Appendix A

Personal Construct Theory

Fundamental Postulate: A person's processes are psychologically channelized by the ways in which he anticipates events.
Construction Corollary: A person anticipates events by construing their replications.
Dichotomy Corollary: A person's construction system is composed of a finite number of dichotomous constructs.
Individuality Corollary: Persons differ from each other in their construction of events.
Organization Corollary: Each person characteristically evolves, for his convenience in anticipating events, a construction system embracing ordinal relationships between constructs.
Choice Corollary: A person chooses for himself that alternative in a dichotomized construct through which he anticipates the greater possibility for extension and definition of his system.
Range Corollary: A construct is convenient for the anticipation of a finite range of events only.
Experience Corollary: A person's construction system varies as he successively construes the replications of events.
Modulation Corollary: The variation in a person's construction system is limited by the permeability of the constructs within whose ranges of convenience the variants lies.
Fragmentation Corollary: A person may successively employ a variety of construction subsystems which are inferentially incompatible with each other.
Commonality Corollary: To the extent that one person employs a construction of experience which is similar to that employed by another, his psychological processes are similar to those of the other person.
Sociality Corollary: To the extent that one person construes the construction processes of another, he may play a role in a social process involving the other person.

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Chapter 2
Psychological Ownership and the Individual Appropriation of Technology

James Gaskin and Kalle Lyytinen

Abstract We use information technology to accomplish a significant portion of our daily tasks. The way individuals choose to use technology varies as much as the outcomes of their usage. Appropriation – the way that people choose or learn to use technology – has been explored at a group level to explain group behaviors and performance. Although appropriation antecedents and outcomes have been investigated in many studies, none has attempted to explain the motivations or factors influencing the *individual* appropriation of technology; nor has extant research discovered the impacts resulting from individual appropriation. In this exploratory chapter, we inquire within this gap by arguing that appropriation and psychological ownership are theoretically equivalent. This new theoretical connection suggests potentially significant antecedents for individual appropriation, which have been overlooked. The desirable consequences of psychological ownership (e.g., competency, security, satisfaction) are proposed to apply to the individual appropriation of technology.

Keywords Psychological ownership • IT Appropriation • Possession • Technology-use

Abbreviations

IS Information systems
IT Information technology

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2.1 Introduction

Research on technology usage to date has largely focused on technology acceptance (e.g., Agarwal et al. 1997; Braun 1998; Davis et al. 1989; Deci 1971; DeLone and McLean 2003; Venkatesh et al. 2003). Variations on the technology acceptance model (i.e., TAM, TAM II, and UTAUT) are primarily concerned with getting people to adopt new technology. "Computer systems cannot improve organizational performance if they aren't used. Unfortunately, resistance to end-user systems by managers and professionals is a widespread problem. To better predict, explain, and increase user acceptance, we need to better understand why people accept or reject computers" (Davis et al. 1989, p. 982).

Twenty years ago, the use of information technology (IT) in business environments was still in a formative period. Thus, the focus on increasing general acceptance of IT was understandable and valuable. But, in the technology-rich environments of today, this issue is largely passé – managers and knowledge workers *must* use technology in order to conduct their daily business. Nearly every business professional of today has, willingly or not, adopted IT. We contend that the locus of study now should not be whether they adopt technology, but *how they use it* to get the job done. Accordingly, in this chapter we formulate a model for the individual appropriation of technology.

The appropriation of technology has been a notable area of research in information systems (IS), but this discourse has almost exclusively been at a group or organizational level (e.g., DeSanctis and Poole 1994; Orlikowski 1992). Furthermore, studies interested in factors affecting appropriation have focused on external influences rather than internal influences (e.g., Majchrzak et al. 2000). Though external influences such as institutional structures, social norms, and task context (DeSanctis and Poole 1994) clearly have an influence on an individual's appropriation behaviors, internal influences, such as desire for control and pleasure, must also play a role – and possibly a greater role, because individuals use many IT tools voluntarily and they expand their use based on intrinsic motivations. Thus, group-level appropriation studies need to be supplemented with studies focusing on individual behaviors, if we want to truly understand the effective use of IT at an individual level. Likewise, individual-level impacts resulting from appropriation remain unexplored in the literature. However, individual-level impacts resulting from technology usage (such as job satisfaction, competency, and commitment) have been shown to have positive effects on performance (Judge et al. 2001), and thus, ought to be analyzed.

In this chapter we adopt psychological ownership as a framework for studying the individual appropriation of technology. Psychological ownership refers to feelings of possession towards a target object (Pierce et al. 2003). It is a sense of "mine." Similarly, appropriation is the extent to which users "take possession" of a technology by making it their own (Carroll 2004). Users take possession of technology by using it in ways that best suit their needs; using some features, neglecting others, and even creating new uses unintended by the designers (Orlikowski 2000). Psychological ownership and appropriation are both interested in what motivates possession and what the consequences of the possession are. Thus, in this chapter we make a new theoretical connection between these two concepts.

Research on the antecedents and consequences of the *individual* appropriation of technology has been surprisingly lacking. No theoretical explanations have been offered to explain the motivations and consequences of the appropriation of technology at the individual level. Thus, the research questions we are pursuing are whether there is a theoretical model that helps explain the motivations and consequences of the individual appropriation of technology, what internal factors affect the *individual* appropriation of technology, and what individual impacts may result from the individual appropriation of technology.

We propose that the individual appropriation of technology has its foundation in the theory of psychological ownership. The next section of this chapter examines the theory of psychological ownership as well as related theories on possession. This is followed by a review of the concept appropriation and its uses in the literature. The antecedents and consequences of psychological ownership are then applied to the individual appropriation of technology. Gaps in the research are pointed out and recommendations for future research are offered.

2.2 Literature Review

This section discusses and reviews theories and literature related to psychological ownership and possession as well as extent research on appropriation.

2.2.1 Possession and Ownership

Theories on ownership and possession originate from research in psychology (Beggan and Brown 1994; Dittmar 1992; Furby 1978; Furby 1980; Kline and France 1899; Rudmin and Berry 1987), marketing (Barone et al. 1999; Belk 1988; Farquhar 2000; Kirmani et al. 1999), and management (Druskat and Kubzansky 1995; Pierce et al. 1991; Vandewalle et al. 1995). Our study is interested mainly in the psychological stream to help understand motivations for ownership, and the management stream to help understand the possible consequences of ownership on individual behaviors in a management context. Marketing research on ownership and possession mainly focuses on brand loyalty, which is not within the scope of our interest.

There are various reasons for acquiring, obtaining possession, or seeking to own something. Furby(1978) – a seminal piece on possession (Van Dyne and Pierce 2004) – conducted open-ended interviews with 270 culturally diverse individuals of varying socioeconomic status, and aged from kindergartners to 50-year-olds, for the purpose of understanding motivations for possessive behavior. A careful content analysis extracted consistent reasons for possessive behavior resulting in 29 main reasons. The two most common reasons unaffected by any demographic factor included “(a) to make possible certain activities … convenience, or enjoyment … and (b) positive affect for the object. Both of these factors were major reasons given at all age levels for why people have personal possessions” (Furby 1978, p. 59).

So what does this tell us about people’s motivation for possession or acquisition? (We use acquisition to refer to the act of gaining possession, which results in ownership). Possessions “make possible certain activities and pleasures … they enable one to affect desired outcomes in one’s environment” (Furby 1978, p. 60). In other words, an individual is motivated to take possession of something because he feels that by taking possession he will be more able, or in a better position, to bring about more desirable results and more pleasurable outcomes within the contextual scope of the acquired object. For example, if I acquire a car, I am in a better position to go on dates – and this would likely lead to a “more pleasurable outcome” than if I had no car.

Another reason for possession that was shared among all groups of Furby’s study, except the kindergartners, was a desire for control. By owning an object one obtains control over its usage. The work done be Deci and others (Deci 1971, 1972, 1975; Deci and Ryan 1985; Zuckerman et al. 1978) agrees that “human beings are motivated to affect and control their environment” (Furby 1978, p. 60). This is evident to anyone who has temporarily lodged at another’s residence. The transient lodger who does not “own” the residence feels much less in control of the goings-on in the residence and acts primarily as an observer of all the happenings there. From a more technical perspective, if I acquire a smart phone I enjoy more autonomy over my communications and am less limited by location.

For high school students and adults, “liking an object becomes a logical prerequisite to acquiring it” (Furby 1978, p. 60). Liking, or perceived enjoyment and satisfaction, is a logical antecedent to acquisition. The more you like something the more you want to have it. The study also found possession to be satisfying. Thus, once you acquire something, it is satisfying to own it (see also Pierce et al. 2003).

It is interesting to note that there are two consequences of possession that were peculiar to high-schoolers and adults: “(a) possessions enhance social power and status, and (b) possessions help define individuality and are extensions of the individual” (Furby 1978, p. 61). Naturally, as one feels more of a sense of power through acquisition, and in a better position to influence his circumstances, he feels an enhancement of social power, or an increasing ability to influence social circumstances and outcomes. Furthermore, as early as the late nineteenth century, psychology research has argued that man feels that he is the sum and total of what he owns (James 1890). Thus, possessions become an extension of man (Pierce et al. 2003). Lastly, high-schoolers and adults report that “possessions provide security” (Furby 1978, p. 61). One who owns a home and a car may feel much more secure than one who has neither. In a more abstract sense, one who “owns” his career, through accepting responsibilities and successfully performing work tasks, may feel more secure than one who does not “own” his career.

Along these lines of psychological ownership (like “owning” your career), Vandewalle et al. (1995) did a study of 797 individuals to see what the consequences are of this abstracted ownership. Psychological ownership was found to be positively related to extra-role behavior. Extra-role behavior is “discretionary behavior that is not formally rewarded by the organization" (Vandewalle et al. 1995, p. 212). It is taking on extra responsibilities and spending extra time beyond what is expected, during one's discretionary time, in order to contribute more to the organization (Katz and Kahn 1978; Van Dyne et al. 1995). Vandewalle et al. (1995) report that "those with higher levels of psychological ownership were more likely to engage in extra-role behavior that benefits the organization" (Vandewalle et al. 1995, p. 219). They also found that psychological ownership was significantly related to job satisfaction and commitment to the organization. These results were also confirmed by a study published in 2004 by Van Dyne and Pierce.

Other research has also connected extra-role behavior of possession to performance (George 1991; Van Dyne and Pierce 2004). "Thus, it is possible to speculate that psychological ownership makes a difference because psychological ownership leads to organizational commitment; committed workers engage in extra-role behavior; and extra-role behavior contributes to higher performance" (Vandewalle et al. 1995, p. 221). Van Dyne and Pierce (2004) also confirmed these results and added to them organization-based self-esteem and organizational citizenship. White (1959) also found efficacy and competence to be related to a sense of psychological ownership.

In summary, the extant literature on ownership and possession indicates that the antecedents of psychological ownership include: desire for autonomy or control, desire for pleasure, desire for security enjoyment expectation, and satisfaction expectation. The indicated consequences of psychological ownership include: satisfaction, control, social power and status, self-identity, security, extra-role behavior (productive use of discretionary time), job satisfaction, commitment to organization, organizational self-esteem, organizational citizenship, efficacy, and competence.

Closely related to the concept of psychological ownership is the concept of appropriation – both are interested in the behavior of acquiring. In the next section we define appropriation in the context of information systems and provide a review of the literature discussing appropriation in the IS arena.

2.2.2 Appropriation

In the IS context appropriation has been defined as "the way that users 'take possession' of a technology innovation over time" (Carroll 2004, p. 2), "the extent to which an innovation is changed during its adoption and implementation" (Beaudry and Pinsonneault 2005, p. 497), and "completing design through use" (Fidock and Carroll 2006, p. 3). Orlikowski uses the concept of appropriation in many of her studies (Orlikowski 1992, 1999, 2000; Orlikowski and Robey 1991). "While users can and do use technologies as they were designed, they also can and do circumvent inscribed ways of using the technologies – either ignoring certain properties of the technology, working around them, or inventing new ones that may go beyond or even contradict designers' expectations and inscriptions" (Orlikowski 2000, p. 407). Likewise Poole and DeSanctis characterized how groups exhibit appropriation behaviors during the adoption of group support systems (DeSanctis and Poole 1994; Poole and DeSanctis 1989): “Appropriations are not automatically determined by technology designs. Rather, people actively select how technology structures are used, and adoption practices vary. Groups actively choose structural features from among a large set of potentials” (DeSanctis and Poole 1994, p. 129).

The common theme among these several definitions and uses of appropriation seems to be the concept of ownership. A user “takes possession” of a technology by choosing which features to use and “actively selecting how technology structures are used.” Users “own” the technology by deciding how they will use it. Their use of the technology then becomes part of their identity, or the way they work. When users appropriate features of a technology they take responsibility for the way the technology is used – effectively removing that responsibility from the designers; thus, appropriation is “completing design through use” because there has been a transfer of ownership from the designers to the users. This type of use would tend to increase one’s competence and familiarity with a technology.

Appropriation has been primarily investigated at the group level. Two prominent examples of this are adaptive structuration theory (AST) (DeSanctis and Poole 1994) and technology adaptation (Majchrzak et al. 2000). Leveraging structuration theory (Giddens 1986) and the concept of appropriation, AST is a framework for studying variations in group work behaviors that occur whilst technologies are used. AST studies appropriation at an organizational level and explains (1) what affects appropriation and (2) what appropriation affects including, for example, decision processes. The way technology is used depends on the features and “spirit” of the technology (spirit is the “general intent” of the technology), the organization and intergroup contexts, and the evolution of use of the technology (e.g., learning and adapting) (DeSanctis and Poole 1994). New structures for use emerge as the technology is used. Group decisions and outcomes depend on the appropriations made. Given ideal combinations of structures and use, desirable outcomes will result (efficiency, quality, etc.). Individual factors effecting appropriation and the individual impacts of appropriation are not within the scope of AST, as the focus of AST is on group behavior rather than on individual behavior.

Majchrzak et al. (2000)’s model for technology adaptation is based on AST and they add to it elements from other literature: misalignment (Leonard-Barton 1988), malleability (Johnson and Rice 1987), and occurrence of discrepant events (Tyre and Orlikowski 1994). Technology adaptation proposes that discrepant events trigger appropriating behaviors in order to make decisions that will lead to positive outcomes, while preexisting structures (from AST) are changed and added to by emergent structures that come from appropriations. Malleability, or the adaptability afforded by the level of structural rigidness, moderates an organization’s opportunity to appropriate. The goal of technology adaptation is to demonstrate why appropriation occurs and what the consequences are at the level of the organization; therefore, no considerations were made for technology appropriation at the individual level.

In order to measure the individual appropriation of technology, we must discover its antecedents and expected outcomes. Though a model of technology appropriation

(MTA) has been suggested (Carroll 2004), no hypotheses or propositions accompany this model. The follow up to this model was recently presented by Fidock and Carroll (2006), though no scales for the appropriation of technology are suggested. In summary, appropriation is the psychological ownership of technology – the choosing of which features to use and how to use them – effectively taking responsibility for the way a technology is used. This concept of appropriation has been investigated primarily at a group level in studies such as DeSanctis and Poole's AST (DeSanctis and Poole 1994) and Majchrzak et al.'s technology adaptation (Majchrzak et al. 2000). This focus on group-level appropriation has left uninvestigated the individual factors affecting appropriation and the individual impacts of appropriation. In the discussion that follows we offer our support for applying the antecedents and consequences of psychological ownership to the individual appropriation of technology.

2.3 Discussion

Appropriation is about "taking possession" (Carroll 2004, p. 2) of a technology or "making it your own." We propose that appropriation and psychological ownership are theoretically equivalent at the individual level. From the literature we observed that psychological ownership affects performance and individual impacts and is motivated primarily by internal factors (e.g., desires for control, autonomy, pleasure, satisfaction, and security) (Furby 1978). However, IS research has overlooked internal factors as antecedents – rather favoring external factors to explain appropriation behaviors – due to the tendency to investigate appropriation at the group level where internal (to the individual) factors may be of less consequence. This myopic focus on the external may in fact be leaving out potentially more powerful antecedents of appropriation. In addition, in the light of long-standing research showing that *individual* impacts (like job satisfaction) have positive effects on performance gains (see Judge et al. 2001, for an exhaustive list of job satisfaction → job performance studies), research on appropriation cannot afford to overlook the important role of the individual in technology appropriations. In this section we briefly discuss each antecedent and consequence of psychological ownership and its potential relevance and application to the individual appropriation of technology. See Fig. 2.1.

2.3.1 Antecedents

The literature on psychological ownership reveals five main antecedents: desire for autonomy or control (Deci and Ryan 1985; Furby 1978), desire for pleasure (Furby 1978), desire for security (Furby 1978), enjoyment expectation (Furby 1978), and satisfaction expectation (Furby 1978; Pierce et al. 2003). Similarly, we expect each of these constructs to positively affect the individual appropriation of technology.

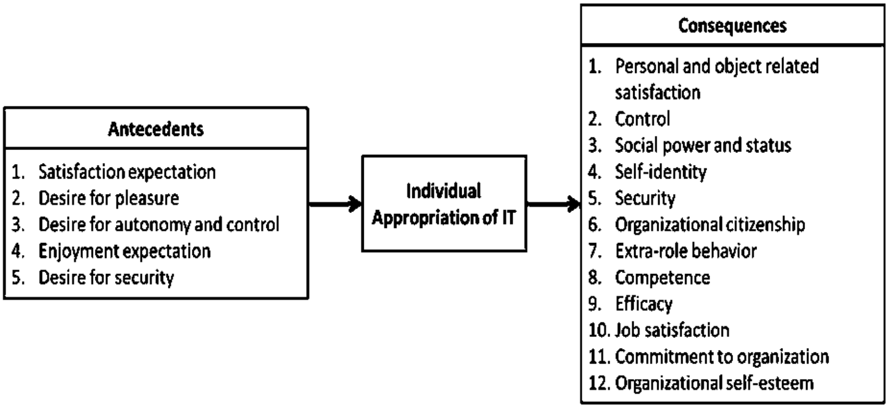

Fig. 2.1 Proposed antecedents and consequences of individual appropriation based on antecedents and consequences of psychological ownership

In other words, we propose that each of these constructs helps to explain why individuals appropriate technology.

A *desire for autonomy or control* (Deci and Ryan 1985; Furby 1978) over a technology and a task may induce an individual to engage in appropriation. For example, when an individual is not familiar with a technology, he may feel unable to control, with consistency, the outcomes of his use. His autonomy, with regards to the technology, may be lacking in that he may be unable to accomplish his will or intentions when using the technology. This would tend to increase his desire to gain control and autonomy (Deci 1971, 1972, 1975; Deci and Ryan 1985) through exploration of the technological features and appropriation of those features. This exploration of features would increase his awareness of the technological capabilities, facilitating his greater control over the technology.

A *desire for pleasure* (Furby 1978) when using a technology, or the ability to affect more pleasurable outcomes, may induce an individual to engage in appropriation. It is frustrating to feel like you cannot influence the outcomes of your use of a technology. A user may feel that if he can only gain some mastery over the technology he would enjoy using the technology more and be able to feel better about the tasks he accomplishes with the technology (Blythe et al. 2004; Dreyfus et al. 1986). Similarly, a technology may be inherently fun to use or may enable pleasure (such as a new cell phone, or gaming device) (van der Heijden 2004). Thus, appropriating the technology may satisfy that desire for pleasure (Ke et al. 2008).

A *desire for security* (Furby 1978) may induce an individual to engage in appropriation. Having not become familiar with the technology he is supposed to use to accomplish his work, he may feel insecure regarding his ability to perform and deliver. This insecurity will lead him to explore and appropriate features of the technology in order to feel more secure in his work.

An *expectation of enjoyment* (Furby 1978) when using a technology may induce an individual to engage in appropriation. One may explore and appropriate features of a technology in order to achieve a level of competence that will result in more enjoyable use. It is much more enjoyable to use a technology competently than incompetently. This competence may only come after a user has engaged in appropriation – familiarizing himself with the technology features, choosing which features to use and for what purposes to use them.

An *expectation of satisfaction* (Furby 1978; Pierce et al. 2003) when using a technology may induce a user to engage in appropriation. It is satisfying to feel in control, secure, and competent when using a technology (Ke et al. 2008). A user may expect to enjoy this satisfaction once he has explored and appropriated the features of a technology to the extent that he feels in control, secure, and competent with it. Prior to appropriating, he may feel some anxiety or curiosity towards using the technology, which will need to be satisfied through appropriation.

Given these arguments, we propose:

Prepositions 1 *Desires for autonomy or control, pleasure, and security, as well as expectations of enjoyment and satisfaction will motivate the appropriation of a technology.*

2.3.2 Consequences

The literature on psychological ownership reveals several consequences: personal and object-related satisfaction (Furby 1978; Pierce et al. 2003), control (Deci and Ryan 1985; Furby 1978), social power and status (Furby 1978), self-identity (Belk 1988; James 1890; Pierce et al. 2003), security (Furby 1978), extra-role behavior (productive use of discretionary time) (George 1991; Katz and Kahn 1978; Van Dyne et al. 1995; Van Dyne and Pierce 2004; Vandewalle et al. 1995), job satisfaction (Van Dyne and Pierce 2004; Vandewalle et al. 1995), commitment to organization (Van Dyne and Pierce 2004; Vandewalle et al. 1995), organizational self-esteem, organizational citizenship (Van Dyne and Pierce 2004), efficacy (White 1959), and competence (White 1959). Similarly, we propose that individuals who engage in the appropriation of technology may expect to enjoy these consequences.

We expect individuals who engage in appropriation to enjoy a sense of *personal and object-related satisfaction* (Furby 1978; Pierce et al. 2003). Appropriation would tend to increase one's familiarity and competence with a technology due to exploration and use of technology features. Competence is more satisfying than incompetence. Furthermore, humans make judgments about their interactions with technology, just as they do with human-to-human interactions (Nass et al. 1997). For example, we get frustrated when we cannot figure something out on the computer, and we are happy and pleased when we can figure things out. Engaging in appropriation would tend to enable one's ability to "figure things out."

We expect individuals who engage in appropriation to enjoy a sense of *control* (Deci and Ryan 1985; Furby 1978). Individuals who have decided which features of a technology to use and how they will use them will feel much more in control of the outcomes of their use than those who have not done so. This is due to familiarity and experience with the technology – one is more able to predict the results of his actions with respect to the technology when he has appropriated its features.

We expect individuals who engage in appropriation to enjoy a sense of increased *social power and status* (Furby 1978). Appropriation will tend to increase competence. Those who have appropriated the features of a technology are better able to perform with the technology. Thus, they will enjoy a position of respect from the perspective of those who have not engaged in appropriation. They will be able to perform better than those around them; therefore, they will enjoy a sense of increased social power and status which may be an unspoken perception or come in the form of actual promotion due to increased ability.

We expect individuals who engage in appropriation to enjoy a sense of *self-identity* (Belk 1988; James 1890; Pierce et al. 2003). The way an individual uses a technology says something about him. Becoming competent with a technology also makes that technology an extension of oneself; it becomes part of one's identity. Having become competent through appropriation, a user may include his or her competence with this technology on his or her resume because it identifies a part of him or her.

We expect individuals who engage in appropriation to enjoy a sense of *security* (Furby 1978). One may feel more secure in his work if he has become competent through exploring and appropriating features of the technology he uses to accomplish his work. It is less likely he will feel insecure with regards to his performance with that technology. Appropriation leads to familiarization, and familiarization with an object leads to comfort. Comfort goes hand in hand with perceptions of security. This is often the case with children and blankets. In anxious situations, a child will calm down and feel more secure when he is presented with a familiar blanket (Passman 1977).

We expect individuals who engage in appropriation to also engage in *extra-role behavior* (George 1991; Katz and Kahn 1978; Van Dyne et al. 1995; Van Dyne and Pierce 2004; Vandewalle et al. 1995). Extra-role behavior is using one's discretionary time productively for the benefit of the organization. When a user is both competent with a technology and enjoys a sense of satisfaction when using it, it is likely he will not hesitate to engage in using it even when "off the clock." This sort of behavior is similar to the motivation to participate in open-source projects. Though there are fewer extrinsic motivations than intrinsic motivations to contribute, the intrinsic motivations such as satisfaction, increased self-identity, and feelings of recognition are sufficient to induce an individual to engage in productive work for others even during their "off time."

We expect individuals who engage in appropriation to enjoy a sense of *job satisfaction* (Van Dyne and Pierce 2004; Vandewalle et al. 1995). Those who have become competent through appropriation are satisfied when they use the technology, and therefore, they will be more satisfied with work. They will also feel more secure and in control as argued earlier. These feelings are likely to lead to more job satisfaction than less (Davy et al. 1997).

We expect individuals who engage in appropriation to exhibit a greater *commitment to the organization* (Van Dyne and Pierce 2004; Vandewalle et al. 1995).

If employees are engaging in extra-role behavior and are enjoying a sense of job satisfaction, as proposed earlier, they are also likely to have greater commitment towards their organization than those who have not received these benefits through appropriation. For example, if I am engaging in extra-role behavior, it is because I enjoy my work. I am more likely to be committed to my organization if I enjoy the work we do (Testa 2001).

Organizational self-esteem (Van Dyne and Pierce 2004) refers to one's confidence in the organization's performance ability. As one becomes more confident in his own abilities through appropriation, he may extrapolate that confidence to the organization. If he is confident in his performance, he may be more optimistic about the company as a whole; this is especially likely in small organizations where individual performance has a real effect on organizational performance (Jacobs 1981).

Organizational citizenship (Van Dyne and Pierce 2004) refers to one's sense of individual contribution to the organization. Logically, as one increases his abilities through appropriation he will also feel better about his ability to contribute and perform. We have already argued that appropriation will lead to extra-role behavior. Those who engage in extra-role behavior are being better citizens of the organization by doing productive work outside of the expected work hours.

We expect individuals who engage in appropriation to enjoy a sense of *efficacy* (White 1959). Efficacy refers to one's effectiveness (Compeau and Higgins 1995). As one increases his familiarity and abilities through appropriation he will also feel more effective with the technology because he will be more aware of, and familiar with, the technology capabilities. Thus, he will be better positioned to effectively execute tasks with the technology than one who has not engaged in appropriation.

Lastly, we expect individuals who engage in appropriation to enjoy a sense of *competency* (White 1959). As one chooses which features to use and how to use them, he will become more familiar with the capabilities of the technology and more confident in his ability to use those features. Thus, he will become a more competent user.

Given these arguments, we propose:

Prepositions 2 *Individual appropriation of a technology will result in increases in: personal and object-related satisfaction* **(***Furby* 1978*; Pierce et al.* 2003**)***, control, social power and status, self-identity, security, extra-role behavior, job satisfaction, commitment to organization, organizational self-esteem, organizational citizenship, efficacy, and com-petence.*

2.4 Limitations and Future Research

The focus of this study has been to review and compare psychological ownership and the individual appropriation of technology. Appropriation at the individual level has not been thoroughly examined by IS researchers; thus, we have been required to make some assumptions regarding the effects of appropriation. Our major assumption is that appropriation increases competency. This assumption is explained in the previous section. It is upon this assumption that many of the other effects of appropriation rely. For example, an individual may feel an increased sense of social power and status due to the increased competence he feels through appropriation. Taking this into account, future research ought to seek to validate the relationship between appropriation and competency first, and then the others will likely follow. This also indicates that competency may play a mediating role with regards to the majority of the proposed consequences of appropriation.

To our best knowledge, none of the relationships involving appropriation in this chapter has been tested at an individual level. To the extent the proposed consequences of appropriation seem desirable, future efforts ought to be focused on establishing these relationships though empirical research. Additionally, the consequences of individual appropriation appear to be a seeming "laundry list" of variables, like a trash can model. Due to the unexplored nature of this area of inquiry, we did not want to combine these variables into multidimensional constructs for this chapter. However, future research may benefit from grouping the outcome variables into highly correlated (statistically and logically) sets. For example, efficacy and competency seem related, as do organizational citizenship, organizational self-esteem, and commitment to the organization.

In this essay, we have not taken into account the degree of faithfulness of the appropriation. Faithfulness of appropriation refers to the use of technology in accordance with the spirit (or general intent) of the technology (Chin et al. 1997; DeSanctis and Poole 1994; Orlikowski 2000). For example, using a cell phone as a door stop is an unfaithful appropriation, whereas using it for a long-distance communication is faithful. Chin et al. (1997) develop a set of scales for determining the faithfulness of appropriations. While these scales are useful for measuring faithfulness of appropriation at a group level, they do not (nor were they intended to) explain and predict what causes individuals to appropriate technology. However, once individual appropriation has been studied more carefully, perhaps Chin et al.'s scales for faithful appropriations may be appropriated (pun intended) for measuring the faithfulness of individual appropriations.

Pursuit of this analogy between psychological ownership and individual appropriation of technology may want to begin with a deeper study of the literature on appropriation in order to develop a set of scales capable of reliably measuring appropriation behaviors (both faithful and unfaithful) at an individual level. As of yet, and to our best knowledge, no such scales exist. These scales can then be used, along with others already developed for the antecedents and consequences of psychological ownership, in order to perform a quantitative analysis of appropriation of IT. However, a more qualitative approach may be useful for not only confirming the analogy between psychological ownership and appropriation, but also to discover antecedents and consequences unique to appropriation of technology. Such an analysis may be best accomplished through open-ended and semi-structured interviews of IT-users.

2.5 Conclusion

Technology usage occurs at the individual level, and yet research on appropriation has focused on the group or organizational level. This leaves a large gap in the research, towards which we have directed our inquiry. In this chapter we have reviewed theories of psychological ownership and extant research on appropriation. Specifically we have been interested in the *individual* appropriation of technology, its potential antecedents and consequences. We observe that appropriation is theoretically equivalent to psychological ownership, and thus, is likely to have similar antecedents and consequences. Research exploring the internal factors that may affect appropriation and the individual impacts that may result from appropriation has been largely neglected by IS researchers. Thus, we recommend future research focus on these two aspects. As appropriation likely leads to increased competence and other desirable outcomes, the study of appropriation is a fruitful and beneficial vista for future research.

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Chapter 3
Transactive Memory and Its Application in IS Research

Dorit Nevo and Ron Ophir

Abstract This chapter provides an overview of the transactive memory (TM) literature, both general and within information system (IS) research. The objective of this chapter is to introduce the reader to TM and its applications in research, and to provide some practical knowledge on how TM can be incorporated into future research in IS. The chapter begins with a brief introduction to the concept of TM followed by an overview of TM studies to date. The focus is then narrowed to TM applications within IS research. The chapter concludes with information on TM measures and its nomological network to facilitate future research in this area.

Keywords Transactive memory • Transactive memory systems • Group research

Abbreviations

IS	Information system
TM	Transactive memory
TMS	Transactive memory system

3.1 Introduction

The importance of efficiently utilizing knowledge and skills is underscored in today's world where competition is often fierce and uncertainty is high. Since many of today's workplace activities occur in groups, it is important that we understand how interactions between group members shape knowledge sharing (Argote 1999).

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Transactive memory (TM) systems, or the group members' awareness of each other's knowledge, skills, and expertise, are an example of a mechanism that allows groups to make efficient use of the knowledge held by their members. Following initial evidence that TM systems can promote group performance (Liang et al. 1995), attention of group and organization research has focused on the conditions under which TM systems develop and improve group performance (Hollingshead 1998; Liang et al. 1995; Moreland and Argote 2003; Moreland et al. 1998; Wegner 1987). Although information system (IS) researchers increasingly utilize TM to study group performance within the IS context (e.g., Kanawattanachai and Yoo 2007; Oshri et al. 2008) or to study IS design (e.g., Nevo and Want 2005), TM has more to offer IS research in the future. We begin this chapter with an overview of TM studies in workgroup, following with an overview of application areas within IS research. We then provide some more practical information for researchers on the measurement, application areas, and nomological network of TM. We conclude this chapter with a discussion of future research directions.

3.2 Research on Transactive Memory

TM has been incorporated into many different research areas, examples of which are summarized in Table 3.1. In this section we offer an in-depth review of several specific areas related to the use of TM in groups, followed by a review of TM within the IS literature.

3.2.1 Transactive Memory in Groups

TM is meta-knowledge of the memory structure in a dyad or group of people (Lewis 2003; Wegner 1987). An individual's TM consists of two parts: (1) the individual's body of knowledge, and (2) directories of meta-memory – containing information about the knowledge and expertise of others (Lewis 2003). TM is defined as the group's shared awareness of who knows what in the group, which is based on attributions of responsibility, skills, or expertise in different domains (Wegner 1987; Wegner et al. 1991). Common experiences provide group members with the opportunity to reach greater accuracy in the attribution of the possession of knowledge to other group members (Moreland et al. 1998). The term Transactive Memory System (TMS) refers to the use of transactive memory by two or more members of a group to store, retrieve, and communicate knowledge (Lewis 2003).

Findings of both laboratory and field research indicate that groups whose members are aware of the knowledge and expertise of other members of the group perform better than groups whose members do not possess such knowledge (for a review, see Moreland and Argote 2003). Thus, TM serves as a facilitator of group performance. Groups whose members are trained together rather than apart develop better TMSs and perform better due to those systems (Liang et al. 1995). Further investigations

Table 3.1 Application areas of transactive memory

Research context	Examples
Group performance (lab)	Liang et al. (1995), Moreland and Myaskovsky (2000)
Group performance (field)	Lewis (2004), Zhang et al. (2007)
TM development and processes	Hollingshead (1998), Brandon and Hollingshead (2004), Littlepage et al. (2008), Rulke and Rau (2000)
Learning and turnover	Lewis et al. (2005), Rao and Argote (2006), Reagans et al. (2005)
Disaster recovery; mixed motives teams	Majchrzak et al. (2007), Jarvenpaa and Majchrzak (2008)
Virtual teams	Kanawattanachai and Yoo (2007), Yoo and Kanawattanachai (2001), Griffith et al. (2003)
New product development	Akgun et al. (2005, 2006), Dayan and Basarir (2009), Dayan and Benedetto (2009)
Globally distributed teams	Kotlarsky and Oshri (2005), Oshri et al. (2008), Kotlarsky et al. (2007)
Classroom performance	Jackson and Moreland (2009), Michinov and Michinov (2009)
Organizational memory	Nevo and Wand (2005), Paoli and Prencipe (2003), Wexler (2002)
Knowledge management	Alavi and Tiwana (2002), Argote et al. (2003), Chae et al. (2005), Kimmerle et al. (2008)
Project management	Reich and Wee (2006)
Organization-wide TM	Anand et al. (1998), Peltokorpi (2004), Jackson and Klobas (2008)

have shown that the meta-knowledge provided through group training, rather than higher stages in group development or opportunities to learn generic ways for interacting in groups, accounted for the performance advantages of group training over individual training (Moreland et al. 1996, 1998). Indeed, providing information about group members' expertise through feedback was enough to enhance group performance (Moreland and Myaskovsky 2000).

The development of TMS involves three underlying processes, namely, encoding, allocation, and retrieval (Rulke and Rau 2000; Wegner 1987). During the encoding stage group members obtain information about each other and create directories of meta-memory indicating who knows what in the group. New knowledge coming into the group is labeled according to its specific area or domain and then stored with (or allocated to) the group's expert in that domain. Group members can retrieve this knowledge by identifying the label (the specification of the domain) of the required knowledge, associating it with the relevant group expert, and locating this expert in the group.

Studies have shown that TMSs in a dyad or group of people can be developed under different circumstances. For example, dating couples have the opportunity to develop an implicit understanding of their division of expertise (Wegner 1987). Groups training on a task, learn who in the group is good at which aspects of the production task (Liang et al. 1995; Moreland et al. 1998). Groups develop this type of knowledge through group discussion while they perform their tasks (Rulke and Rau 2000). Groups can also improve their TM based on feedback given to the group on its members' expertise (Moreland and Myaskovsky 2000).

Studies of group TM commonly use three dimensions as indicators of TM: memory differentiation, task coordination, and task credibility (Lewis 2003). Memory differentiation refers to the degree that group members differ in the knowledge that they possess about the task. Task coordination refers to the degree that explicit planning and coordination efforts are needed. And task credibility refers to the degree that group members believe that the task knowledge that others hold is correct (Lewis 2003; Liang et al. 1995).

Other research has investigated variations in contextual factors and the impact of such variations on the extent that groups develop TM (for a recent review, see Moreland et al. 2010). For example, group structure characteristics, such as gender composition (Myaskovsky et al. 2005), turnover (Lewis et al. 2007), as well as task characteristics, such as task-role assignment (Moreland and Myaskovsky 2000) and cognitive interdependence (Hollingshead 2001).

3.2.2 Transactive Memory in IS Research

We now turn our focus to studies of TM within the IS literature to date. We identify three main areas in which TM has been studied in IS. The first area studies the existence and impact of TMS within development projects teams. The second area is focused on the development of TMS in virtual teams. The third area explores how information technology can be leveraged to enhance the benefits of TMS and overcome limitations such as group size or geographical distance. We discuss these areas in more detail below.

3.2.2.1 TMS in Development Projects Teams

Several studies have focused on the role of TM in New Product Development and IS Development projects. Development teams play an important role in organizational learning, change, and innovation (Akgun et al. 2006). These teams, especially those which are distributed, require a large amount of coordination and organization of work (Kotlarsky et al. 2007), and effective teamwork is a success factor for organizations involved in development projects, especially within a highly competitive environment. TM is studied within this development context to account for team members' different views, perspectives, backgrounds, and knowledge, as well as for their social ties with others in the organization (Dayan 2010).

Common outcomes of interest in studies of new product development and IS development projects are product success, time to market, team learning, and knowledge coordination (e.g., Akgun et al. 2005, 2006; Dayan and Basarir 2009; Schmickl and Kieser 2008). The effect of TM on these outcomes is studied through multiple routes. For example, Dayan and Basarir (2009) relate TM to team reflexivity, which is the extent to which group members reflect upon the group's objectives, strategies, and processes, and adapt them to the environment. Reflexive teams are better able to respond to environment changes, internal circumstances, emerging conditions, and customer wants. Dayan and Benedetto (2009) show that TM is positively linked to teamwork quality, which is in turn linked to product success, team learning, and speed to market. Schmickl and Kieser (2008) link TM to the ability to localize knowledge, thus reducing the need for knowledge transfer among specialists. Kotlarsky and Oshri (2005) show that, in globally distributed IS development teams, TM leads to more successful collaboration in terms of both product success and personal satisfaction. Finally Akgun et al. (2005, 2006) link TM to team learning and speed to market, although the latter is impacted negatively by TMS in highly turbulent environments. Akgun et al. (2005) also examined the development of TMS in new product development teams and showed that team stability, interpersonal trust, and team members' familiarity account for TMS development.

3.2.2.2 TMS Development in Virtual Teams

Virtual teams are characterized by physical distance between team members, technology-mediated interactions, diversity among team members, and limited collaborative history (Alavi and Tiwana 2002). Within this wide research context TM is studied to understand information processing within the team, as well as the impact of team members' knowledge and expertise on the virtual team's performance and collective mind (Curseu et al. 2008; Griffith et al. 2003; Kanawattanachai and Yoo 2007; Yoo and Kanawattanachai 2001).

Given the unique characteristics of virtual teams a key question of interest in TM studies concerns the development of TMSs in the virtual environment (cf. Griffith et al. 2003; Moreland et al. 2010). Griffith et al. (2003) identify key challenges to TM development in virtual teams as the need for shared experiences, common language, nonverbal cues, and group members' familiarity. They suggest that proper technology support can alleviate these challenges and lead to the development of TM in teams. Similarly, Kanawattanachai and Yoo (2007) developed and tested a temporal model linking the three dimensions of TMSs (expertise location, credibility, and coordination) to virtual teams performance. Their findings show that it takes time for TM to develop in new virtual teams and that constant communication is important at the early stages of the team's life to support the development of TM. Once a team develops its TM, however, its members can economize their communication efforts and rely more heavily on the developed TMS.

3.2.2.3 Technology Support for TMS

The link between information technology and TM goes back to the original work on TM by Wegner et al. (1991) who drew a parallel between the working of a computer memory and the idea of TM.

Recognizing that TM systems become more complex with group size and are difficult to maintain in the dynamic, distributed, and decentralized environments of today's organizations (Keel 2007), IS researchers proposed that information technology can be useful in supporting organization-wide TMSs. Proposing how such system should be designed Jackson and Klobas (2008) and Nevo and Wand (2005) both highlight the importance of meta-knowledge, which is used to describe not only "who knows what" but also to compensate for tacit group members' knowledge such as shared histories and familiarity with each other (Nevo and Wand 2005).

Taking a different approach Keel (2007) proposed that technology can support TM development through "virtual TM," which is computationally created and administered by agents. With this approach too, the key tasks remain to accurately identify, represent, and maintain expertise in a way that can effectively support TMS development.

Finally, Peltokorpi (2004) extends the role of computer-mediated communications reviewed above in the context of virtual teams to the organization as a whole, suggesting that ongoing and effective communications are key to the development of TMS across the organization.

3.3 Applying Transactive Memory in IS Research

We have thus far reviewed past areas of research within the TM literature, with special focus on TM studies within the IS literature. To facilitate the incorporation of TM into future IS research in this section we bring together relevant information for IS researchers interested in studying TM further. We focus on the following three aspects: (1) measurement of TM; (2) related constructs, antecedents, and outcomes; and (3) future research areas.

3.3.1 Measuring Transactive Memory

TM has been studied using both quantitative and qualitative measures and in various settings such as lab experiments and quasi experiments, field studies and surveys, and case studies (e.g., Lewis 2003; Liang et al. 1995). TM measures are commonly based on the three indicators of TM: memory differentiation, task coordination, and task credibility. Instances of strong TM are when expertise is distributed between group members so that no one member possesses all the knowledge required for the group task; when group members engage in minimal active planning of the execution of the task; and when members rarely question each others' knowledge of the task (Liang et al. 1995).

3.3.1.1 Behavioral Coding

Behavioral coding of TM is guided by the underlying assumption that stronger TMS are those where group members do not need to explicitly discuss or assert their expertise. That is, the stronger or more effective the TMS is, the less time is spent by members (groups) on articulating their relative domains of expertise, making claims on, or assessing credibility of, that expertise, or engaging in explicit coordination based on expertise location (Liang et al. 1995). In a behavioral coding procedure developed and used by Moreland, Argote, and colleagues (cf. Liang et al. 1995; Moreland and Argote 2003), raters blind to the hypotheses of the study observed taped sessions of group work and coded TM in those groups based on the following definitions of the three indicators of TM (cf. Liang et al. 1995; Moreland and Myaskovsky 2000):

Memory Differentiation (Specialization): Weaker TMS are those where group discussion/communication more frequently include individual members' claims on their specialized knowledge or expertise, more frequent claims on differentiation between group members, more instances where group members ask each other for help on specific aspects of the task, and more instances where group members are recalling or working together on a specific aspect of the task.

Task Coordination: Lower task coordination is observed when members discuss the order of work and who will do what; where there seems to be confusion about how to accomplish the task; when conversation or body positioning of participants indicate confusion; and when groups backtrack and repeat portions of task and work does not seem to be done smoothly and efficiently.

Task Credibility: Lower task credibility is observed when members are more likely to second guess or criticize work of other group members.

Moreland and colleagues (cf. Moreland and Argote 2003) have demonstrated that these indirect, coded, measures were consistent with context-specific self-report measures (questionnaire items distributed to group members).

3.3.1.2 TM Scales

The context-free TM scale developed by Lewis (2003) uses individual-level self-reported questionnaire items to arrive at group-level measures of TM. It is now the most commonly used scale to measure TM in both field and laboratory studies. The scale has also been employed to measure changes in TM over time (e.g., Lewis 2004). Similar to the three dimensions described above, Lewis' 15-item scale captures specialization, credibility, and coordination based on agreement with the following statements (Lewis 2003, p. 604):

- Specialization: "(1) Each team member has specialized knowledge of some aspect of our project, (2) I have knowledge about an aspect of the project that no other team member has, (3) Different team members are responsible for expertise in different areas, (4) The specialized knowledge of several different team members was needed to complete the project deliverables, (5) I know which team members have expertise in specific areas"
- Credibility: "(1) I was comfortable accepting procedural suggestions from other team members, (2) I trusted that other members' knowledge about the project was credible, (3) I was confident relying on the information that other team members brought to the discussion, (4) When other members gave information, I wanted to double-check it for myself. (reversed), (5) I did not have much faith in other members' "expertise." (reversed)"

- Coordination: "(1) Our team worked together in a well-coordinated fashion, (2) Our team had very few misunderstandings about what to do, (3) Our team needed to backtrack and start over a lot. (reversed), (4) We accomplished the task smoothly and efficiently, (5) There was much confusion about how we would accomplish the task. (reversed)"

Further work by Lewis and colleagues (Lewis et al. 2007) introduced measures of TM stability and efficiency to account for variation in TM effects.

A different conceptualization was proposed by Austin (2003) in the context of ongoing organizational groups (as opposed to newly formed experimental groups). Austin proposes the following four dimensions of TM: Group's knowledge stock captures the individual knowledge within the group; TM consensus is the extent to which group members agree about who knows what, and represents a group's mental model about the distribution of its members' knowledge; specialization represents the distribution of knowledge with narrowly defined areas of expertise; and TM accuracy is the extent to which individuals identified as possessing particular knowledge actually possess that knowledge.

Austin (2003) utilized a combination of self-reported questions and hypothetical scenarios to measure the above four dimensions of TM. Building on this conceptualization, Cruz et al. (2007) used the following approach to measure these four dimensions:

- Stock of knowledge: measured at the beginning of each period (week) using a test.
- Consensus: "(1) In general, you have made the production decisions (1: individually, each member with his part, 3: voting and the majority criteria, 5: trying to reach a consensus), (2) In general, we have made the marketing decisions (1: individually, each member with his part, 3: voting and the majority criteria, 5: trying to reach a consensus), (3) In general, we have made the financial decisions (1: individually, each member with his part, 3: voting and the majority criteria, 5: trying to reach a consensus), (4) In the team, there is a leader in the decision process (1: never, 5: always)" (Cruz et al. 2007, p. 205)
- Specialization: "(1) You have understood the relationships between the variables with which you have to decide (1: yes, each one separately, 5: yes, when we meet all members), (2) At the end of each meeting, we make schemas and briefings about discussions and decisions (1: no, never, 5: yes, always), (3) You have improved working in your group from the beginning (1: no, nothing, 5: yes, a lot), (4) Individually, I have worked with the business strategy game this week (1: less than an hour, 5: more than five hours)" (Cruz et al. 2007, p. 205)
- Accuracy: Measured using a dummy variable to indicate the participation of each member of the team in each session

3.3.1.3 Other Measures

Beyond the above two approaches to measuring TM in groups other measures of TM or specific dimensions of TM can be found in the literature. For example both

Jackson and Klobas (2008) and Oshri et al. (2008) have used observations in a case study setting to study the development of TM directories, Ren et al. (2006) employed computational modeling to study TM development, and various researchers have developed their own scales to measure TM in their unique research context. These measures are summarized in Table 3.2.

Table 3.2 TM measures and scales

Data collection method	TM measure	Selected references
Experiment	Behavioral coding of memory differentiation, task coordination, and task credibility	Liang et al. (1995), Moreland (1999), Moreland et al. (1996)
Survey	Respondents perceptions of specialization, credibility, and coordination	Lewis (2003, 2004)
Survey	**TM structure stability**: Coding and computation based on respondents' self-reports of their specialty/special expertise (open-ended question; asked twice over the duration of the experiment)	Lewis et al. (2007)
	TM process efficiency: Coding and computation of group-level measure based on individual recall of task (open-ended survey item) and evaluation (by experimenter) of outcome completed by group.	
Survey	**Expertise composition**: measured through dispersion in functional background; industry experience; organizational tenure.	Rau (2005, 2006)
	Expertise location: measured by asking respondents to identify each others' areas of expertise	
Field study (multilevel)	**Individual directory development** (and an aggregate form for **team directory development**) measured by responses to "who knows what" within the team and coded as either 1 (indicating expertise) or 0.	Yuan et al. (2010)
Survey	Group task knowledge stock; transactive memory consensus; task knowledge specialization; transactive memory accuracy	Austin (2003)
Quasi-experiment	A scale developed based on Austin's (2003) conceptualization	Cruz et al. (2007)
Case study	Observations of TM directories	Jackson and Klobas (2008), Oshri et al. (2008)
Survey	**Expertise location**: (1) The team has a good "map" of each others' talents and skills, (2) team members know what task-related skills and knowledge they each possess, (3) team members know who on the team has specialized skills and knowledge that is relevant to their work.	Kanawattanachai and Yoo (2007, p. 796)

(continued)

Table 3.2 (continued)

Data collection method	TM measure	Selected references
	Task–knowledge coordination: (1) Our team members had a global perspective that includes each other's decisions and the relationship among them, (2) our team members carefully interrelated actions to each other in this project, (3) our team members carefully made their decisions to maximize an overall team performance, (4) our team members had developed a clear understanding of how each business function should be coordinated.	
	Cognition-based trust: (1) Most of my teammates approach their job with professionalism and dedication, (2) I see no reason to doubt my teammates' competence and preparation for the job, (3) I can rely on other teammates not to make my job more difficult by careless work, (4) Most of my teammates can be relied upon to do as they say they will do.	
Survey	**Expertise location**: (1) The team has a good "map" of each others' talents and skills, (2) team members are assigned to tasks commensurate with their task-relevant knowledge and skills, (3) team members know what task-related skills and knowledge they each possess, (4) team members know who on the team has specialized skills and knowledge that is relevant to their work.	Faraj and Sproull (2000)
Survey	**Teams' accurate cognitive map**: (1) I know a lot about the expertise of my group members, (2) My group members know a lot about my expertise, (3) My group members know a lot about one another's expertise, (4) My group coordinates knowledge well.	Child and Shumate (2007)
Computational modeling	**TM density**: how much useful knowledge exists in TM.	Ren et al. (2006)
	TM accuracy: the percentage of accurate knowledge in TM.	

3.3.2 Nomological Network

TM has been studied in various contexts and levels (e.g., dyads, groups, organizations) with research focusing on different aspects of the TM system. Table 3.3 provides an overview of the variables often studied alongside TM as a tabular representation of its nomological network.

The development of TM and the positive effect of TMS on group performance rely on the successful encoding, storage, and retrieval of the knowledge of expertise

Table 3.3 Selected examples for variables used with TM research models

Antecedents (TMS development)	Training (Liang et al. 1995; Moreland et al. 1996, 1998; Prichard and Ashleigh 2007; Sharma and Yetton 2007) Group structure (Myaskovsky et al. 2005) Team configuration (O'Leary and Mortensen 2010) Team stability (Akgun et al. 2005; Lewis et al. 2007) Interpersonal trust (Akgun et al. 2005; Ophir 2003) Familiarity (Akgun et al. 2005; Lewis 2004; Moreland 1999) Proximity (Akgun et al. 2005) Group size (Sharma and Ghosh 2007) Differentiated expertise/variability (Lewis 2004; Littlepage and Silbiger 1992) Task characteristics (Moreland and Myaskovsky 2000; Hollingshead 2001) Task interdependence (Yuan et al. 2010; Brandon and Hollingshead 2004; Peltokorpi and Manka 2008; Zhang et al. 2007) Cooperative goal interdependence (Zhang et al. 2007) Communications (Kanawattanachai and Yoo 2007; Lewis 2004; Peltokorpi and Manka 2008; Yuan et al. 2010) Support for innovation (Zhang et al. 2007) Group potency (Peltokorpi and Manka 2008)
Related concepts	Shared mental models (Brandon and Hollingshead 2004; Cannon-Bowers and Salas 2001; Mohammed and Dumville 2001; Yang et al. 2008; Zhang et al. 2007) Shared cognition (Ashworth and Carley 2007; Baba et al. 2004) Expertise location (Faraj and Sproull 2000) Collective mind (Elsbach et al. 2005; Weick and Roberts 1993) Absorptive capacity and communities of practice (Cadiz et al. 2009; Griffith et al. 2003)
Moderators to performance	Group size (Ren et al. 2006; Sharma and Ghosh 2007) Task complexity (Akgun et al. 2005) Environmental turbulence (Akgun et al. 2006)
Outcomes	Team performance (Faraj and Sproull 2000; Lewis 2004; Liang et al. 1995) Team viability (Lewis 2004) Job satisfaction (Michinov et al. 2008) Team identification (Michinov et al. 2008) Team learning (Lewis et al. 2005) Speed to market (Akgun et al. 2005, 2006) New product success (Akgun et al. 2005, 2006)

distribution in the group. Much of the research on TM has been concerned with identifying the conditions under which TM develops (or fails to develop well) and is (or is not) utilized. The first section of Table 3.3 provides examples of the variety of group characteristics, group processes, and task characteristics that have been explored to date as antecedents for the development of usage of TM in groups.

The three TM processes involve the mapping and sharing of knowledge within a group. The second section in Table 3.3 lists several related models and concepts that focus of knowledge sharing and mapping within groups and organizations. Underlying commonalities for these concepts are the barriers to information sharing and the challenges of knowledge mapping (cf. unshared information and uncovering of hidden profile, Stasser 1992; Stasser et al. 1995).

For example, both TMS and shared mental models describe shared cognitive structures at the group level that affect group processes and outcomes. The TM perspective is concerned with the shared understanding of who knows what and the related processes that support the creation, maintenance, and utilization of such shared understanding (Liang et al. 1995; Wegner 1987). The shared team mental model perspective is concerned with multiple, nonindependent, shared representations of a range of elements in the team's relevant environment (for a recent review, see Mohammed et al. 2010). Another difference is the treatment of redundancy in expertise across group members: where TM measurement would likely consider such redundancy as a weaker TMS, the shared mental model perspective is focused more on the similarities in perceptions as to that redundancy (Kozlowski and Ilgen 2006; Mohammed and Dumville 2001; Mohammed et al. 2010). Yet, similarities exist, such as between TM and a shared mental model of expertise (cf. Levesque et al. 2001), or positive relationship between measurements of the two (Ellis 2006); further research is needed to better understand how TM and shared mental models relate and affect group processes and outcomes (Mohammed et al. 2010).

In another related work, Griffith et al. (2003) propose that the study of the knowledge ecosystem in virtual and distributed teams should incorporate TM, along with absorptive capacity and communities of practice. Specifically, they propose that the three independent constructs moderate the process of converting group potential knowledge to useable knowledge. Absorptive capacity refers to one's ability to internalize and process information received (Cohen and Levinthal 1990). Communities of practice are fluid, and include frequent informal interactions, often with individuals outside group boundaries (Brown and Duguid 1991).

Finally, TM may be linked to information processing theory (Miller 1956) as they both focus on how individuals process information and encode it to memory. However, while information processing theory focuses more on the internal working of the human memory, TM theory explores how people utilize others to externally encode and retrieve information. Thus, TM theory can be seen as one approach to dealing with the limitations of human memory.

The third and fourth sections of Table 3.3 provide examples for moderators and a range of outcomes that have been studied in the TM context.

3.3.3 Future Research Areas

The relationship between ISs and TM is illustrated in Fig. 3.1. The TM literature can offer insights to IS research in explaining group-level phenomena such as performance, decision-making, satisfaction, and learning. At the same time, ISs research can help extend studies on the impact of TM beyond the dyad or small groups, by

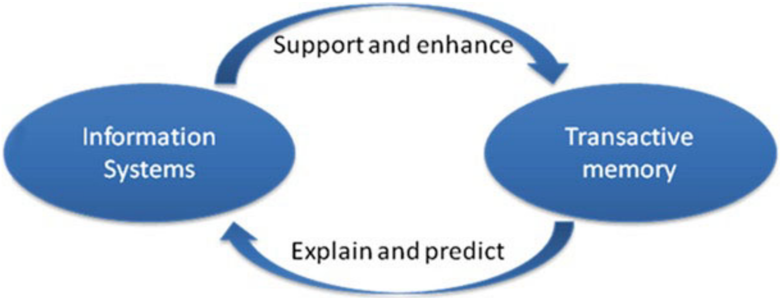

Fig. 3.1 Research interrelation between IS and TM

expanding the reach of the TM to larger groups. Finally, interactions between these two directions make TM studies in the IS field all the more interesting.

For example, while IS researchers have studied the impact of TM in IS development teams or IS-mediated teams, an interesting area for future investigation may be hybrid teams, in which both virtual and face-to-face activities take place. A longitudinal investigation of the changes in these teams' TMS may be very interesting. In particular, building on work such as Cramton's (2001) investigation of mutual knowledge problem, it would be interesting to investigate the impact of asymmetric communications on TMS development and maintenance. Of further interest are teams in which there exists some inequality in terms of access to media, supporting interactions between some team members more than others.

A related area concerns the development of a TMS which is partially located within team members' minds, and partially captured in an IS. An example is an organization that employs some expertise location systems to facilitate the location and coordination of expertise.

There are also many areas where the ISs literature can be used to augment the TM literature, especially due to the tacit nature of TM (Moreland et al. 2010). For example, given the role of rich communications and nonverbal cues in TM development (e.g., Lewis 2004), researchers can focus on how new and evolving types of media can support the development of TMSs in groups. Media such as video conferencing and virtual worlds, and their unique characteristics and capabilities, can be explored further to understand how they contribute to the development of TM in the technology-mediated environment. Finally, research on the design of ISs that mimic the mechanism of TMSs can greatly benefit the area of knowledge management and expertise location in organizations. TM can serve as a theoretical foundation for the design of more effective expertise locator systems and enable researchers to identify important contingencies which are relevant for the design of such systems. Such studies may also offer an important link from IS design to team performance, thus contributing to our understanding of the business value of these systems.

Early studies of TM defined and demonstrated the naturally occurring phenomenon in small groups, whereby group members are exposed to, and develop, a shared understanding of who knows what in the group during group interaction, and are able to encode, store, and leverage (retrieve) that knowledge. Yet, changes in group membership and virtual or geographically dispersed teams present significant challenges to the development and utilization of TM. Two recent research directions provide useful frameworks to examine the work of IS teams or IT support for other teams. Lewis et al. (2007) suggest that the effects of turnover (membership change) on TMS can be better understood when taking into account the stability of TMS structure and the efficiency of TMS processes over time, providing evidence from laboratory studies. Future incorporation of these characteristics into IS research on TM may improve understanding of knowledge processes within IS teams, and of ways in which IS can provide technological support for TM. Griffith and colleagues (2003, 2009) suggest that incorporating TMS in the study of knowledge processes in distributed and virtual teams is necessary to understand the transformation of potential group knowledge (at the individual and group level) into usable group knowledge. They argued that understanding the ability of virtual or distributed teams, where face-to-face interaction is limited or nonexistent, to leverage their knowledge can be better understood when integrating the effects of the three independent theoretical constructs: TM, absorptive capacity, and experienced communities of practice (Griffith et al. 2003) and developed and validated measures for the latter two (Cadiz et al. 2009). The integration of these three constructs together in IS research may provide additional insight into the understanding of the dynamics of TM structure and processes in IS teams and in technologically supported teams.

3.4 Conclusion

TM theory focuses on expertise coordination and location within small dynamic groups. The development of TMSs in groups has been shown to lead to numerous benefits including improved performance, decision-making, and learning. ISs research can benefit from utilizing TM theory to explain various phenomena concerning IS-focused teams or IS-supported teams. In addition, information technology can be utilized to expand the benefits of TM from the small group to the organizational domain.

To facilitate future research on TM within the IS field this chapter reviewed TM and its application in the general organizational and the IS literature. To offer contribution to IS researchers the review is structured around the knowledge required by researchers considering the use of TM in their work. We systematically reviewed not only the general TM literature but specific areas concerning measurement, applications, and related areas. We reviewed key approaches to measuring TM, summarized key antecedents, related concepts, and outcomes, and identified some areas of interest for future research.

This chapter also offers an in-depth view of TM use within the IS literature. Specifically we identified three main ways that TM is used in the IS literature: in IS development and IS-focused teams, in IS-supported (virtual/globally distributed) teams, and as the objective of the IS, looking at designing technology support for TM. Building on these foundations we identified future research areas that link TM and IS research and incorporate technological development such as new forms of media.

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Chapter 4
The Language-Action Approach: Information Systems Supporting Social Actions

Karthikeyan Umapathy

Abstract The Language-Action Perspective (LAP) approach, with the premise that people perform actions through communication, provides an appropriate framework for analyzing and designing information systems matching the needs of today's information and communication technology (ICT)-intensive organizations. The LAP approach considers that work in organizations is performed through communication and coordination among its workers. Therefore, according to the LAP approach, purpose of the information systems is to support social actions. Language-action theories provide information systems researchers guidance to gain a comprehensive understanding on how people can use communication to create, control, and maintain social interactions in the organizational context. In this chapter, we provide an overview of the LAP approach and its main theoretical foundation Habermas' theory of communicative action along with a discussion on the differences between traditional view and LAP view of information systems.

Keywords Language-Action Perspective • LAP • Language-Action Theories • Theory of Communicative Action • Speech Act Theory

Abbreviations

ICT	Information and communication technologies
LAP	Language-action perspective
TCA	Theory of communicative action
UoD	Universe of discourse

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4.1 Introduction

One of the important functionalities of information systems in the organizational context is to support communication and information sharing among workers to do their work. Thus, one way for analyzing and designing information systems is to use theories oriented towards actions performed through communication. One such approach is the Language-Action Perspective (LAP), which is a theoretical orientation that has been taken up by multidisciplinary community of researchers and practitioners to solve information systems design problems. The basic premise of the LAP community is that much of the work in today's organizations is performed through use of language – which facilitates communication, coordination, and interaction among organizational actors.

The LAP approach is based on the heterogeneous theoretical foundations that consist of the theory of communicative action (TCA) (Habermas 1984, 1985) and the speech act theory (Searle 1969). LAP was first introduced in the field of information systems by Flores and Ludlow (1980) who argued that human beings are fundamentally linguistic beings and act through language (Schoop 2002). LAP recognizes that language is not only used for exchanging information (as in reports or statements) but also to perform actions (as in promises, orders, requests, and declarations) (Umapathy 2009). Following this notion, communication is primarily an action and is followed by an interpretation by means of language that is based on the intersubjectivity between the speaker and the hearer. This insight has profound implications for the theory and practice of designing systems to support organizational communication and interaction.

The objective of this chapter is to provide background information of the LAP approach, focusing on the theory of communicative action and reviews of few showcase articles. In the next section, we provide a brief overview of the theoretical foundation of the LAP approach. In the following section, we provide a discussion on the differences between traditional and LAP views of information systems. In the following section, we provide a brief discussion on the LAP approach's criticisms. In the following section, we provide a brief review of some exemplary LAP-oriented research articles. Finally, we provide a discussion on how the LAP approach is appropriate for modern day organizations.

4.2 Theoretical Foundations of LAP

The LAP approach is "grounded in the linguistic and social rules that govern the use of the language" (Umapathy 2009). The main theoretical foundation for the LAP approach is the Speech Act Theory (Austin 1962; Searle 1969) and the Theory of Communicative Action (Habermas 1984). Speech Act Theory was initially developed by Austin (1962), and further developed and formalized by Searle (1969). The underlying principle of the speech act theory is that language can be used for performing different kinds of actions, rather than simply describing a situation or a fact. For example, consider a statement by a taxi driver "I will pick you up tomorrow morning 6 AM." This can be considered as a performance of commissive action as against making a statement that may be judged true or false. Thus, according to speech act theory, speaking is acting and by speaking the speaker performs a "speech act" (Bach and Harnish 1979). More details of the speech act theory and its relation to LAP can be found in Umapathy (2009). In this chapter, we provide a detailed discussion on the theory of communicative action (TCA) which utilizes the basics of the speech act theory into its theoretical framework.

4.2.1 The Theory of Communicative Action

The theory of communicative action (TCA) was developed by Habermas (1984, 1985) with the intention to conceptualize social-life context. This theory argues that speech acts are the elementary units of communication and the propositional content of speech acts establishes a relation between the utterance and the outside world (Schoop 2001). TCA distinguishes three worlds where this relation can be taken up. These three worlds are: objective, social, and subjective (Cecez-Kecmanovic and Janson 1999; Habermas 1984).

The *objective world* is defined as "the totality of all entities about which true statements are possible" (Habermas 1984, p. 100). The objective world refers to the state of affairs that represent propositional content expressing beliefs or intentions. This state of affairs can be in agreement or disagreement with what is the case in the world. Thus, when an actor attempts to change the existing state of affairs, success lies in the direction of whether the actor's perceptions and beliefs are true or false (Cecez-Kecmanovic and Janson 1999). Hence, the relations between the actor and the objective world are judged according to the success or failure of their goal-directed interventions on the state of affairs.

The *social world* is defined as "the totality of all legitimately regulated interpersonal relations" (Habermas 1984, p. 100). The essence of the objective world can be revealed with reference to the existence of "state of affairs"; similarly, the essence of the social world can be revealed with reference to the existence of "norms." All actors to whom a certain set of norms apply belong to the same social world as a role-playing subject. Within a social world, a norm is de facto established which is recognized by those affected, and this intersubjective recognition grounds the social force of the norm. In the social world, actions of an actor are open to objective evaluation according to two directions of fit (Cecez-Kecmanovic and Janson 1999). First, actions of an actor are judged based on their normative context, i.e., whether their actions are in accord or deviate from the existing norms. Second, norms are justified according to whether they embody the values and interests that are recognized as legitimate by those affected. Hence, relations between the actor and the social world are judged according to their legitimacy and justification.

The *subjective world* is defined as "the totality of the experiences of the speaker to which he has privileged access" (Habermas 1984, p. 100). The subjective world is an internal world to an actor and exists complementary to the objective and social worlds (Cecez-Kecmanovic and Janson 1999). An actor has desires and feelings which are subjective. At will, the actor can express these experiences to others who may trust or distrust the actor's sincerity and truthfulness. Thus, the significance of the subjective world is represented by the truthful utterance of experiential sentences that are justifiable.

TCA suggests that when an actor performs a speech act, then the actor is communicating about either the external or the internal world in the given context (Habermas 1984; Schoop 2001). Further, different types of utterances (different illocutionary forces) would relate to different worlds. For example, if an actor utilizes constative type of speech act (i.e., statements of belief, desire, and intentions) to utter statements about the real world, then the actor is communicating about the objective world. Similarly, if an actor utilizes effective speech act (i.e., statements affecting institutional state of affairs), then the communication would be about the objective world. If an actor utilizes directive (i.e., statements directing action), commissive (i.e., statements intending actions), or verdictive speech act (i.e., statements making official judgments), then the communication would be about the social world. If an actor utilizes acknowledgement speech act (i.e., statements expressing attitudes), then the communication would be about the subjective world.

TCA classifies these speech act–based actions into six action concepts (Habermas 1984; Manninen 2003). The action concepts are:

1. *Instrumental action* (also known as teleological action) refers to the action performed by the actor in relation to the objective world (occurring in nonsocial context) (Habermas 1984). Instrumental actions are success-oriented and are material actions that follow technical rules (Schoop 2001). Instrumental actions are performed by manipulating and controlling events and state of affairs of the environment (which may include material, financial, and other entities as well as other social actors) (Cecez-Kecmanovic and Janson 1999).
2. *Strategic action*, similar to instrumental action, is in relation to the objective world but anchored in a social context (Habermas 1984). Thus, strategic action occurs when the goal-oriented actor is influencing and transforming the behavior of other actors to conform to the actor's desires or goals (Cecez-Kecmanovic and Janson 1999; Schoop 2001).
3. *Normatively regulated action* refers to the action performed by the actor in relation to the social world (Habermas 1984). Normatively regulated actions are oriented towards reaching an understanding. Normatively regulated actions are performed in accordance to commonly accepted norms (Cecez-Kecmanovic and Janson 1999).
4. *Dramaturgical action* refers to the action performed by the actor in relation to the subjective world (Habermas 1984). Dramaturgical actions are performed in public forum to evoke an actor's image or impression by purposefully disclosing the actor's subjectivity (Manninen 2003).

5. *Communicative action* refers to the action performed by the actors in simultaneous relation to all the three worlds (Habermas 1984). Communicative actions are oriented towards reaching an understanding and maintaining it by coordinating their planned actions accordingly (Cecez-Kecmanovic and Janson 1999). Communicative action aims to bring consensus among actors through rationally grounded discussions (Schoop 2001). Therefore, actors engaged in communicative action inform each other about states of affairs, events, decisions taken, and so forth (Ngwenyama and Lee 1997).
6. *Discursive action* refers to the action performed by the actors in simultaneous relation to all the three worlds (Habermas 1984). Discursive actions aim to establish a set of common norms for all involved actors (Manninen 2003). When discursive action is performed, actors question their social practices, beliefs, and states of affairs and seek to redeem them through argumentation with involved actors (Manninen 2003; Ngwenyama and Lee 1997). Therefore, actors engaged in discursive action entail explanation, discussion, and criticisms of the existing norms until they agree on a course of action (Manninen 2003; Ngwenyama and Lee 1997).

In order to perform either of the above classified actions, two general rules are required (Habermas 1984; Wilson 1991). First, there is no distortion with communication, i.e., there are no manipulations or misinterpretations involved with communications. Second, everything communicated is open for questions of validity, which can be accepted or contested. These rules enable actions through communications which are controlled via speech acts. Such communications are evaluated on the basis of better arguments related to four validity claims (Habermas 1984; Wilson 1991): (1) that the utterance must be true with respect to the objective world, (2) that the utterance must be appropriate with respect to the normative context of the social world, (3) that the utterance must be sincere and honest in respect to the speaker's subjective world; and (4) that the utterance must be well formed and comprehensible by those affected. Thus, three worlds form a reference framework for actors and they utilize their relations to these worlds as reference to conduct social interactions (Cecez-Kecmanovic and Janson 1999). The six types of social actions form a useful framework for examining everyday social interactions supported by information systems.

4.3 Difference Between Traditional and LAP Views of Information Systems

Traditionally, information systems are considered as an information processing system designed to provide information for managerial and decision-making purposes (Connors 1992; Davis and Olson 1984). Traditional approaches consider information systems as a repository of facts about the world, and thus aim to develop representation mapping between the system and the world. Therefore, information system development is considered as a process to manipulate information to meet the requirements of a specific business task (De Michelis et al. 1997). Moreover, traditional information system development is based on simplified assumptions and heuristics that capture known properties of the real system (in this context, business task) while ignoring unknowns (Oreskes et al. 1994). Therefore, traditional information systems are seen as "mirrors of reality" while users are provided with abstractions of the reality (Flores et al. 1988; Goldkuhl and Lyytinen 1982). Following this view, each user has a "local view" of the total view, which is the individual's slice of the reality seen through an information system (Goldkuhl and Lyytinen 1982).

On the other hand, LAP focuses on communicative aspects of the information systems. LAP approach considers that information systems store facts about objective reality formulated based on socially and technically conditioned knowledge-based rules (Goldkuhl and Lyytinen 1982). In LAP approach, an information system is considered as a system that supports communication between people to perform their actions together (Flores et al. 1988; Goldkuhl and Lyytinen 1982). According to LAP, users are part of a community, who interpret the world and coordinate their actions together in that world (Goldkuhl and Lyytinen 1982). Thus, in this view, the user is seen as a participant in the community of interpretation; thus, information is contextualized to a community of interpreters (Goldkuhl and Lyytinen 1982).

In order to support communication and actions among people, information systems must support interpretation of the world by means of language that is based on intersubjectivity between the speaker and the hearer (Goldkuhl and Lyytinen 1982). If there exists misinterpretations, then breakdowns would occur in communications and actions performed. Therefore, according to LAP, information system development is considered as the process of identifying and supporting breakdowns that may occur with the flow of actions performed by the people (Flores et al. 1988). Thus, the goal of systems development is to support mutual understanding through rational discourse, i.e., support free and undistorted communication (Klein and Huynh 2004). Therefore, LAP considers systems development to be a social process, if social and pragmatic aspects are not taken into consideration during analysis and design, then the system may not be considered as legitimate and socially accepted (Yetim 2009). Table 4.1 provides a summary of the differences between traditional and LAP approach to information system development, as adapted from Goldkuhl and Lyytinen (1982).

4.4 Criticisms of LAP and Theory of Communicative Action

The LAP approach and, in particular, the usage of Habermas' theory of communication action and Searle' speech acts have received some criticisms. An overview of the criticism on usage of speech acts with the LAP approach can be found in Umapathy (2009). In this chapter, we focus on criticisms towards the theory of communicative action. Habermas notion of validity claims has been criticized for overemphasizing on

Table 4.1 Differences between tradition and LAP view of information systems

	Traditional view	LAP view
Theoretical roots	Systems theory	Speech act theory and theory of communicative action
View of organization	An organization is a social unit whose members collectively pursue declared objectives (Checkland and Holwell 1998)	Organizations are cultural processes in which social reality is continuously defined and redefined through both communication and action
Information systems viewed as	A technical system that has social implications	Social system only technically implemented
Ontology	Data and information (Flores et al. 1988)	Communicative actions
Focus of development methodology	Technical control of elements of information systems and its environment	Intersubjectivity rules that govern usage of language
Nature of information	Objectified information that is consistent and provides a view of reality	Information is contextualized to a community of interpreters
Relationship to environment	Information system is used to support control over environment	Information system is integrated within the community of users
Relationship to user	Relationship between data and user is emphasized	User is seen as part of a community of interpreters of reality
Desirable properties	Faithful and consistent data; efficient and functionality of the system	Socially accepted system that supports rational and successful communication
Constraints for using information systems	Technical capability and expertise	Sharing interpretation rules

the clarity and rationality required for human interaction, but neglecting professional knowledge and facts for argumentation (Saiedi 1987). Similarly, the claim of legitimacy has been criticized to overlook conflicts among norms, and the claim for sincerity has been criticized for not considering historical bonding and the duality of identity (conscious and unconscious) (Saiedi 1987). Habermas notion of social norms, values, and meanings are intersubjectively accepted and also criticized as it does not take into account implicit cultural assumptions that actors outside a culture would not understand. These criticisms have implications in regards to development of sustainable information systems where issues of gender, race, and discrimination are important (Jones and Basden 2003). Certainly, Habermas' theory of communicative action has been criticized by social scientist and philosophers, discussion of which is out scope for this chapter. However, withstanding criticisms, the LAP and theory of communicative action have been utilized by many information systems researchers. In the next section, we provide a review of some exemplar information systems research articles that utilize LAP as their theoretical framework to inform their research.

4.5 Review of Exemplar Information Systems Research Articles

Lyytinen and Hirschheim (1988) argue that the traditional view of information systems is too limited as it is considered as a mechanism to support organizational control. However, they argue that the role of information systems is to support social actions such as communicative interactions among organizational actors. Lyytinen and Hirschheim, therefore, argue that, if we consider information systems to be an integral part of, and manifestation of, the social environment, then Habermas' communicative action theory is appropriate for the analysis and design of information systems. In their article, Lyytinen and Hirschheim show how discursive action can be utilized for modeling information systems use. They analyzed information systems use in the organizational context based on discursive action views and validity claims to draw implications such as there is need for information systems to support discourse among actors by providing new information for the discourse, rethinking implementation and access to information based on how people make sense of their environment instead of based on role types, and finally, establishing new communication channels that provides more socially open institutional arrangements.

Agerfalk (2004) considers that the role of information systems is to permit, promote, and facilitate performance of actions by users. In regards to information systems use in the business context, he argues that information systems play a mediating tool role to support social actions such as business action and communication. He suggests there are three types of roles: communicator (e.g., sales manager) who is responsible for the communicative actions, interpreter (e.g., customer) who receives and acts upon the messages, and performer (e.g., salesperson) who performs communicative actions on behalf of communicator. He developed nine actability dimensions for evaluating information systems' ability to support appropriate social behavior. The nine dimensions are: action elementariness, recorded action, action potentiality, structured action, irrevocable action, remote activity, delayed interpretation, delayed feedback, and delegated action. Along with the discussion of the nine dimensions, he provides a set of questions to ask and an example case study applying those nine dimensions.

Rittgen (2006) argues that in the traditional view, information systems are considered to be a passive repository of data that reflect the structure and behavior of a Universe of Discourse (UoD). According to him, the role of information systems is to support and coordinate social actions performed by humans. He argues that both views of information systems are necessary, i.e., both technical aspects advocated by traditional perspectives and social aspects advocated by the LAP approach are important for developing information systems as a socio-technical system. Towards that end, he developed a mapping framework between Unified Model Language (UML) constructs from traditional perspective and Dynamic Essential Modeling of Organization (DEMO) constructs developed based on the LAP approach.

Aldo de Moor (2002), for the context of virtual professional communities, where in professionals collaboratively work on activities to achieve shared goals, argues that traditional symbolic and information flow manipulating methodologies are not sufficient. Virtual professional communities form complex socio-technical systems, where there is continuous change leading to coevolution of social and technical systems. He argues that complexity of these communities comes from tacit knowledge that is embedded in their actions, experiences, and values of community members. He develops a specification method by combining principles of LAP and organizational semiotics to form neo-humanism framework that is characterized by subjectivism and conflict. The subjectivist viewpoint considers that knowledge is socially constructed through interactions with humans and conflict viewpoint considers that there is a natural tendency towards change conflict. This neo-humanism framework is suitable for information systems modeling for the context of virtual professional communities, because community members with varied interests need to work together and construct joint models for their work.

Umapathy and Purao (2007) utilize language-action theories to develop a reference framework to analyze and provide guidance to web services standards development. They argue that interactions between services are similar to business communication with an intended action behind it; thus, service interactions can be considered as communicative actions. Inspired by the layered architecture for business process and the ecommerce context developed by other LAP researchers, Umapathy and Purao developed a three-layered framework: communication platform, for enabling communication between services; communicative act, for establishing and maintaining commitments between services; and rational discourse, for coordinating interactions among services to achieve the business objective. They further identified conditions and sub-layers for each three layers. The reference framework is then utilized to assess three different web service standardization efforts, namely, W3C-based standards approach, semantic web services approach, and ebXML approach.

4.6 Discussion

The LAP approach provides designers “a uniform and understandable structure that can support human activity in all of its richness” (Weigand 2006). Language-action theories do not provide the capability to predict system behavior and resource demands, rather they provide designers the ability to understand, interpret, and envision the human situation (Weigand 2006). Like any other theoretical frameworks, LAP provides a viewpoint for asking questions, for anticipating breakdowns, and for inventing opportunities (Yetim 2009).

The LAP approach view of information systems as a means to perform social actions has profound implications. Traditional approach of designing information systems, which focuses on symbolic representations for manipulating and processing information and controlling complexity of the users working context, sometimes inadvertently alters users’ working context. The LAP approach focuses on the purpose of information sharing and actions performed through the use of information systems.

The LAP approach utilizes three world views and different action types from the theory of communicative action to distinguish different actions performed and speech acts to represent different types of information being shared. Through the foundations of speech act theory and theory of communicative action, the LAP approach guides information systems researchers to gain an understanding on the users' intentions of sharing information and performing actions to ensure that designed systems do not cause major changes to the users working context.

In the current information society, two facets of information, integrity and authenticity, are of importance (Dietz 2004). In regards to integrity of information, the LAP approach through use of speech acts and action types provides the ability to identify atomic entities as well as validate them based on the nature of their usage (Dietz 2004). In regards to authenticity of information, the LAP approach addresses issues of originality of the information by providing the means to distinguish the original and derived facts and addresses the issues of ownership of information by distinguishing the originator and the transmitter of the information (Dietz 2004).

With the increasing advancement of information and communication technologies (ICT) and their continued penetration into everyday activities in the organizational context, there is increasing demand for information systems that are technically sound and socially accepted. Most ICT applications currently developed fails to add value to organizations as they are wrongly focused on the technology ignoring crucial relationship with organizational activity mediated through information sharing (Beynon-Davies 2009). Therefore, it is very important to consider how the ICT application fits with activities and information needs within and across organizations. Towards that end, it may be wise to have business process logic and consequent support provided by the ICT applications to follow the same patterns that occur in the given organizational context. The LAP approach provides layered architectures that will allow analysts to gain comprehensive understanding of core business processes, decompose complex business processes into their elementary business transactions, identify business roles involved, and dependencies and kinds of exchanges that occur between roles. Thus, the language-action theories can provide adequate framework for analyzing and designing information systems for organizations that rely on ICT infrastructures.

As with any theory, framework which receives significant attention tends also to attract criticisms; the LAP and theory of communicative action are no exception. It is important that researchers who are thinking of using LAP approach should be aware of these criticisms and should thus be able to generate their own informed view of the usefulness and limitations of the LAP approach.

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Chapter 5
A Summary and Review of Galbraith's Organizational Information Processing Theory

Clemens Haußmann*, Yogesh K. Dwivedi, Krishna Venkitachalam, and Michael D. Williams

Abstract This chapter reviews Galbraith's original theory of organizational information processing and its proposed advancements. Original theory version describes uncertainty, especially task uncertainty, as the determinant of an organization's structure. Four strategies are proposed to solve the organizational design problem: creation of slack resources and creation of self-contained tasks reduce the need for information processing. Investment in information systems and creation of lateral relations are strategies to reduce this uncertainty by increasing the capability of information processing but also has its limitations. Interpersonal characteristics as well as interdepartmental and interorganizational relations determine the organizational design problem, not just task uncertainty. Therefore, equivocality has to be reduced besides uncertainty. The additional factors are presented and integrated in a new model based on the original theory. The relevance of organizational information processing theory in the context of IT is demonstrated by practical examples, for explanation, justification, and integration of IT. Theoretical basis can be used to disclose possible reasons for problems and different outcomes which are arising in the case of IT adaptation.

Keywords Organizational Information Processing Theory • Review • Advancement • Information Systems

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Abbreviations

CNC	Computerized numerical control
ERP	Enterprise resource planning
IS	Information systems
IT	Information technology
OIPT	Organizational information processing theory

5.1 Introduction

In the contemporary environment, growth of information technology (IT) has not only contributed to the opportunity to make business processes interconnected but also supported organizations to adapt to its changing environment. Increasingly, organizations enabled by information systems (IS) often help to do work tasks more efficiently. In 1973, Jay Galbraith introduced an approach towards the importance of information processing in organizations. He developed "Organizational Information Processing Theory" (OIPT) in the context of businesses facing dynamic changes in their business environment. Galbraith recognized that firms often operate effectively despite different organizational structures and also described how firms can be organized to deliver performance effectiveness. This also includes development of possible strategies for managing organizational adaptation to new internal and external business situations. One of these strategies is the implementation of IS in an organization. This makes the theory relevant to researchers interested in examining impact of IS/IT on organizational redesign and adaptation for more efficient and effective organizational information processing. Considering its relevance for IS/IT researchers and practitioners, this chapter aims to review the original theory of organizational information processing and its proposed advancements.

The next section presents a summary and review of the existing theory of organizational information processing and its limitations. Following that, a discussion of related theoretical advancements and its different applications is presented. Recommendations for future research implications are outlined in the next section. Finally, the chapter presents a summary of the propositions derived from the literature and a conclusion in the end.

5.2 An Overview of Galbraith's Organizational Information Processing Theory (OIPT)

As many other theories used in the context of IS, OIPT has been developed for the purpose of organization design. In other words, Galbraith (1973) describes it as a so-called design problem of organizations. How can organizations be designed and structured in order to ensure their effective and efficient operations? To understand his way of thinking, theoretical background has to be outlined first.

5.2.1 *The Theoretical Foundation: Contingency Theory*

According to Galbraith's (1973, p. 2) views, there are following two rudimental conclusions of contingency:

"1. There is no one best way to organize.
2. Any way of organizing is not equally effective."

He argues that variations between different forms of effective organizations are not random. Besides variations there are certain organizational characteristics, which seem to make a difference. One of the characteristics suggests that each subtask is separately organized to ensure its effective performance. As a consequence, different structures are dependent on the subtask. To ensure the effective operation of these differentiated tasks, they have to be integrated into the whole task to achieve overall efficiency and effectiveness. The level of differentiation varies between organizations (Galbraith 1973).

The best solution to the design problem "is contingent upon the uncertainty and diversity of the basic task being performed by the organizational unit" (Galbraith 1973, p. 4). Although uncertainty is the central point in organizational design, but how it influences design policy raises a key question. Planning or decision making in advance is strongly limited by uncertainty. Galbraith (1973) states that "the greater the task uncertainty, the greater the amount of information that must be processed among decision makers during task execution in order to achieve a given level of performance" (Galbraith 1973, p. 4).

Information processing is the key concept concerning this theory. In this context, uncertainty means "the difference between the amount of information required to perform the task and the amount of information already possessed by the organization" (Galbraith 1973, p. 5). Further hypothesis suggests that organizational distinctions are nothing else but variations of three possible strategies of different organizations (Galbraith 1973, p. 4):

1. "to (...) increase their ability to preplan"
2. "to increase their flexibility to adapt to their inability to preplan"
3. "to decrease the level of performance required for continued viability"

Their relative costs and the amount of uncertainty determine the choice of a certain strategy. The amount of uncertainty itself depends on the specific task in a particular organization. But the amount of information which has to be processed to perform a special subtask is described by Galbraith (1973) as a function that is dependent on three variables. They are "the diversity of the outputs", "the number of different input resources utilized", and "the level of goal difficulty or performance as measured by some efficiency criterion" (Galbraith, 1973, p. 5). So, especially information processing during daily work is of interest in this context and an organization has the choice between finding ways of processing more information or avoid processing as the amount of information becomes extensive (Galbraith 1973, 1974). Based on theoretical elements presented here, we now move to the organizational aspects for theoretical development in the following section.

5.2.2 The Organizational Basis for Developing the Theory: The Mechanistic Model

Galbraith (1973) developed an abstract bureaucratic mechanical model (i.e., mechanistic model) as a hypothetical basis from which one can look at different organizational design strategies for dealing with increasing complexity in organizations. One of the big reasons for growing complexity in large organizations is the increasing division of labor to maximize performance (Galbraith 1973). In a manufacturing company, for example, a complex product has to pass a series of steps of production involving a large number of staff. These steps are obviously quite interdependent. Therefore, coordination between the different steps or working groups is necessary to ensure maximum performance.

A simple face-to-face coordination mechanism may be a good solution for small companies but definitely not feasible in large organizations. This design problem calls for a more formal and integrated solution. When looking at the steps of production with a high degree of division of labor, the organization has to process a certain amount of information to achieve a high level of performance. If task uncertainty increases, the organization has to process a higher amount of information for sustaining the desired performance level and therefore has to implement certain strategies.

Rules, programs, or defined procedures are a more simple approach to deal with design problem. Staffs working in different subtasks are taught possible situations and events that could occur while performing each subtask (Galbraith 1973): For example, a product can be ordered in different colors. Customers can choose from a predefined selection of colors. Supposing if the painting department receives such an order from the sales department, then all the steps of painting in this color are predefined. Further communication is not necessary. But there is also one problem: one has to know all the possible situations and correspondingly appropriate reactions in advance. During this process some learning effects happen, but a solution is just practicable for routine and job-related situations (Galbraith 1973).

In case of an unforeseen event, management becomes a challenge, for example, if a foreign customer orders the product in a special color, which is constrained due to national regulations and not part of the predefined selection. In addition, no product has ever been delivered to this country before. In such cases of new and exceptional instances, staffs are not prepared and there is no response prepared in advance available. Different departments (sales, design, assembly, and so forth) are involved. In such a scenario, the unexpected problem is solvable by hierarchy. Managerial roles are created to guide and make decisions in these unanticipated situations where different subtasks are involved, and therefore coordination is necessary. In case of management by exception, a decision is passed downwards in hierarchy to the lowest-shared superior of the involved subtasks (Galbraith 1973).

Galbraith (1973) emphasized that hierarchy is employed in addition to the rules, programs, and procedures mentioned above. It does not replace them. The problem thereby is that a person has a limited capacity to process or handle information.

Therefore, the different links in a hierarchy have this limited capacity, too. So, in the case of an increasing number of exceptions, a hierarchy can reach its maximum capacity of processing information with the result of an overload. To avoid this overload, the points of decision should be transferred downward in hierarchy to the points were the action takes place to ensure flexibility while uncertainty increases. One can do this by increasing the discretion of lower levels in the hierarchy despite another control problem. This is about how organizations ensure that the lower levels will react with appropriate behavior within that context. "Substitution of craft or professional training of the work force" (Galbraith 1973, p. 12) are possible solutions, but not sufficient (Galbraith 1973).

Workers are selected according to the skills needed to perform the tasks for which they are responsible. The problem is that by doing what seems to be the best for one task (e.g., craft standards), workers could fail the overall goal of the organization because of the interdependence between different subtasks (Galbraith 1973). The design department could refuse to redesign the product because it does not seem to be economically viable. A supervisor has broader information. He could recognize that sales of a particular product line may not be economical but can result in a large number of sales for another product line and result in profitability.

In addition to professionalization, an organization-wide perspective by goal- or target-setting processes is useful. Staff performing subtasks has to know the overall strategy of the organization in order to perform in a way which is appropriate to the whole organization's goals. Different subtasks are coordinated without specific rules or programs, so that workers can react flexibly to new situations with a focus on the overall strategy and goals. If one has to do tasks that have not been performed a few times before, the targets and goals are quite stable. But one has to consider that if task uncertainty is increasing as for example in the case of totally new product designs, the goals have to be adjusted (Galbraith 1973).

Standards calculated by using averages of, for example, past costs are not appropriate anymore. If the planned targets are not met, additional decision making becomes necessary. Therefore, more information has to be processed to solve the problem at a higher level of the hierarchy and to pass the new target downwards to the subunits. In this context, management by exception is the way to deal with problems. All the solutions mentioned above just work if task uncertainty does not increase more and more, because at a certain point, an hierarchical solution becomes overstrained by the huge amount of information which has to be processed. So an organization cannot persist by working as outlined by the mechanistic model because it will become overloaded at a certain point. Possible solutions are to decrease the amount of information to be processed or to increase information processing capacity (Galbraith 1973).

Galbraith (1973) proposes the following four different new design strategies to address information processing challenge. By creating slack resources or self-contained tasks, an organization can "reduce the need for information processing" (Galbraith 1973, p. 15). Investing in vertical IS and creating lateral relations are also strategic possibilities to increase the information processing capacity (Galbraith 1973, 1974). These possible strategies are discussed below in further detail.

5.2.2.1 Creation of Slack Resources

If an organization chooses to work at a lower level of performance, the number of exceptions decreases and therefore there is a decrease in the amount of task uncertainty. Less information has to be processed by the hierarchy and the target can be met much easier. Slack resources are additional costs because more resources are consumed on average (Galbraith 1973). In effect, a company may simply reduce its quality standards.

5.2.2.2 Creation of Self-Contained Tasks

An organization can also decrease the amount of information which has to be processed by adding the needed resources to perform the tasks directly to the different subunits. Self-contained units are created by using geographical areas as classification, for example, a product produced with the specific national requirements in a country to serve its local market. Output is now the method of measurement for performance instead of input that is used in the above-mentioned strategy. On the one hand, output diversity is reduced by specialization on one type of output and therefore the amount of information which has to be processed as well (Galbraith 1973). The central organization does not have to produce products for different markets and their national requirements anymore.

On the other hand, less division of labor away from the functional structure reduces information. Further, resources are not shared anymore by different units. Less special resources are employed because different units do not have sufficient demand (e.g., an expert in one field, so more generic people are employed instead of specialists (Galbraith 1973)). In summary, the number of exceptions can be decreased by a reduced level of performance, less diversity of output, or less division of labor according to Galbraith (1973). The next strategy shows how the capacity for processing can be increased to solve the organizational design problem.

5.2.2.3 Investment in Vertical Information Systems

Galbraith (1973, p. 17) suggests "employing computers", and "various man–machine combinations" to increase the capacity of information processing in order to avoid an overload of the traditional hierarchical channels, to provide additional new channels, and to implement new decision mechanisms. The result is the same as evident in the first two strategies. There are a less number of exceptions that have to be referred upwards in the hierarchy. The amount of investments needed depends on the amount of uncertainty faced by an organization (Galbraith 1973).

In case of exceptions because of unanticipated events or situations, existing plans as budgets, etc. have to be adjusted. If these events occur in an essential number, developing new plans is more efficient than adjusting the old ones. The frequency of replanning is increasing with increasing uncertainty. A higher frequency of replanning requires more capacity to process relevant information and therefore more investment in appropriate IT. So, investment in IT is "the cost of this strategy" (Galbraith 1973,

p. 17). At a certain point, humans are not able to deal with anymore amount of information which has to be collected and processed to the correct place in the hierarchy where it is needed. They require assistance by IT to avoid getting overloaded. Per planned time unit, a higher amount of information is processed while the number of exceptions decreases and therefore the danger of overload (Galbraith 1973).

Galbraith (1973, p. 31) identifies four following policy dimensions influencing the choice of a vertical information system context:

1. "*Decision frequency*, or *timing* of information flows to and from the decision mechanism": the information flow can be continuous or periodic in extreme. This influences the number of exceptions as mentioned above (Galbraith 1973).
2. "*The scope of the database* available to the decision mechanism": it is either a global or a local database. The best solution of a problem differs in these two cases. A larger scope results in additional information channels and therefore in higher costs. An interesting point in this context is that global databases avoid furthermore problems in behavioral control. But if managers of subunits use global information, they have to be directed by goals which are aligned to a global goal system. "Motivation, cooperation, and conflictresolving technologies" are limiting factors of effectiveness instead of cognitive factors if computers are used. Reward systems, lateral relations, or self-contained groups can help performance in such contexts (Galbraith 1973, p. 33).
3. "*The degree of formalization* of the information flows to and from the decision mechanism": the usage of formalized languages allows to process more information. Costs for specialist and for training of staff occur, but information can be formalized to a certain degree depending on the type of uncertainty. Information about ambiguous activities is difficult to be formalized. Formalization cannot really deal with unique events, but can be employed well if the factors are known but their values are missing. It has to be considered that more information can also lead to an overload of the decision mechanism if it is done without appropriate means of processing (Galbraith 1973).
4. "*The capacity of the decision mechanism* to process information and select the appropriate alternative": processing just more and more information can result in an overload. Therefore, the decision mechanism capacity has to be expanded relative to the other three policy dimensions. In this regard, group decision mechanism or IT is possible in principal directions as suggested by Galbraith (1973).

Especially policy dimension two shows how different design strategies may be employed together to achieve greater effectiveness. Galbraith (1973) goes on further and describes possible prototypes for IS: *local periodic systems* do not take account of interdependence or uncertain environment, but are quite "simple and inexpensive" (Galbraith 1973, p. 36). Decisions are made if data are collected. In *local real-time systems* instead, data collection takes place at a low and local level continuously and decisions are made if needed and manually dominated. Such a system is considered to be inexpensive (Galbraith 1973).

Global periodic systems include interdependence and enlarge the capacity of information channels by using formalization for information collection. Decision making is machine-aided and takes account of global goals of the organization.

On-line, real-time systems collect formalized data continuously on a global basis which makes them very expensive. Man–machine systems are involved in decision making and actions are consistent between different units and new situations are taken into account. Galbraith (1973) sees a problem in the "inability to create new organization structures to fully utilize the computers" (Galbraith 1973, p. 42) because of lack of culture and fear of loss of power. This was a very important point during the 1970s when IS were very new at that time, but is still valid today.

5.2.2.4 Creation of Lateral Relations

If processing information may result in overloads, one should avoid the necessity for processing. In other words: decisions making should take place at a level in the hierarchy where the information that is needed is available without processing. Decision making has to be passed down from higher levels to lower levels. So information does not have to be processed anymore at higher levels for making these decisions. An example is managers of different subunits who talk to each other in order to deal with an unanticipated event. The managers of the design and assembly departments solve the problem on their own without involving a superior part of the hierarchy. Decision making is decentralized again as mentioned above, but self-contained groups are not created, although temporary teams can be formed as task forces (Galbraith 1973).

In case where there is a high frequency of interdepartmental contacts, a liaison role as proposed by Galbraith (1973) would be a better solution to support and coordinate these lateral relations. However, by passing more and more decision-making authority downwards, the decision makers are more far away from the organization's leaders and its overall goals and strategies. Galbraith (1973) suggests solving these problems of leadership by creating a role of integration. This person (e.g., a product manager) is a representative of the general manager in the lateral decision processes to ensure an alignment of the decisions with the overall strategy and goals of the general manager and organization. The question remains, how much power and influence should be assigned to this person, who can just play a supporting role in the case of information. Budget control could be the role task or the whole organization can be organized following the matrix design with dual reporting relations (Galbraith 1973). But these dual reporting relations can also cause problems. People in subordinated tasks are faced with two supervisors. This situation could lead to more uncertainty if the different roles are not defined very well.

The question is now which strategy should be chosen by an organization. The answer depends on the environmental context. Strategies can also be combined. A company can choose the strategy with the lowest relative costs compared to the others. Galbraith (1974) sees his four strategies as "an exhaustive set of alternatives" (Galbraith 1974, p. 36). So "the organization must adopt at least one of the four strategies when faced with greater uncertainty" (Galbraith 1974, p. 36). If no strategy is as such adopted, the performance is reduced which means nothing else other than an adaptation of the first strategy. The amount of information needed and the processing capacity "are always matched" (Galbraith 1973, p. 19), even if not consciously. Equality can result by schedule or budget overruns if the organization decides nothing. Therefore, companies should plan their organization simultaneously with increasing uncertainty which can be caused by new products, manufacturing processes, or technologies. Otherwise, slack resources solve the overload of the hierarchy (Galbraith 1973).

This theory seems to be accomplished on the first view, but is not there, and other factors need to be considered as well. The next section deals with the limitations and tries to explain eventual reasons for them.

5.3 Limitations of the Organizational Information Processing Theory

Galbraith (1973) describes IS just as one possibility to solve the problem of organizational design. In historical context, when the theory was developed in the 1970s IS were the state-of-the-art and far from being used in most organizations or industry sectors. It was the time of change from manual to electronic data processing and introduction of new technology. This technology was comparatively expensive and its introduction was confronted by a lack of experience to use this equipment. Another explanation is the limited performance of the host systems compared to their costs. They were only affordable for large enterprises.

The first mass-produced microprocessor was presented in 1971, which allowed turning away from host systems. But the potential of computers was not recognized until early 1980s. Computing at home started then in the 1980s with for example the Commodore VIC20. This is a point that can be seen as a disadvantage of Galbraith's theory, but does also contain the opportunity to connect IS with its organizational background and to justify and explain its development during the last few decades. These theories seem to be quite limited to its time of origin. But it offers potential for development and advancement in future.

Galbraith (1973) investigated organizational design problem from a more technical perspective. However, personal and individual information restrictions and interpersonal characteristics are mentioned briefly, but not really taken into account concerning his theory. But these perspectives influence information processing and decision making and therefore overall effectiveness of the organization. Zmud (1979) illustrates different aspects of individual differences and their impact upon the success of management IS. Individual differences were classified by cognitive styles, personality, demographic, and situational variables. Galbraith (1973) emphasized the quantity of information and highlighted its narrow limitation. Information quality seems to be important as well (Stock and Tatikonda 2008). Media richness theory adds richness as a characteristic of information (Daft and Lengel 1986) and is explained below. Stock and Tatikonda (2008) equate these two terms of quality and richness of information. Even so where information is not rich, it can have a certain quality that is not necessarily low.

Other studies, such as Cooper and Wolfe (2005), developed an information processing model of IT adaptation by linking Galbraith's original theory with innovation diffusion literature. They argue that Galbraith (1973) focuses only on uncertainty and its reduction by adapting appropriate strategies to achieve "organizational coordination and control" (Cooper and Wolfe 2005, p. 32). But uncertainty reduction is often not the only factor which determines whether IT adaptation is successful or not. They refer to Leonard-Barton and Kraus (1985) who have described that "different frames of reference among adaptors and users" (Cooper and Wolfe, p. 32) can lead to ambiguity and therefore maybe to a higher amount of uncertainty. The adaptation of a system could be just counterproductive in this case. Just more available information does not really provide support in making decision without coordination in the case of departments with huge cultural differences and therefore arisen conflicts (Cooper and Wolfe 2005).

Flynn and Flynn (1999) have found out that no positive impact is generated by investments in IS to reduce uncertainty in manufacturing plants, which is quite remarkable. But it can be explained if one takes social factors more into account. Bensaou and Venkatraman (1995) confirm instead in their study that performance can be increased in the case of supply chain management by matching uncertainty with appropriate information processing capacity in interorganizational relationships. Further manufacturing–marketing interface literature confirms such coherency in that regard (Gattiker 2007).

Although not surprising, people of different companies but with the same educational background work together in the case of supply chain management (e.g., technical sales and technical purchasing departments work together). They talk the "same" language. Ambiguity is rather unlikely. If a whole plant is in focus of the investigation, distinctively different departments and people have to work together. The likelihood of ambiguity is much higher. Fairbank et al. (2006) point out that the relationship between information processing designs or strategies and performance is not linear as explained by Galbraith (1973). It is a lot more complex. Even having different designs is not equally effective and depends on the strategy of the organization (Fairbank et al. 2006).

Gattiker (2007, p. 2899) argues that "standard operating procedures" and "hierarchical referral" are not effective enough in the case of increased uncertainty. They can enable better information processing until a certain and very limited degree. These strategies are more of a first step. But they are not obsolete, because this is the necessary basis to implement other effective but also expensive strategies. According to the original theory, uncertainty can be just addressed by intra-organizational standardization (Chou and Chang 2008). But there are other ways to do this; firms have started to work more together as shown in the past and the external perspective as mentioned but not included by Galbraith (1974) is also essential.

Fairbank et al. (2006) argue that the strategy concerning investment in lateral relationships needs a broader meaning with an interorganizational perspective. They describe it as managing the environment and added two further possibilities of employing IT. IT can be used for enabling and maintaining alliances and partnership between firms, which is an interorganizational perspective. Galbraith (1973) focused on IT in order to reduce "dependence on external suppliers" (Fairbank et al. 2006, p. 296). But IT can be also used to learn more about the customer (e.g., customer relationship management). As mentioned above, the original

Table 5.1 Shortcomings of the original theory (Identified from Burke et al. 2001; Chidambaram 1996; Chou and Chang 2008; Cooper and Wolfe 2005; Daft and Lengel 1986; Fairbank et al. 2006; Leonard-Barton and Kraus 1985; Morton and Hu 2008; Stock and Tatikonda 2008)

Information quality and richness	A fit between quantity and quality is necessary to make information useful and helpful.
Ambiguity	Users may be located in different frames of references. Task uncertainty is not the only factor.
Interorganizational perspective	The focus of the original theory is the interior of one organization and not interorganizational.
Nonlinearity	The relation between information processing and performance is not linear.
Duality	Information technology can be a solution but also a reason for uncertainty.
Social cognition	Interpersonal characteristics and information restrictions are not taken into account.

theory saw the implementation of IS just as a possible reaction among others to solve the organizational design problem. Another problem consideration in this context is that IS could be a highly new technology, especially when the theory was developed, and should therefore increase the amount of uncertainty as well. So an organization has to choose between one of the other three strategies to deal with the increased amount of uncertainty caused by the implementation of IS. This duality (Morton and Hu 2008) is referred in later discussion. Table 5.1 summarizes the important shortcomings of the theory.

Various theoretical advancements have been suggested to override such limitations. A selection of these advancements is discussed in the next section.

5.4 Theoretical Advancements

The original theory has been used in number of areas including IS because it provides multiple opportunities to explain situations and offer solutions in a wide range of management tasks. Two advancements which address main limitations of the original theory are discussed in this section: the inclusion of equivocality and consideration of social cognition.

5.4.1 Information Processing Theory and Equivocality

Uncertainty does not seem to be the only important factor. Divergent frames of references have to be reconciled in order to ensure effective IT adaptation which can be achieved by equivocality reduction according to Cooper and Wolfe (2005). Daft and Lengel (1986, p. 556) define equivocality which can be seen as a new constraint as "ambiguity, the existence of multiple and conflicting interpretations about an organizational situation." Media richness theory includes this factor in opposition to Galbraith's original theory. According to Cooper and Wolfe's (2005) extended approach, information is processed not only to achieve a reduction in uncertainty as Galbraith (1973) has suggested but also to reduce equivocality. Additionally, Daft and Macintosh (1981) describe two possible reasons for equivocality which are summarized by Cooper and Wolfe (2005, p. 33) as follows:

1. “A complex task with cause–effect relationships that are not well understood”.
2. “A task’s underlying meaning may not be as well understood, because its compatibility with the organization’s history and current direction might be open to question”.

Moreover, the two factors, equivocality and uncertainty, are also different. Uncertainty is reduced by getting the appropriate information, while equivocality by producing answers (Cooper and Wolfe 2005).

Media richness theory distinguishes between lean and rich media. The latter is more effective in reducing equivocality than the first one and is classified according to Cooper and Wolfe (2005, p. 33) by enabling:

1. “quick feedback allowing questions to be asked and clarifications to be made in a timely manner”
2. “multiple cues (...) to provide an array of information”
3. “language variety”
4. “personal focus wherein messages can be tailored to the mental model, needs, and current situation of the receiver”

Face-to-face discussions are part of this category, whereas unaddressed written documents, as for example quantitative reports, are, therefore, the so-called lean media. These work quite well to reduce uncertainty, but not to reduce equivocality. Therefore, according to media richness theory, an organization’s effectiveness depends on the “matching of information processing volume and richness to task uncertainty and equivocality” (Cooper and Wolfe 2005, p. 33).

Previous studies (Cooper and Wolfe 2005; Daft and Lengel 1986) go further in contrast to Galbraith (1973) and point out external environment, interdepartmental relations, and technology as sources of uncertainty and equivocality. In the context of IT, the importance of these three sources depends on the respective stage during an adaptation process. The environment of an organization is often a source of ideas and examples for probable new technology which can be adapted. But if the decision to adapt a particular technology is made, relations within the organization become quite important as well as the new technology itself and then the external environment of an organization concerning uncertainty and equivocality (Cooper and Wolfe 2005).

The intensity of interdepartmental relations depends on the degree of interdependence between the departments and on the degree of differentiation. The first one can be caused by various reasons as for example jointly used resources or a successive product flow through different departments in the production chain of an organization (e.g., the production department uses the same maintenance department as the assembly department). The latter is often due to different kinds of profession categories whose members find it difficult to understand each other (Cooper and Wolfe 2005).

Interdependence makes coordination indispensable, because the action of one department may influence another department, either positively or negatively (Cooper and Wolfe 2005). This problem has got various aspects, not just in the field of information processing and IS, but also in other management disciplines. If an organization pays their department managers according to the targeted departmental result, while there is uncoordinated interdepartmental interdependence, managers are then made responsible for results that they cannot fully influence. The assembly department's manager is paid according to the number of assembled products. If the production department has quality problems, the following assembly department is affected as well. Its manager's salary is reduced but he/she cannot influence this situation.

Cooper and Wolfe (2005) pointed out that increasing interdependence leads to increasing uncertainty because autonomy and stability are recognized as decreasing by the departments. High differentiation between different departments is characterized by ambiguity concerning information processing and therefore the danger of arising conflicts and misunderstandings. In other words: high differentiation means high equivocality (Cooper and Wolfe 2005). This is often the case between technical- and commercial- dominated departments.

The so-called organizational technology is action-based. Variety and analyzability of the tasks have to be performed in order "to transform organizational inputs into outputs" (Cooper and Wolfe 2005, p. 34). Task variety depends on the frequency of unforeseen events; task "analyzability is related to the extent to which individuals are able to follow objective, computational procedures in completing a task" (Cooper and Wolfe 2005, p. 34), which means that systematic procedures can be used in the case of analyzable tasks. But on the other side, in the case of low analyzability, people cannot employ such procedures and have therefore to judge and interpret. Experience plays an important role in this context. If task variety is low, predictions are quite possible, people are used to the tasks, and so uncertainty is low (Cooper and Wolfe 2005). Working on the assembly line is an example.

Cooper and Wolfe (2005, p. 35) state, "successful adaptation of an IT (...) ultimately requires the reduction of uncertainty and equivocality to a threshold at which one is reasonably clear concerning what the IT is to accomplish, how the IT is to do so, and what organizational (re)design and member training are required." IT adaptation does therefore not only consist of installation, but does also include IT development and design, as well as the installing of organizational procedures and the necessary training of staff. By investigating the adaptation process of new imaging technology, six attributes, which seem to be important, have been formulated and added to the model: organizational diversity, IT pervasiveness, IT flexibility, IT radicalness, IT incompatibility, team member knowledge, and reframing. Multiple conclusions and proposals have been expressed concerning the influences of the different attributes on the success and efficiency of the adaptation process (Cooper and Wolfe 2005).

5.4.2 Information Processing Theory and Social Cognition

Burke et al. (2001) argue that people do not always choose media as predicted by media richness theory. They point out that media effectiveness is rather dynamic then static. Media effectiveness improves over time because users learn about the features and become more experienced. Social information processing takes social cognition and possible development of interpersonal relationship into account. The relational characteristics used as a fixed set in media richness theory change according to social information processing theory because of “normal but temporally retarded interpersonal development” (Burke et al. 2001, p. 125).

Users get to know each other because they are able to form mutual impressions even from text messages. They learn about how to use technologies and how to send and extract personal and relational information from messages, which seem to be rather impersonal. Users get experienced, media becomes richer, and, therefore, social information processing theory may explain how a special medium can allow more relational communication between groups. The difference to media processing theory is rather the rate of social information processing than the amount of exchanged social information itself. As a result social information processing includes the socio-technical interaction that was left out by media richness theory and takes account of group effects arising over time. One benefit from an internal perspective is the recognition of group effects. So, one can explain the development of system usage and effectiveness over a longer period (Burke et al. 2001).

Burke et al. (2001) have done empirical research to identify a potential increase in cohesion and process satisfaction over time depending on the different types of media. Cohesion is described “as the aggregate of the interpersonal attractions of individual group members to each other and to the group as a whole” (Burke et al. 2001, p. 126). Cohesion seems to be positively related with performance: “satisfaction with the group process includes relational and procedural aspects of the activity, member contribution, and participation” (Burke et al. 2001, p. 127). Process satisfaction depends on communication. Cohesion and process satisfaction are positively correlated. So, richer media should have a greater impact on satisfaction than leaner ones. According to this study, even leaner media enable groups to develop cohesion. Process satisfaction is not effected by media in such a degree that it is statistically significant. Each kind of media that was investigated seemed to be “equally effective at permitting alternative exploration and validation, participation and leadership contribution” (Burke et al. 2001, p. 136). In opposition to Daft and Lengel (1986), even complex tasks with a lot of ambiguity involved do not seem to need richer media. It has been assumed that they do need richer media in order to deal with the high amount of information required to reduce ambiguity. Especially by considering media employment over time, media richness does not seem to be as important as stated by media information processing theory (Burke et al. 2001).

Cohesion and satisfaction are dynamic factors as predicted by the social information processing theory according to Burke et al. (2001). This predicts that performance and therefore efficiency increase over time. Time is seen as a media user’s ally that allows learning and technology adaptation and the development of group dynamics. But we should not consider time as an overall means to increase performance. Other aspects have also been taken into account as appropriate coordination. Burke et al. (2001) added that in case of extreme differences rich media seem to be slightly more effective then lean ones. So there is a possibility to influence performance by the selection of a lean medium (Burke et al. 2001).

Chidambaram (1996) had already found out that relational affiliation takes place among groups who are using group support systems even under anonymity. Even if they are not known to each other, social impressions are generated by the received information over time and group feelings and attitudes are developed. Relatively impersonal systems do not prevent this development "if enough time passes and sufficient information exchange occurs" (Chidambaram 1996, p. 158).

In summary, the chapter has explained the original theory and various advancements to this point. The next section presents practical implications of the theory.

5.5 Organizational Information Processing Theory in Practice

OIPT is not a theoretical model to serve academic community. It is a theory with a wide application spectrum in practice, especially in the context of IS. In particular, the selection of IS architecture, enterprise resource planning (ERP) systems, and external technology integration are three applications seen in an IS context and are presented below.

5.5.1 Information Systems Architecture

Various aspects of information processing have been discussed in general and in the context of media and IS adaptation. An interesting question remains: Which IS architecture should be used to best meet the organizational requirements? There is no single solution; the required match is unique for each organization. Anandarajan and Arinze (1998) add that performance depends on a "match between contextual variables and structural design" (Anandarajan and Arinze 1998, p. 268).

Anandarajan and Arinze (1998) point out that the architecture has to be chosen according to the level of uncertainty. They have examined whether a match between information processing requirements and client/server architecture is necessary at all for an effective system by questioning organizational workgroups. A delivered value proposition is defined as an indication of an effective system, which is measured by user satisfaction. A match between task and technology is assumed to be the key to an effective system and therefore "the allocation of process resources between clients and servers" (Anandarajan and Arinze 1998, p. 266).

According to Anandarajan and Arinze (1998), higher task analyzability leads to an increased user satisfaction with a server-centric system. That is not surprising, because routine tasks can be highly automated (e.g., invoice practice). Low task analyzability lets users to be more satisfied with a client-centric architecture (e.g., customized production). Therefore, task and technology match is essential for the effectiveness of an organization's overall system. They further suggested that based on their results, computer systems for workgroups should rather meet the needs of the group itself than following an overall unique organizational policy

(Anandarajan and Arinze 1998). This point is important, but just to a certain degree especially from human and user satisfaction aspects. But one should keep in mind that negative influences can also result. The system has to be integrated and the different groups and departments should be aligned to the overall strategies of an organization.

5.5.2 Organizational Structure and ERP

Coordination becomes more and more challenging due to geographic distribution, mergers, and acquisitions. Especially integration efforts concerning suppliers and distribution channels make coordination more and more a key factor to success. Gattiker (2007) lines out three ways for organizations to react: "to increase capacity or inventory buffers", "to simplify production and other processes", or "to increase integration" within the organization (Gattiker 2007, p. 2896). He argues that Galbraith (1973) suggests just the first one as a possible solution. But Galbraith (1973)'s third strategy does also implicitly include integration because of overall coordination; in particular using vertical IS may provide a higher degree of integration.

One way often discussed to ensure a high integration and coordination among business functions is to use ERP systems. Gattiker (2007) investigates if ERP systems are effective in enabling integration between marketing and manufacturing. Integration seems to be necessary because of the high interdependence which exists between these functions or in the concept of information processing theory: a high degree of uncertainty. Therefore, a central statement emerged: "the greater the interdependence between manufacturing and marketing, the greater the benefit from ERP" (Gattiker 2007, p. 2896). But this impact should vary from organization to organization according to the information processing view, because ERP is seen just as one possible mechanism to process information. And as explained above, this mechanism has to match uncertainty and this uncertainty is special and different for each organization (Gattiker 2007). This is an important point with lots of implications particularly for practitioners because information processing theory is able to explain why the results and achieved performance of ERP are varying a lot between organizations.

Gattiker (2007) confirms with his study that there is a greater overall ERP benefit if there is a "greater ERP-enabled coordination improvement" and that a "greater manufacturing–marketing interdependence is associated with" (Gattiker 2007, p. 2902) such a greater improvement. Surprisingly, no evidence has been found that ERP-enabled coordination improvements do not increase with time since the system implementation as predicted above by social information processing theory. But task efficiency improves over time according to the study. Business processes become therefore more efficient mostly due to learning effects. But data quality, "the accuracy and relevance of the information provided by the ERP system" (Gattiker 2007, p. 2909), did not improve due to data organizing in the implementation stage or soon after it.

It is important to notice that ERP systems have been implemented already for more than one year and not the overall company was subject of this study (but in the context of manufacturing plants). This is not a study about implementing ERP systems. Thirty-eight percent of the variation in the overall impact between plants is due to manufacturing–marketing coordination improvements. Nearly 25 percent of coordination improvements can be ascribed to interdependence. This supports as predicted by information processing theory that interdependence is essential to uncertainty and that a higher amount of interdependence leads to a greater "benefit of a highly integrative coordination mechanism such as ERP" (Gattiker 2007, p. 2911). Moreover, it is not only additional integration but also the scope which is important (Gattiker 2007).

Gattiker (2007) has looked at ERP systems since its establishment for a certain time, but a more important question arises before its arrival: How can we ensure that ERP system implementation is successful? Or better: which type of organization seems to be the best one to fit with ERP systems? Morton and Hu (2008) propose that ERP is a highly function-integrating system which needs a high degree of standardization of business processes. Therefore, it is convenient for organizations with the same characteristics, i.e., highly formalized, centralized organizations (Morton and Hu 2008).

ERP system implementation requires that organizations move away from functional orientation to standardized business processes in a function-orientated structure, whereas an alternative solution in customization is considered as quite costly and risky. But does this high degree of interdependence caused and required by ERP systems have a negative impact? It should have one, but task uncertainty is seen to be much more powerful then task interdependence as a constraint. Therefore, the overall impact is positive. Unsuccessful implementation is quite likely if a fit between an organization's structure and the ERP system is missing. The risk of political conflicts or organizational resistance is much higher in this case. The implementation is considered unsuccessful if the targets concerning costs, time, and system performance are not met (Morton and Hu 2008).

Chou and Chang (2008, p. 149) argue that uncertainty is just addressed by "intra-organizational standardization, or interorganizational homogenization." Organizational intervention is also useful in uncertain scenarios. Uncertainty reduction is not just influenced by interdependence and differentiation but also by organizational mechanism and as already mentioned above, customization. Organizational mechanism is a managerial intervention which "refers to those activities aimed at improving organizational acceptance of the system by bringing organizational processes into closer alignment with the best practices of ERP" (Chou and Chang 2008, p. 150). Customization refers to the organizational acceptance of this alignment. Alignment is necessary because neither improvement in coordination nor task efficiency results automatically (Chou and Chang 2008).

5.5.3 External Technology Integration

Galbraith (1973) focuses on intra-organizational design problems (e.g., information processing problems between different departments), whereby his theory can be well adapted to interorganizational contexts. Especially new IS as mentioned earlier or new technology like computerized numerical control (CNC) machines have to be selected, purchased, and installed. This external technology integration process can be analyzed and described by information processing theory. Instead of task uncertainty, technology uncertainty is one important dimension. It is the difference between "the information needed by the recipient organization to obtain and implement the technology, and (..) the information the recipient actually has at the start of the" integration process (Stock and Tatikonda 2008, p. 68). Another dimension is organizational interaction. "Communication, coordination and cooperation" (Stock and Tatikonda 2008, p. 68) are components of this dimension that has an influence, as well as technology uncertainty, on the performance of external technology integration.

Analog to OIPT, a fit between these two dimensions is required, because the first one defines the needed processing requirements and the latter one the required processing capacity. Contextual factors like process experience with external technology integration, user participation, and project criticality have also been tested. The fit and all the contextual factors except process experience have an impact on the overall success. This could be due to very unique projects. The alignment between technology uncertainty and interorganizational interaction which are both managerial decision variables is essential in terms of performance. Interorganizational factors are as important as internal ones (Stock and Tatikonda 2008).

Ahmad et al. (2010) stated that interfunctional design coordination enables an organization to use mass customization by product modularity. Increased interdependence between R&D, marketing and manufacturing is due to the first one. The latter one creates a higher product variety and therefore more uncertainty in various contexts. This results in an overall necessity for more information processing. Interfunctional design coordination accomplishes better and more information processing between the different units and departments involved. This shows again how OIPT may help in various areas of application.

5.6 Recommendations

Galbraith's original theory has been used quite often, but a real empirical verification has not been done. That is maybe due to the nature of the complexity of the framework. Regardless, the conclusions made by Cooper and Wolfe (2005) were quite reasonable but they are just based on observation and technology diffusion literature. They can be used as a reference model in an IT adaption context, but an empirical investigation seems to be necessary to establish validity. Anandarajan and Arinze (1998) mentioned that further research is necessary, especially concerning the environmental characteristics of an organization. Previous studies have focused on an internal view and therefore neglected the direct influence of an organization's environment.

Empirical studies should take rather objective measures, but as Anandarajan and Arinze (1998) stated, perceived measures are the only possible ones for certain variables. And there is another issue to consider: IT is seen as a means to increase the quantity of information which is processed. But we have to consider the people who have to work with IS. This point is missing in the information processing literature. IS has to offer possibilities to motivate "actors to process information in an accurate and timely way" (Argyres 1999, p. 163). Aspects of organizational economics should be taken into account as well. IT can provide incentives to secure the quality of messages and to interpret the messages properly (Argyres 1999).

The information processing view provides a framework, but cost aspects should be further developed. Argyres (1999) combined organization information processing with transaction costs and agency theory to solve this gap. Transaction costs are caused by misalignment and potential opportunistic behavior as assumed by agency theory. Governance arrangements are a possible solution to exchange information at a relatively low level of transaction costs. It is not only enough to focus on the means of information processing but also consider communication incentives as well. In order to achieve a comprehensive understanding of the impact of IT on coordination and efficiency, both of these dimensions have to be analyzed (Argyres 1999).

Argyres (1999) investigated and analyzed the development and construction process of the B-2 "Stealth" Bomber by using information processing approaches among others and so expanded the previous field of these studies by an interorganizational use. This point of view has become more and more important and should be investigated further, because interorganizational cooperations, especially for projects with a limited duration and partnerships among equal partners, needs a theoretical background, in particular in the context of IT. The necessity of an addition by agency and transaction costs theory is much more obvious here than in a closed organization. But also within an organization, agency problems appear, for example, a misalignment of managers with the organizational goal and possible opportunism (Argyres 1999).

Transaction costs provide an explanation why organizations exist at all, namely, because of the lower transaction within a hierarchy for certain situations. This could be due to a significant cheaper access to relevant information (e.g., for inputs) (Argyres 1999; Williamson 1985). Organizations become more and more connected and integrated along the whole supply chain by use of IS. As Argyres (1999) pointed out, interorganizational standards that are essential in business relationships are required at a number of different levels as hardware, software applications, and operating systems. Finding these standards is quite difficult. At the beginning of such a business relationship, organizations have normally invested already in different IS which had seemed to meet their organizational needs. Here transaction costs theory argues that opportunism could avoid the adoption of a single standard at the system level because of these sunk investments. Organizations start to bargain in order to enforce their preferred standard. Argyres (1999) added that high uncertainty about IT can let organizations disagree about the optimal single standard. But especially common standards for communication are essential for the success of the relationship. They separate this highly integrated business model from independent firms which are operating together by market-based contract (Argyres 1999).

Galbraith (1973) stated that the selection of an organizational strategy depends on the relative costs of these strategies, but he did not clearly specify the cost aspect. In this regard, Argyres (1999) has considered and also points out two possible effects of IS on the organizational structure. A higher degree of decentralization can be realized by reducing agency costs, because IT allows monitoring of performance at a quite low level. It also reduces the costs of information processing between different levels of the hierarchy and could also prefer more centralization. These are obviously counteracting effects. Whether horizontal or vertical effect dominates is dependent on the relative magnitudes of both the effects (Argyres 1999). The magnitudes depend supposedly on the features offered by different systems. Anandarajan and Arinze (1998) investigated this point empirically while Argyres (1999) gave a theoretical explanation.

OIPT can provide explanation and recommendations for new business models. The connection with transaction costs and agency theory should be further investigated to include especially the cost and human dimensions to increase the applicability in practice. Galbraith (1973) suggested strategies, but no cost–benefit approach has been developed for the selection and use of strategies (Fairbank et al. 2006). Such an approach would be an important contribution to the theory. As Zmud (1979) has argued earlier after the introduction of Galbraith's theory, the central key issue should be a decision support system rather than an information system where users and their behavior should be taken more into account. The next section presents some concluding highlights of this chapter.

5.7 Conclusion

Organizations differ in their structure but can be equally effective. There is no single best design choice. Organizational structure depends on the uncertainty faced by an organization, especially on task uncertainty. Four strategies are possible to solve the problem of organizational design: creation of slack resources and creation of self-contained tasks reduce the need for information processing. Investment in vertical IS and creation of lateral relations are strategies to reduce this uncertainty by increasing the capability of information processing (Galbraith 1973, 1974).

OIPT provides a good basis for a perspective as an explanation and justification for the use of IT and on the other side for IT integration. The framework provides also a theoretical background which does disclose possible reasons for problems arising in the case of IT adaptation. So, organizations can use this framework to avoid problems. The original theory and its advancements does not just explain but also offers a wide range of strategies to solve emerging problems and then to support the process of solving the problems as seen in the case of IT adaptation.

Information processing theory has the advantage, as stated by Galbraith (1973, 1974), that it is an accomplished approach that includes all possible strategies and possible ways of development. Especially the extension of the information processing view by equivocality is an appropriate approach. It is not a question anymore of

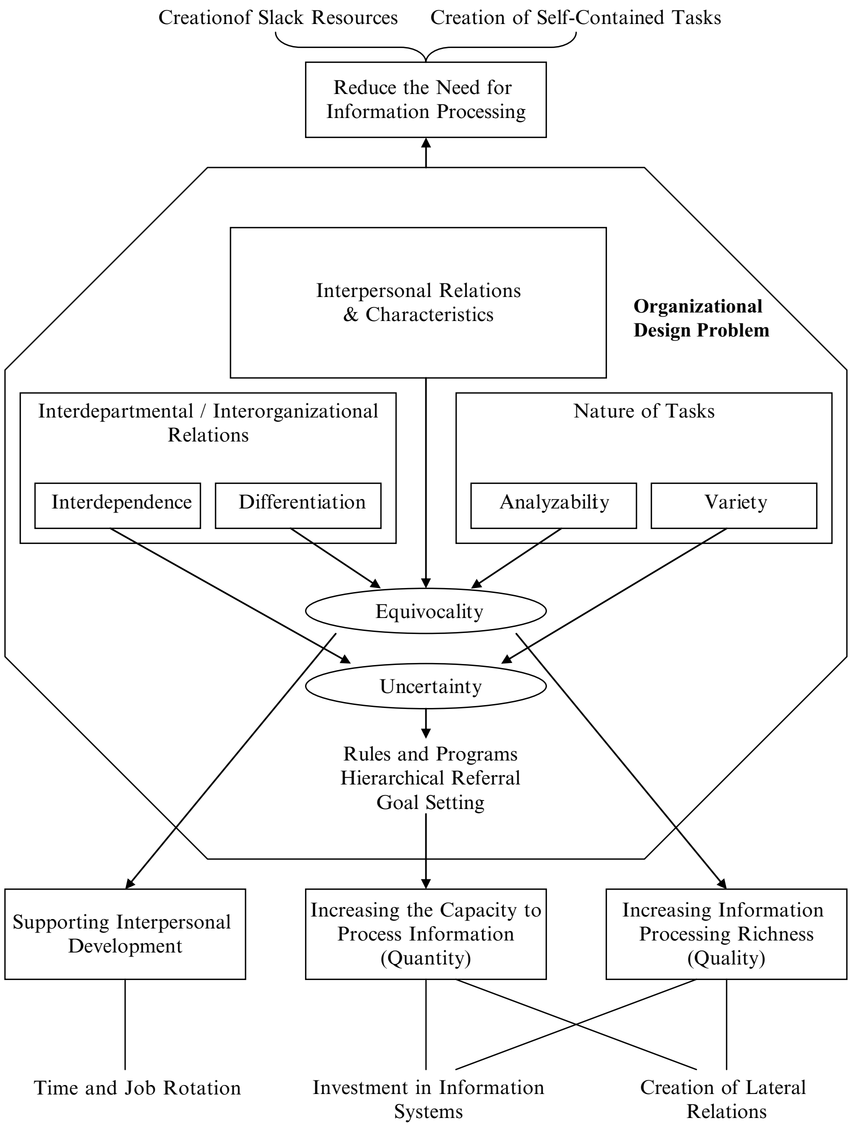

Fig. 5.1 A proposed *revision of the organizational information processing model* (Adapted and revised from Burke et al. 2001; Chidambaram 1996; Cooper and Wolfe 2005; Galbraith 1973, 1974)

whether organizations adapt IT or not. The degree of employment of IT may vary, but it would be hardly possible to stay in business without using computers in the current environment. The focus has changed over the last few decades since the original theory was introduced. And therefore the original design problem has changed more towards the question of how much IT should be introduced. The most important question in this context is how one should organize the adaptation of new

IT. Media richness theory provides a good approach in this regard, but has its weaknesses as mentioned above. Figure 5.1 illustrates a proposal for a more developed model which includes these specifications.

Organizational structure has been influenced in various ways by IT offering lots of possibilities and opportunities, but as it has become more and more employed, organizations have become dependent on it. Therefore, IT holds a danger. These aspects should be more investigated, because organizations have to face this danger of being overloaded by information which has to be processed in order to adapt and implement IT or IS. So, one of the original strategies proposed by Galbraith (1973, 1974) has become a case of organizational design problem on its own. This depends on a point of view and not everyone doing research in this domain of knowledge corresponds to one opinion. At least, it forms a starting point for adapting the original theory and for developing new theories. Lastly, IT is an antecedent as well as a consequence of actions. IT is a result of organizational action but it also causes organizational actions (Morton and Hu 2008). This duality has to be kept in mind within all considerations and decisions in an organizational context.

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Chapter 6
Scientia potentia est: Organizational Learning, Absorptive Capacity and the Power of Knowledge

Kimberly A. Zahller

Abstract An organization's ability to learn from past experience and observation of the environment around it affects the efficiency and effectiveness of its operations. Organizational learning (OL) theory broadly defines this process in terms of seeking, interpreting, and using knowledge, with the process triggered by a reference gap and resulting in learning. The ability of the organization to leverage knowledge obtained through OL results in absorptive capacity (ACAP). ACAP specifically measures how the organization acquires, assimilates, transforms, and utilizes new information, resulting in both knowledge and commercial outputs and competitive advantages. While OL describes the construction of the knowledge base, ACAP describes how learning results in performance, flexibility, and innovation. ACAP is especially critical in rapidly changing, complex, or highly uncertain environments requiring the assimilation of a great deal of information in contexts which may not be programmable. Today's digital environment, with the widespread availability of vast amounts of detailed, real-time information, renders the ability to screen, analyze, communicate, retrieve, store, and use new information into the key to increased performance, better organization–environment strategic fit, and lasting competitive advantage.

Keywords Organizational learning • Absorptive capacity • Knowledge base • Innovation

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Abbreviations

ACAP	Absorptive capacity
DLL	Double-loop learning
IS	Information systems
IT	Information technology
OL	Organizational learning
PACAP	Potential absorptive capacity
RACAP	Realized absorptive capacity
RBV	Resource-based view of the firm
SEM	Structural equation modeling
SLL	Single-loop learning

6.1 Introduction

The unofficial motto of academics everywhere is Francis Bacon's aphorism "*Scientia potentia est* (*Mediatationes Sacrae* 1597)." Organizational strategists, marketing researchers, R&D laboratories, and industrial espionage agents all have long ago embraced the idea that knowledge is power in the economic marketplace. In today's global economy, the pace of change and the range of alternatives have increased so markedly that an organization unable to adapt and learn will not survive. Consequently, the ability to learn has moved beyond performance improvement to become a competitive advantage.

To understand why similar organizations appear to possess different levels of knowledge and why organizations with the same knowledge use it with different degrees of effectiveness, we must examine the process by which organizations learn. Learning itself is not a static or simple concept. The process requires separate competencies in acquiring, interpreting, applying, sharing, and storing knowledge for future retrieval. These individual components must be integrated smoothly and must function continuously (although the rate may vary) in an iterative process for learning to be effective. Organizational learning (OL) theory attempts to chart this process, at least at a broad theoretical level, although researchers are hampered by issues of measurement, tacit knowledge, and the highly individualized nature of context and knowledge base.

The resource-based view (RBV) of organizational competitive advantage posits that organizations experience differential performance based on superior, or unique, resources which they command. Knowledge is a key resource, it is true. However, in the current digital age, with rapid and extensive access to a wide range of information, available in real time and in great detail, the ability of organizations to control knowledge unavailable to others has been sharply reduced. Absorptive capacity (ACAP) theory moves beyond the RBV view with its explanation of *dynamic* learning, or the ability of the organization to not only learn from basic relationships, but to leverage that knowledge to question and adapt processes, relationships, and applications.

Both OL and ACAP are necessary to understand how organizations increase and incorporate new knowledge and the subsequent effects on performance, strategy, and competitiveness. While OL explains the process by which information flows into (and across) an organization, is interpreted to create knowledge and is stored within the organizational memory, ACAP extends the theory to explain how knowledge may be leveraged to create *new* understandings, shifting organizational paradigms and creating, in turn, innovation and flexibility. In the next section, the OL model and its constructs are discussed. ACAP is introduced in the following section, and the chapter concludes with a discussion of implications in today's digital society and for future research.

6.2 Explaining the Learning Process: Organizational Learning

6.2.1 Description of the Model

Justice Potter Stewart, when pressed to define hard-core pornography (*Jacobellis* vs. *Ohio* 1968), was unable to offer a rigorous definition, but famously stated "I know it when I see it." OL seems to suffer from the same nebulousness: instances of learning can be easily recognized, but concrete definitions of either the components or process evade formulation. The difficulty stems partly from the problems inherent in trying to operationalize and measure tacit, cognitive constructs and partly from the context-sensitive nature of learning: each organization will have a different knowledge base of experiences, definitions, and relationships based on the different abilities, knowledge, and experiences over time of the individuals that comprise that organization. Consequently, an impressive array of theorists has turned its attention to the problem but, while there are broad similarities, significant differences remain in definitions, constructs, and approaches.

The theory began to emerge in the 1960s from the fields of organizational theory and social psychology (Cangelosi and Dill 1965; Cyert and March 1963; Weick 1979), and gained in popularity with management researchers following the work of Argyris and Schön (1978). In the early years, a significant debate occurred as to whether organizations could learn, or if learning should properly only be measured at the individual level. Fortunately, this argument has been resolved: while organizations do not possess an organic brain, they do have "cognitive systems and memories" (Hedberg 1981) which preserve, transmit, and utilize past experience in the form of shared policies, norms, operating standards, and world views. Nevertheless, learning does begin with individuals and does not pass into organizational experience and memory until the new knowledge is communicated with others and incorporated into the system. Consequently, the unit of analysis for OL may be (1) individual or subgroup learning, (2) OL, or (3) interactions between the two levels (Cangelosi and Dill 1965).

Organizations do not lend themselves well to experimental manipulation and theory testing in laboratory settings, which has hampered the ability to formulate a single, authoritative model. Learning itself is a cognitive, tacit process and its operationalization remains difficult. The definition of "learning," itself, remains problematic; there is an ongoing debate as to *when* OL takes place, with the alternatives being when the organization (1) adds to its knowledge base or pool of potential alternatives but does not change current actions/processes, (2) alters current actions to correct errors, but does so blindly, without conscious attempts to understand or modify the action–outcome relationship, or (3) may exhibit both characteristics. The majority view, with which this author agrees, is that learning is a continuum, with most organizations falling somewhere between the two extremes. Individual organizations may occupy either of the two end points (pure research or trial and error experimentation) at different points in their life cycle, and what is discovered at those times may not be immediately applicable but increases organizational understanding of their environment. Additional information leading to increased understanding constitutes learning, even in the absence of an immediate action. Over time and across functions, however, learning should reflect a mixture of both process (learning) and product (knowledge/decision).[1]

Definitions of OL include adaptation (Cangelosi and Dill 1965; Cyert and March 1963), assumption sharing (Argyris 1976, 1977a, b; Argyris and Schön 1978, 1996), and the creation of institutionalized organizational memory (Levitt and March 1988; Shrivastava 1983; Shrivastava and Mitroff 1983). Duncan and Weiss (1979) emphasize the construction of the organizational knowledge base in their characterization of OL as "the process within the organization by which knowledge about action–outcome relationships and the effect of the environment on these relationships is developed (p. 84)." Huber (1991) emphasizes OL's effect on the potential for change: "an entity learns if, through its processing of information, the range of its potential behaviors is changed (p. 89)."

The latter two definitions are combined with Daft and Weick's model (1984) of the organization as an interpretation system in constructing a proposed model of OL (Fig. 6.1). The overall learning process begins with a "reference gap" from error or lack of knowledge (Cangelosi and Dill 1965; Duncan and Weiss 1979; Miles and Randolph 1980). This gap, when recognized, leads the organization to search for knowledge from the environment or its own memory, apply rules and procedures from its prior knowledge base to interpret the new data, and act. The actions produce learning by either additions to organizational memory or corrections to performance gaps (Daft and Weick 1984). Huber (1991) also includes two key constructs of (1) information distribution within the organization and (2) the storage and retrieval of data from organizational, recognizing that an organization's ability to learn is also a function of how widespread knowledge is among its members and the ability of the organization to draw upon past experience to guide current interpretations and future actions.

6.2.2 Antecedents

Learning is driven by a need, or what Duncan and Weiss (1979) refer to as a *reference gap*. There may be the need to resolve an error between organizational expectations and actual outcomes, to resolve a strategic mismatch between the organization and its

[1]But see Fiol and Lyles (1985) for an argument against learning as "adaptation."

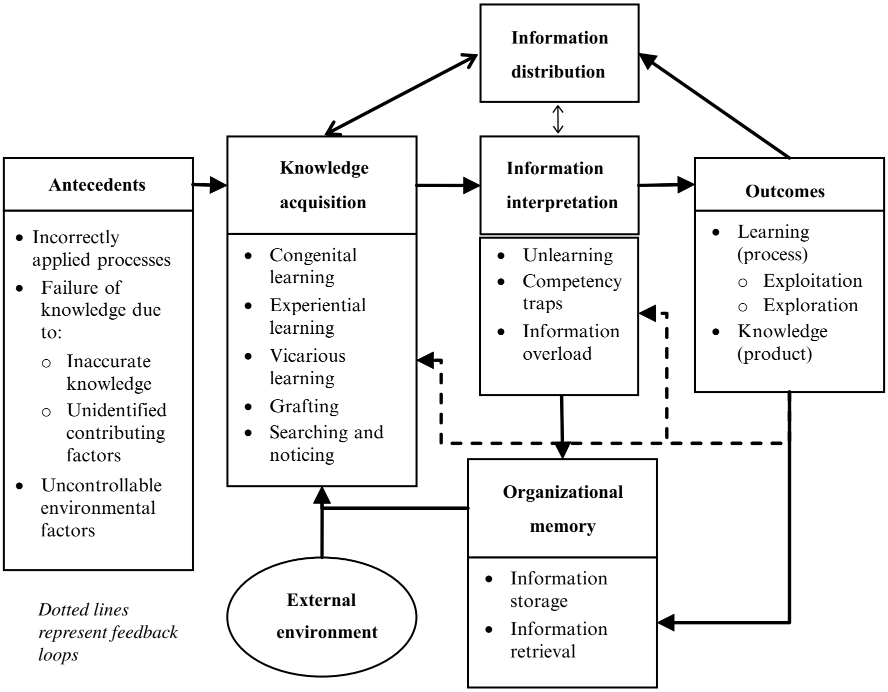

Fig. 6.1 Proposed model of organizational learning (based on Daft and Weick 1984; Duncan and Weiss 1979; Huber 1991)

environment, or simply to build a pool of experience and history for new organizations. The most common driver is the need to resolve an error between organizational expectations and actual outcomes. If the error is not due to environmental uncertainty or to mistakes in implementing (correct) processes, the organization activates the learning process and seeks to adapt its goals, diagnostic signals, or search rules. As long as the reference gaps are small, reflecting insignificant problems, the stress created (Cangelosi and Dill 1965) will be minimal. Organizations will not overcome inertia and initiate the learning process until stress has become significant via the magnitude of a single gap or a cumulative effect of ongoing errors.

6.2.3 Constructs

With the *knowledge acquisition* construct, the organization scans both the internal and external environment and seeks valid data and processes. The information found is used to explain, modify, or create action–outcome relationships and the assembly rules (collections of related action–outcome relationships) used in combining these relationships to achieve organizational goals and is then added to the organizational knowledge base. Information in the knowledge base may be present at the organization's birth ("congenital"), be directly acquired from experience, be indirectly acquired through observation of others ("vicarious"), or may be grafted onto the organization by importing individuals with requisite missing skill sets (Huber 1991). However, scanning will only be initiated when a problem is perceived and perceived to be significant enough to merit the expense and effort of search. In many cases, problems may be hidden in aggregated or interdependent data, may go undetected due to missing variables in the organization's operational model, or may simply be ignored.

Huber (1991) uses a construct of *information distribution* to focus our attention on the critical role of intra-organizational communication in OL. Information distribution consists of (1) the likelihood that a subgroup needing information and another subgroup possessing that information "find each other" and (2) the speed with which the match up occurs. Further, the construct should also encompass issues of intra-organizational communication (channels, frequency, policies, norms, and extensiveness) and trust (Argyris 1967; Cangelosi and Dill 1965; Duncan and Weiss 1979). The proposed model of OL indicates that information may be distributed within the organization in the form of raw data, interpreted data, or outcomes from action taken. Information distribution does not mean that all subunits of the organization possess the same information in the same degree: specialized learning may occur in individual groups, with only broad rules or interpretations communicated to the organization as a whole, which is a way of reducing cognitive overload. However, the more units possessing a common understanding of at least the overarching goals, definitions, and cause–effect relationships, the greater is OL.

New information is compared to the information stored in the knowledge base as part of the *interpretation* process, when the organization attempts to expand current knowledge, adapt/alter current processes, or detect current or potential misfits between the organization and environment. This is the phase in which organizations make sense of stimuli and engage in testing assembly rules through iterative cycles to find a solution (Weick 1979). In so doing, organizations will be affected by the cognitive maps they have already developed, information overload and strategies to manage it, framing effects, the necessity for unlearning, and the richness and variety of the types of information available (Huber 1991).

The learning process is not short, easy, or costless, so firms will avoid change, and the associated uncertainty, as long as possible. This creates a certain inertia, as organizations tend to (1) not actively seek new, possibly conflicting information, especially in stable environments, and (2) stop with the first, not necessarily the best, working interpretation. Organizational assumptions, if not challenged, will bias the information selected, the rules applied, and the interpretations derived (Argyris and Schön 1978; Shrivastava and Mitroff 1983). These assumptions create the cognitive schemas with which all data are screened and interpreted and which incorporate managerial preferences, expressions of organizational legitimacy (i.e., congruence with social values), assumptions regarding scope and boundaries of knowledge search, and the degree to which knowledge has been shared within the organization and embedded into the organizational memory. In other words, organizations will satisfice instead of optimize by not seeking for possible unknown but superior rules (Cyert and March 1963).

When errors occur or environments change minimally, these changes are normally dealt with by simple refinements of response or switching with behaviors available in the existing knowledge base. When environmental changes are large, requiring a substantial response or possible change in organizational strategy, however, frequently the organization must "unlearn" the old response and replace it with a new system of action–outcome relationships, definitions, assembly rules, and goals (Hedberg 1981). Unlearning is difficult and lengthy, especially so as organizations are frequently reluctant to acknowledge the necessity because it is such a painful process. Typically, a significant problem will arise, creating environmental turbulence and initiating search. As the search proves ineffective to still turbulence, the organization suffers a breakdown of their current schema and valid processes, resulting in either paralysis or unlearning and relearning (Hedberg 1981).

Ironically, the more successful an organization has been, the more difficult unlearning will be as past success has reinforced their theories used in interpretation (Levitt and March 1988). Competency traps may emerge, where favorable performance with inferior procedures causes the organization to accumulate more experience with the inferior procedure, rather than seeking, evaluating, or acquiring experience with available superior procedures. Superstitious learning may take place, where the organization has a positive outcome following a course of action, but the true relationship is misspecified or the true drivers hidden. Even the definition of success may be ambiguous and lead to difficulties: different groups will have different goals which will be negotiated within the organization and the resulting definition will be highly dependent on organizational power. New leaders, hired to graft new knowledge onto the organization will import new theories and tend to discount past success. Finally, targets for performance will change over time as new indicators of success emerge and aspiration levels for indicators change. In all of these cases, the feedback loop from learning to both scanning and interpretation will be affected, as errors creep into screening criteria and assembly rules.

Organizational memory, or the ability of the organization to encode, store, and retrieve information from past experience, is created by and helps create OL (Huber 1991; Levitt and March 1988). In order to be useful, learning must move beyond individual/subgroup learning and into the organizational memory, creating organizational knowledge that is communicable, consensual, and integrated with prior knowledge (Duncan and Weiss 1979). Learning occurs following interpretation of information and represents a "consolidating" phase, when the new understandings are encoded into organizational memory with any required adaptations (Cangelosi and Dill 1965). The size and variety of the pool of alternatives, as well as the intensity and direction of search among the alternatives, determines the rate of OL (Levitt and March 1988). Learning is an iterative cycle and, as the knowledge base expands and the cognitive structures within organizational memory are elaborated, decision making will become faster and more able to process greater amounts of complexity and ambiguity (Argyris 1976; Cangelosi and Dill 1965), granting a competitive advantage to organizations in highly uncertain or rapidly changing environments.

6.2.4 Mediators and Moderators

In general, the greater the *complexity of the environment*, the more data that will be required by the organization and from a greater variety of sources, all with varying degrees of validity (Weick 1979). However, complex, rapidly changing environments can block OL due to cognitive overload (Hedberg 1981; Huber 1991), so organizations may react by increased use of screening devices which then strengthen existing biases and blind spots. Complexity may be in terms of product mix, interdependence with others, or the size and diversity within the organization, among other factors.

Ambiguity in the environment creates uncertainty in the meaning and importance of signals received, the proper action–outcome relationships and assembly rules to apply in interpretation, and even which goals the organization should pursue. Consequently, as signals become more ambiguous, fewer assembly rules from organizational memory are used and those only at a very general level. With fewer rules, decisions cannot be programmable and the organization must engage in more iterative and incremental testing and experimentation cycles (Daft and Weick 1984; Weick 1979). Conversely, in extremely stable, well-known environments with little ambiguity, more (and more detailed) assembly rules are used and fewer cycles are required. Important predictors for the degree of ambiguity in an organization's informational environment include uncertainty of objectives and of action–outcome relationships (Earl and Hopwood 1979).

6.2.5 Outcomes

Learning is the first of the major outcomes modeled by OL theory, and reflects changes to the process of acquiring, interpreting, adapting, and using new information. Adaptation may vary from correcting errors to more complex learning leading to questioning and adapting underlying organizational assumptions, values, and goals. Argyris refers to these as single-loop learning (SLL) and double-loop learning (DLL), respectively (Argyris 1976; Argyris and Schön 1978). SLL in itself is not incorrect, as it reflects an organization's continual process of incremental adjustments between expectations and outcomes. However, unless the organization also questions whether it is doing the right things, not simply whether it is doing things well (i.e., DLL), SLL runs the risk of holding organizational performance to a constantly improving, but increasingly irrelevant, goal.

Another measure of learning as a process involves differentiating between end goals of either exploration or exploitation (March 1991). Exploitation learning focuses on process improvement, of reducing variation and improving predictability. This produces an emphasis on narrowing the gap between expectations and outcomes, and reducing performance stress. Exploration learning, on the other hand, focuses on testing, expanding, and altering the boundaries of knowledge. This emphasis results in great variation in performance, but allows faster reactions to a changing environment and leads to greater innovation. A healthy organization will exhibit both exploration and exploitation learning, although the relative proportions will vary across time and circumstances (March 1991).[2]

Knowledge gained or *decisions* made constitute a second measure of learning as a product. This measure is difficult to operationalize as a reflection of added data points which may confirm, clarify, or expand existing relationships and processes, but not create obvious changes in organizational actions. A more useful operationalization of this measure is strategic change and fit between the organization and its environment. Daft and Weick (1984) relate organizational data search and interpretation strategies with the Miles and Snow typology (1978). Earl and Hopwood (1979) use Thompson and Tuden's (1959) model of decision making under uncertainty to explain how organizations screen, interpret, and manage information in terms of information source (official vs. unofficial) and information characteristic (routine vs. nonroutine).

A third measure has been proposed that more closely links learning to the strategy and innovation literature; instead of product or process improvement, the *rate or degree of management innovation* is seen as the critical indicator of OL and determinant of the organization's future health and survival (Stata 1989). This measure demonstrates the transition from OL's focus on how organizations learn to ACAP's emphasis on learning effectiveness.

6.3 Differentiating Learning Capabilities: Absorptive Capacity

6.3.1 Description of the Model

Heraclitus of Ephesus wrote "Much learning does not teach understanding (*Fragment 16* c. 500 BCE)." In much the same vein, where OL seeks to explain the process by which organizations learn ACAP measures how well the organization learns (or produces understanding). The theory was introduced in 1990 by Cohen and Levinthal as a way of explaining why some organizations are significantly more competent at learning and adapting. ACAP extends OL theory by differentiating firms able to recognize the value of new, external information and firms unable to look beyond current, internal processes and thus suffering from an inability to innovate. The unit of analysis is always the organization; however, it is recognized that organizational ACAP depends upon the individual ACAP of its members. Although the knowledge acquired is usually from external sources (interorganizational or through interaction with the environment), the theory also encompasses intra-organizational learning as best practices or innovative ideas and processes are transferred from subdivisions and assimilated across the organization. The overwhelming theme of the ACAP

[2] An interesting model using the OL framework to explain organizational strategic adjustments as a working out of competing goals in exploration versus exploitation may be found in Crossan et al. (1999).

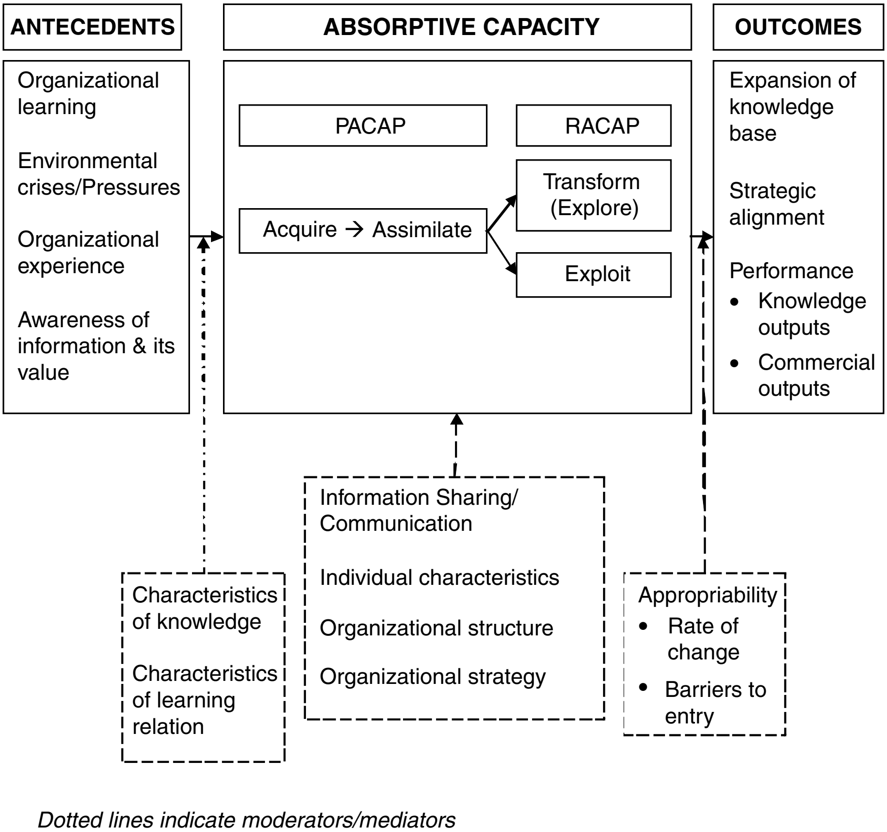

Fig. 6.2 Process model of absorptive capacity, antecedents and outcomes (based on Lane et al. 2006; Zahra and George 2002)

model is that an organization's capacity to learn determines its competitive strength, performance, and survival in rapidly changing environments.

The ACAP model (Fig. 6.2) is very similar to the OL model, but focuses specifically on the ability of the organization to expand and leverage knowledge. Zahra and George (2002) define ACAP as "a set of organizational routines and processes by which firms acquire, assimilate, transform, and exploit knowledge to produce a dynamic organizational capability." The four key internal components of ACAP are sometimes broken into potential absorptive capacity (PACAP) and realized absorptive capacity (RACAP) (Zahra and George 2002), which neatly resolves the process vs. product debate from OL theory. PACAP represents the ability of the firm to absorb and integrate new knowledge; RACAP represents the actual usage made of the knowledge. Ideally, an organization will demonstrate a balanced capability between the two subconstructs. Antecedents to ACAP consist of experience and external sources of knowledge (and the degree to which such knowledge is complementary); the consequents are variously described as competitive advantage, performance outcomes, innovation, or knowledge improvement (Zahra and George 2002).

6.3.2 Antecedents

Arguably, the main antecedent to ACAP is OL; if the organization is not capable of seeking, interpreting, storing, and using the collective knowledge and experience of individual members, it will never develop the ability to leverage it to create new understandings. However, the most common antecedent to ACAP is simply the ability of the organization to recognize the existence and value of external knowledge. This ability is dependent on a variety of organizational characteristics. Cohen and Levinthal (1990) argued that diversity of backgrounds and opinions, free and complete communication, and slack in terms of "expertise redundancy" were necessary antecedents of ACAP. Within the context of IT, Boynton et al. (1994) found that the IT management climate was a significant predictor of an organization's ability to develop IT-oriented ACAP. Szulanski (1996) found that an "arduous relationship" (caused by distance or difficulty of free and open communication) among the groups would prevent ACAP. Lane and Lubatkin (1998) show that interorganizational learning and ACAP are dependent on similar knowledge bases, organizational structures and compensation policies, and "dominant logics" (or preferences) between the partners (although similarity may be more important for basic knowledge, allowing the "student" to learn from dissimilar, advanced knowledge of the "teacher"). Kim (1998) demonstrated that crises and competitive pressure led to the awareness of the need to develop ACAP and of the value of external knowledge. Zahra and George (2002) specifically incorporated the knowledge source (and characteristics of diversity and complementarity/overlap) and prior organizational experience in their model of ACAP. Malhotra et al. (2005) theorized that the nature of the information exchanged and the organization's capability platform would determine the formation, maintenance, and development of ACAP. The important dimensions of shared information were determined to be the extent, breadth, and quality, and the privileged nature of the information exchanged.

6.3.3 Constructs

Organizational ACAP is a function of prior knowledge and the intensity of effort exerted to acquire new knowledge (Cohen and Levinthal 1990). These factors interact to determine the four component processes whereby organizations *acquire*, *assimilate*, *transform*, and *exploit* external knowledge (Lane and Lubatkin 1998; Zahra and George 2002) and reflect OL theory constructs, but with an increased emphasis on internal information management processes. Data acquisition measures the ability of the organization to notice and value external information, as well as its success in seeking and locating new data. Assimilation reflects the ability of the organization to interpret, to communicate, and to internalize new knowledge and resulting understandings.

Although some theorists (Lane and Lubatkin 1998; Lane et al. 2006) conceptualized ACAP as only three processes (acquire, assimilate, utilize), others (Malhotra et al. 2005; Zahra and George 2002) separated utilization into two separate processes reflecting the organization's ability to (1) adapt external knowledge to its own unique needs, producing new knowledge creation and strategic capabilities (transformation), and (2) apply the new knowledge, reflecting operational efficiencies and overall performance capabilities (exploitation).

Some theorists (Koza and Lewin 1998; Lane et al. 2006; Malhotra et al. 2005; March 1991) distinguish between exploration/transformation and exploitation. Exploration can represent divergent learning in interorganizational alliances, where a shared common knowledge base enables one or both partners to develop new, differing knowledge, more advanced applications, or innovate significantly (Dyer and Singh 1998; Lane and Lubatkin 1998; Mowery et al. 1996; Szulanski 1996; Zahra and George 2002). In fact, if the partners do *not* share common knowledge – for example, a similar understanding of cause–effect relationships – knowledge transfer will *not* occur (Keller 1996; Szulanski 1996). Exploitation, on the other hand, represents convergent knowledge, or the increased synergy and performance available through learning best practices or new technologies from a more advanced partner (Kim 1998; Lane and Lubatkin 1998; Zahra and George 2002) and reduces variation and increases predictability of outcomes.

Exploitation becomes especially important in the case of "lagging" economies seeking to catch up with more technologically advanced nations; however, if exploration does not occur with exploitation, the lagging economy will fail to adequately develop ACAP and will continue to be reliant on outside sources (Keller 1996; Kim 1998; Mowery and Oxley 1995). In other words, optimal ACAP requires both convergent and divergent learning, although the relative proportions may vary across organizations, settings, or time. If convergent learning predominates, the organization quickly stagnates and becomes embroiled in competence traps, satisficing instead of optimizing actions and outcomes (Koza and Lewin 1998).[3] Some overlap of convergent knowledge is necessary; "redundant expertise" within the organization provides the operational slack to experiment and the ability of individuals within the organization to communicate efficiently and effectively. Necessary divergent knowledge is represented by a wide diversity of backgrounds and experience which enables the organization to combine information in new ways or apply knowledge to new fields (Cohen and Levinthal 1990; Mowery et al. 1996).

Zahra and George (2002) highlight the different effects of ACAP – expansion of the knowledge base and utilization of knowledge – by the introduction of two subconstructs. PACAP is an aggregated measure of an organization's ability to

[3]Organizations tend to overemphasize operational efficiency and convergent learning as they increase in age, size, and complexity, producing the movement toward institutional isomorphism remarked upon in the literature (DiMaggio and Powell 1983; Koza and Lewin 1998).

acquire and assimilate new, external information into its knowledge base. RACAP aggregates measures of transformed and exploited information into a single measure of knowledge utilization. As such, this structure emphasizes the views that usage consists of both exploration and exploitation (March 1991) and that knowledge simply added to a prior store without ever being used may expand capability, but will not produce increased performance (Lane et al. 2006).

6.3.4 Mediators and Moderators

Several facets of the key ACAP processes have already been mentioned as moderating the speed and extent of the development of ACAP. *Types of information exchanged, the degree of difficulty in forming a relationship, the degree to which organizations communicate within and without their boundaries, the degree of diversity of knowledge, slack in the form of redundant expertise, the level of intensity of effort in the learning process* – all of these may affect the degree to which an organization acquires, assimilates, and utilizes external information.

Zahra and George's model (2002) incorporates three key groups of moderating and mediating variables. The group known as *activation triggers* captures the initial shock, crisis, or awareness of the existence and value of external information and the desire and need to do something to acquire it. Consequently, triggers affect the link between antecedents and ACAP processes. Triggers may be internal or external. They may even be purposefully self-created crises (Kim 1998) to produce the pressure and intensity needed for exponential improvement in "catch up" situations. Triggers must be wide in scope, broad in potential impact, and persistent in order to generate ACAP creation and search, however, as learning is costly: the more intense the effect of the trigger on the firm, the greater the allocation of organizational resources to ACAP.

The second group – *social integration mechanisms* – affects the relationship between PACAP and RACAP. These variables represent the degree to which information and knowledge is shared within the organization. Shared information is critical in OL, as we have seen, in order to ensure a common set of definitions, rules, and cause–effect relationships; this, in turn, ensures timely and efficient communication and a minimum of wasted resources due to misunderstandings. Further, knowledge that is obtained in one subgroup of the firm may be more critical to a completely different group; thus, PACAP and RACAP capabilities are based in different areas of the organization. Communication occurs both formally and informally, with formal systems favoring exploitation learning and standardization of outcomes and processes, while informal systems favor creativity, idea generation, and exploration learning (March 1991; Zahra and George 2002).

The final group, which affects the link between ACAP and outcomes, is reflective of the degree to which a firm's proprietary knowledge is appropriable by other organizations. When knowledge spillovers are high (and *appropriability* low), an organization will invest less resources in ACAP unless the organization possesses differential capabilities in dynamic learning and can improve at a faster rate than its competitors or unless there are barriers to entry deterring other organizations from capitalizing on spillover knowledge (Zahra and George 2002).

Lane et al. (2006) present an expanded model of moderating and mediating influences. The characteristics of internal and external knowledge and of learning relationships mediate the relationship between environmental conditions (antecedents) and organizational ACAP and drive the depth, breadth, and ease of learning. Knowledge and commercial outputs mediate firm performance, reflecting the necessity of both exploration and exploitation learning; it is arguable, however, that these are in fact subcomponents of "performance" and not true mediators. The mental characteristics of individuals with the firm (producing creativity), firm strategies (providing focus), and organizational structures and processes (affecting efficiency and effectiveness) together moderate ACAP, and mediate the relationship between both knowledge and commercial outputs and ACAP (Lane et al. 2006).[4]

6.3.5 Outcomes

Knowledge outcomes or *commercial/performance outcomes* together comprise a measure of *organizational performance* (Lane et al. 2006). This may be measured by means as varied as operational efficiency and performance (Keller 1996; Szulanski 1996), increased patents secured (Mowery et al. 1996), spread of technology (Boynton et al. 1994; Kim 1998), or increased competitive knowledge (Malhotra et al. 2005). Convergent development allows interorganizational learning between strategic partners to produce more efficient or effective learning, flexibility, or performance, but the firms both act together and in the same domain. A competitive advantage may also be enjoyed in the case where organizations develop divergent capabilities. In these instances, firms initiate strategic alliances with partners with a skill set that is needed by the original firm, but which that firm does not wish to develop. By "accessing" instead of "acquiring" this specialized knowledge, organizations may develop ACAP, but in completely new and unique areas, complementing their partner and creating a combined performance and competitive advantage greater than either organization individually (Mowery et al. 1996).

An organization possessing ACAP also enjoys *competitive advantages*. These advantages are primarily associated with the firm's ability to learn in ambiguous and changing environments, to innovate, and to differentiate themselves by the rate of knowledge acquisition. Zahra and George (2002) specifically define ACAP as a *dynamic* capability, which not only enables the organization to learn a certain body of knowledge (akin to Argyris' construct of SLL), but also enables the organization to create and modify the processes, relationships, and applications of the knowledge base (indicative of DLL). Competitive advantages arise from increased strategic

[4]An excellent example of ACAP in action is given by the founder of Dogfish Head Brewery in a discussion of entrepreneurship and the history of his organization (Calagione 2005).

flexibility and *innovation* levels, as well as more common performance indicators (Zahra and George 2002). Organizations with well-developed ACAP are able to move faster and achieve higher levels of innovation than competitors with lower ACAP, as illustrated by the ability of organizations in developing countries to "catch up" through intense concentration on development of their human resources and knowledge base (Kim 1998).

6.4 Comparison of Organizational Learning and Absorptive Capacity

Both OL and ACAP deal with information and learning. Information is broadly defined as a range of new facts, action–outcome relationships, and moderating effects on those relationships. OL tends to focus on environmental characteristics as moderating known relationships while ACAP focuses to a great deal on internal characteristics. Learning is the result of what the organization *does* with the information it perceives and gathers, and may be either passive (expansion of knowledge base) or active (changes in performance, strategy, or innovation) in nature. While the OL model overall limits itself to the active/passive learning dimension, ACAP examines choices among several potential active learning outcomes and the competitive advantages to these choices.

OL describes *how* an organization learns. ACAP examines *how well* an organization learns and *why* it learns. Consequently, the two models are complements of each other. An organization must be able to learn from data gathered from its environment before it can concentrate on how effectively and efficiently it applies that knowledge to produce strategic benefits. It will be remembered that OL is considered one of the necessary antecedents of ACAP, precisely due to this relationship. Similarities in constructs between both models do produce a certain overlap; the key to differentiating between the two is in the researcher's level of focus.

The OL model operates at a macro level, with the focus on the flow of information within the organization to construct the knowledge base. The ACAP model operates on a micro level, with the focus on detailed explanations of internal and external influences on the learning process, differences between application of learning, and a consideration of multiple potential outcomes and learning goals. A good summary might be that OL examines how an organization develops its knowledge base, while ACAP questions what the organization does with the knowledge base. OL focuses on intra-organizational learning and the dissemination of knowledge within the organization, while ACAP primarily focuses on interorganizational learning from exploration and exploitation of information from external learning relationships. Thus, the choice of model used will depend on the research question's focus; regardless, an understanding of how the alternative model complements one's chosen model will enrich the theory and hypothesis development.

6.5 Measurement Issues

After defining constructs, we are left with the problem of measuring cognitive and behavioral processes with very few objective indicators of their presence or development. One of the most common objective measures of ACAP is R&D spending (used since Cohen and Levinthal introduced ACAP theory in 1990). Unfortunately, this measure biases against learning organizations without formal R&D divisions or budgets. Mowery et al. (1996) used a measure of change in patent portfolios (number, areas, and citation patterns) to reflect interfirm knowledge transfer within strategic alliances. Although this measure was shown to be more predictive than R&D spending, it again biases against learning organizations which do not engage in patentable research.

Failing objective measures of innovation as an indicator of ACAP, the researcher must rely on qualitative data; most research in this area relies on surveys of organizational personnel or evaluations of the organization's capabilities and performance by outside experts. The survey data itself may be entered in various models (and lends itself to path analysis and SEM) as either individual or factor scores, or it may be used to construct additional measures. Lane and Lubatkin (1998) used a measure reflecting relative absorptive capacity as a measure of the degree of similarity between "student" and "teacher" organizations in strategic alliances. Relative absorptive capacity was measured across three dimensions (knowledge base; organizational structures and compensation policies; dominant logics) and was found to have a better predictive capability than simply R&D spending. Zahra and George (2002) introduced an efficiency factor (η), measuring the proportion of RACAP to PACAP. When RACAP approaches PACAP, the efficiency factor is higher, demonstrating that firms have the ability to capitalize on and effectively use their ACAP and should demonstrate increased performance.

Although ACAP specifies the ability to acquire, assimilate, interpret, and exploit external knowledge, theorists have recognized that knowledge within the same organization can sometimes possess the characteristics of external knowledge. While most research concentrates on learning from interorganizational relationships (e.g., joint ventures, strategic alliances, licensing agreements, etc.), or in interaction with the environment (e.g., R&D work, the effects of changing market and economic conditions, the effects of governmental policies, etc.), some researchers have used measures of the internal transmission of best practices within a firm, the introduction of technology across the firm to manage the knowledge base or process effectiveness, transmission of knowledge between distant or very disparate units, or absorption of acquired divisions (Boynton et al. 1994; Szulanski 1996).

Research into the ability of the organization to learn from external data *not* contained within another organization includes many studies examining R&D[5] for both basic and applied knowledge (Cohen and Levinthal 1990). However, R&D research

[5]Note that this is R&D by one firm alone, and not R&D in partnership with another, complementary organization.

has increasingly come to mean R&D partnerships in strategic alliances or joint ventures with complementary organizations and thus shifts to interorganizational research (Mowery et al. 1996). Interorganizational learning may occur within alliances to leverage individual, complementary competencies or acquire knowledge and technology from the partner (Dyer and Singh 1998; Kim 1998; Koza and Lewin 1998; Lane and Lubatkin 1998; Malhotra et al. 2005).

A subsection of interorganizational researchers specifically look at the development of absorptive capacity in firms that must catch up to more advanced economies, as was the case in post-WWII Japan and, more recently, South Korea. This area should remain especially interesting in terms of the emerging economies of the "BRIC" nations (Brazil, Russia, India, and China). Research has found significant relationships between developing ACAP and measures of the national innovation system (Mowery and Oxley 1995), the overall investment in the skills and education of the human workforce (Keller 1996), and the reversal of the normal Research–Development–Engineering sequence (Kim 1998). Regardless, the key is not in which primary channel the "latecomer" nations uses to import technology or capital goods, but rather in the development of ACAP with its associated broad (and rapidly deepening) knowledge base.

It is important not to render some of these constructs into excessively simplified or excessively constraining measures. Lane et al. (2006) offer a list of responses to common misconceptions regarding ACAP that appear in the literature. First, ACAP is relevant across a wide range of organizations and contexts, and not simply R&D budgets and efforts. Second, it is not sufficient to establish the existence of valuable external knowledge – the organization must be aware of and recognize the importance and value of the knowledge. Third, relevant prior knowledge is not the equivalent of ACAP, but only a part; ACAP combines prior knowledge with the intensity of effort to assimilate, interpret, and apply new external knowledge. Fourth, competitive advantage is not based on Ricardian rents (exclusive or scarce knowledge possessed by one organization), but on efficiency rents (superior ability to utilize widespread knowledge). Finally, and in a pleasing symmetry with OL theory, ACAP does not reside solely in the organization, but also depends upon the ability of individuals within the firm to maintain and develop this capacity.

6.6 Discussion

ACAP is a key contributor to organizational performance and competitiveness through the ability to learn from others' experience, thus reducing time and costs in exploring the boundaries of knowledge. The focus on external knowledge and relationships with strategic partners is increasingly relevant in a specialized, rapidly changing field such as IT where the mastery of all aspects is not feasible. In developing ACAP, an organization may team with another to develop divergent or convergent knowledge. Organizations from lagging economies may also use an "increasing spiral" (Kim 1998) of individual to group to organizational ACAP to catch up to more technologically advanced organizations. Once an organization falls behind, however, it is exceedingly difficult to regain prior profitability and competitive levels, highlighting the need for continual development of ACAP via human resource development, exploration of boundaries, and exploitation of prior knowledge. Thus, potentially fruitful areas of research might examine the differences in IT design required to address divergent vs. convergent information, exploration vs. exploitation goals and to facilitate the desired "increasing spiral" in organizations playing "catch-up" in lagging economies.

Today's digital environment is, by definition, information based. Consequently, an understanding of the processes by which organizations seek out, value, adapt, and utilize external information is highly relevant to research into digital technology development and adoption. As information becomes digitalized, the speed of organizational processes and the rate of change increase. A digitalized economy also results in greater depth and breadth of access to information. In turn, increased exposure to a wider range of data increases the rate of learning and the degree to which prior knowledge may be applied to new situations. As an organization moves through the learning process of scanning, interpreting, and applying new information to close reference gaps or decrease outcome variability, the degree to which they have invested in developing the capacity to absorb, transform, and utilize the new knowledge will determine the degree to which they are successful. A greater investment in ACAP will result in the earlier identification of significant future areas of desired capability, faster response to changing market conditions, faster improvement in and more effective processes, and a better targeting of products and services to customers' expectations. A very timely area for research would specifically examine the effects of information overload and the extent to which the four dimensions of digital information (depth, breadth, speed, frequency) hinder or assist in information interpretation, assimilation, and application.

IT plays an important role in the dissemination, storage, and retrieval of information within an organization. Consequently, much of organizational memory is contained with IS in digital formats. The ability of organizations to store, search, and analyze this data will determine future learning and overall levels of ACAP. The amount and type of information required, and the degree to which OL and ACAP will interact with technology will vary with environmental conditions. In high uncertainty, more information is needed, but very little is programmable or standardizable and managers within the organization must rely on judgment to a greater degree. In conditions of high complexity, elaborate rules and decision trees may be needed, and the ability to extract large amounts of information across many sources (and evaluate it for consistency, accuracy, and relevance) will be required. Subgroups within the organization will require different information (or information in different formats) and will possess varying capabilities, domains, and uses of knowledge. For effective OL, however, these subgroups must be able to distribute knowledge they develop as well as access knowledge developed by other subgroups; these requirements call for specific IS characteristics. Research questions of interest in this area would include the relationship between the depth, breadth, and speed of learning and various IT design and platform configurations. These questions could also be enriched by consideration of information interface design to determine how to best permit rapid and effective communication and knowledge transfer between individuals.

An area of highly useful future exploration would examine how individual or subgroup learning is incorporated into the organizational knowledge base. The processes used to validate, transmit, preserve, and retrieve information are not well understood. Conditions leading to information sharing and the role of interpersonal networks also have not been studied and would be an additional area for future research. Following Huber's (1991) conceptualization of differential learning among subgroups, the role of specialized decisions systems and the process by which high-level summaries of knowledge are distributed to and incorporated by the organization as a whole would be a rewarding path to pursue. Also within this general category of knowledge transfer and communication, the role of trust in intra-organizational learning has been understudied, although interorganizational trust in strategic alliances has been a rich field.

An organization's ability to learn and effectively leverage that learning to create new understandings is the key to performance and competitiveness. The high speed of change and tidal wave of increasing (and increasingly detailed) information demands the ability both to be strategically flexible, recognizing when current understandings and applications need to change, and to deal with cognitive overload. Learning is critical, but it is costly and requires constant attention and conscious effort on the part of the organization. Abigail Adams recognized this as long ago as the late eighteenth century and offered a cautionary admonishment contemporary organizations would do well to heed: "Learning is not attained by chance. It must be sought for with ardor and attended to with diligence (*Letter to John Quincy Adams* 1780)."

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Chapter 7
Applying Actor Network Theory and Managing Controversy

Amany Elbanna

Abstract Actor Network Theory has been applied in the IS research for over a decade. However, when applying ANT, IS researchers still face difficulties in convincing the academic community of the importance and contribution of their analysis. This chapter reviews some of the key concepts and propositions of ANT, the most common criticism ANT-based IS research would receive from sceptic reviewers and suggests possible ways to deal with it.

Keywords Actors Network Theory • IS implementation • IS project management • Case study • ANT frameworks

Abbreviations

ANT	Actor Network Theory
SSK	Sociology of Scientific Knowledge
ERP	Enterprise Resource Planning systems
SSM	Soft System Methodology

7.1 Background

The basic idea of ANT is that, in order to achieve a goal, a network of faithful alliances needs to be created to carry the network builders' intentions and materialise their goals. As the theory holds a distinctive view of society as a network of humans and

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non-humans that interact and cooperate to pursue a certain goal, it maintains that any network building would involve the recruitment of human and non-human actors.[1]

The notion of "network" used in ANT is concerned with mapping how actors define and distribute roles, and mobilise or invent others to play these roles. Such roles may be social, political, technical, or bureaucratic in character. The objects that are mobilised to fill the roles are also heterogeneous and may take the form of people, organisations, machines, or scientific findings. Hence, the ANT network concept helps to underline the simultaneously social and technical character of any social arrangements. It is a metaphor for the interconnected heterogeneity that underlies sociotechnical engineering (Law and Callon 1988).

After the introduction, Sect. 2 describes some of the main themes of ANT. Sect. 3 presents some examples of the application of ANT in IS research. Sect. 4 presents the common criticism IS ANT-based studies would receive from sceptical reviewers and how ANT researcher could deal with it.

7.2 Key ANT Propositions

7.2.1 Network Building

The network building takes place through translations. Translation is the mechanism by which the network builder recruits actors and ensures their faithful alliance. It was first coined and used by Michel Serres (Callon and Latour 1981; Serres 1974) and its first English publication appears in Callon (1986). Since then, it has been adopted through Callon (1986). It describes a variety of ways in which the network builder actively seeks to interest and enrol others to support his project (Faraj et al. 2004). However, it takes place through the application of different strategies (Callon 1986; Latour 1987), it aims to ensure that other actors, irrespective of what they do, remain faithful to the realisation of the network builder's goals.

The word "translation" itself reflects its usual linguistic sense in that it means that one version translates every other (Latour 1987, p. 121). It does not mean a shift from one vocabulary to another, but it does mean "displacement, drift, invention, mediation, the creation of a link that did not exist before and that to some degree modifies two elements or agents" (Latour 1994, p. 32; Latour 1999, p. 179). It also has a "geometric meaning" that is about moving from one place to the other. Translating interests means at once offer new interpretations of these interests and channel people in different directions (Latour 1987, p. 117).

[1]This view has been criticised particularly from mainstream Sociology and the Sociology of Scientific Knowledge (SSK), for examples see Bloor (1999), Collins and Yearley (1992a, b), Pels (1995).

Callon identified four interrelated moments of translation: problematisation, interessement, enrolment, and mobilisation (Callon 1986). It is worth noting that these moments are not linear. They are largely inseparable, so there is no particular order or sequence for their occurrence (see, e.g., Callon and Law 1982). These moments are defined as follows: *Problematisation* is the process by which an actor positions his project as indispensable to others. This is usually achieved when the actor sets his project as an obligatory passage point for others to go through if they want to pursue their own interests. *Interessement* involves attracting one entity by coming between that entity and a third one. This means that interessement includes cutting or weakening all the links between the target allies and their original network. The possible strategies and mechanisms that are adopted to bring about these interruptions are unlimited. *Enrolment* is likely to be complex. There will be many different actor networks attempting to translate the actors, with some in competition and others in at least tacit cooperation. Law (1986a) clarifies that "**The elementary case of translation is thus triangular**. One entity enrols. Another is enrolled. And a third fails in its attempts to enrol [as in the original]" (Law 1986a, p. 71). The fourth moment of translation is *Mobilisation*. Mobilisation represents the successful alignment of actors into the network builder's network.

These moments of translation indicate that attempts to translate and recruit actors into a certain network are associated with attempts to distance or weaken the relationships between these actors and other networks. The network that succeeds to dominate is the one that attracts and interests many actors. However, a run of success does not preclude the possibility that next time another actor network will establish a similarly powerful structure of forces, with the previously constructed actor network will find itself localised within another network. This is a key reason why ANT assumes that reversibility is an embedded character of any network (Callon 1991).

7.2.2 Performance of Power

ANT provides a distinctive view of power as constructed through the intertwining relationship between the social and technical. This view follows ANT proposition that artefacts do not stand apart as means or tools to be directed by social interests. Rather, they are interwoven with the social and should be seen as forming an integral part of such systems (Law 1986b). The social interacts with and is constituted by these other materials. According to ANT, relationships became stable when they are embodied into durable materials (Law 1991) since the technical is regarded as what holds the social network together and renders it durable (Latour 1988a, 1990, 1991). Power is then constructed from a network of humans and non-humans aligned together. This established network of aligned humans and non-human stores and maintains the power of the network builder. Therefore, power is a performance not a possession. It could only be practiced through others. It is an effect of the establishment of a loyal network of humans and non-humans. Following this line of argument, ANT holds that the exhibition and practice of power depends on the enmeshed humans and non-human network one manages to recruit and hold.

ANT distinctive notion of power does not consider power as being out there for people to practise as the traditional view but considers it as a product of social and technical relations (Law 1996). Latour explained that power is not some kind of reservoir which people deploy, but only the result of local associations between many and varied agents (Latour 1986, 1988b)[2]. He gives an example of a – then – Lebanese president, Amin Gemayel, in his palace that he officially has power, but since very few people act when he orders things, he is powerless in practice (Latour 1986). Power then, according to ANT, is not a property of any one element but of a chain of hybrid elements (Latour 1991). Hence it does not reside with any of the actors but on the network of associations that the actor is involved in[3]. In this sense, it agrees with Foucault's notion that power is exercised and not possessed (Foucault 1979), and that power is an end result of a complex mesh of relations and not a given a priori.

7.2.3 The Global/Local Relationship

ANT adopts a symmetrical view of sociological dichotomies, such as those between global and local, and macro and micro phenomena. It does not consider any difference in kind between the macrostructure and the microstructure and hence treats both with the same analytical tool.

ANT regards the sociotechnical world as not having a fixed, unchanging scale, and argues that "it is not the observer's job to remedy this state of affairs" (Latour 1991, p. 119). Latour (1991) emphasizes that these global/local definitions are not fixed as actors could change them. He encourages researchers to observe these changes of scale rather than having a fixed predefined ideas arguing that "respecting such changes of scale, induced by the actors themselves, is just as important as respecting the displacement of translations" (Latour 1991, p. 119).

7.3 The Application of ANT in IS Research

ANT has been adopted in IS research in many different ways. Its possibility of accounting for non-humans provides an appealing conceptual grounding for IS research. Also, its philosophical position and methods of inquiry facilitate its practical application (Walsham 1997). This section presents examples of the application of ANT in different strands of IS research.

[2]For more details and application of this concept see Elbanna (2010b).

[3]For more details and application of this concept see Elbanna (2010a).

ANT has been applied in IS research in a wide range of topics including systems implementation; organisational change; systems design; IS development methodology; IT infrastructure development, introduction and use; evaluation; and the role of IT consultants. It has been also adopted in many different ways ranging from simple use of its vocabulary to more complex deployments of some of its frameworks.

Some IS researchers apply ANT to conceptualise the implementation process of certain technologies[4]. For example, Vidgen and McMaster study the implementation of an automated access control system for a car park (Vidgen and McMaster 1996). They focus on how the technology black box was opened by the parties involved and how what was once believed to be a simple installation of a technology opened up to reveal a much more complex web of relations and associations. They adopt the notions of "quasi object", "networks", and "black boxes" to conceptualise the mutual changes that occur to the technology and the organisation, including both humans and non-humans in the stakeholder map. Elbanna (2007) studies the implementation of ERP system in an international organisation. She applied ANT as a critical lens to discuss the notion of integration and unravel the intertwining relationship between the ERP system and its organisational setting (Elbanna 2007). In another study, she applies ANT to reveal the model of improvisation involved in the implementation of rigid systems such as ERP (Elbanna 2006).

Lilley (1998) also studies the implementation of an Oil Management System that emerged from one of the European sites of a parent company (Lilley 1998), which went on to extend the system's implementation to several sites around the world. The aim was to implement a site-specific system built around a common core. Lilley tells the story of this case of network building using Callon's four moments of translation. Interestingly, he tries to account not only for the translation process from the outside viewed by the network builder, but also from the inside viewed by the recruited entities.

McGrath (2001) examined the role of environmental forces on the IS implementation. She applies the vocabulary of Callon's sociology of translation to shed some light on how the environmental forces influenced action during a specific period of organisational change and how actors engaged locally in enrolling and mobilising support for that intervention (McGrath 2001). She focuses on linking the global and local contexts of the implementation of the new computer system. McGrath arguably views ANT as a "collection of powerful tools and ideas", as opposed to being a "complete and constraining methodology."

Some IS researchers apply ANT for conceptualising the development of IT. For example, Bloomfield and others analyse a series of events in the design and development of information systems in the UK National Health Service (NHS) (Bloomfield et al. 1997). They adopt ANT to conceptualise systems development as the construction of a complex heterogeneous network of humans and non-humans. They focus the analysis on the notion of the analysis following the notion of stabilisation and destabilisation of the actor network.

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[4] Parts of this section have been adapted from Elbanna (2009).

Klischewski (2000) applies ANT to conceptualise IS development by regarding it as "networking" (Klischewski 2000) with black boxed commitments (Klischewski 2001). Being interested in providing a practical guide for systems development, Klischewski makes black boxed commitments a starting point of the analysis and then follows their circulation as immutable mobiles rather than following the construction of each commitment and how it is black boxed and reopened in times of controversies.

Along a similar line, Monteiro (2000) attempts to find a practical use of ANT in systems design (Monteiro 2000). He defines some guidelines for systems design using ANT. To do this, he appropriated the theory and made arbitrary uses of a simplified version of it that focuses only on a selection of concepts rather than accounting for all of them.

Atkinson (2000) develops a contingency approach for systems development named Soft Information Systems and Technologies Methodology (SISTeM), which stems from Soft System Methodology (SSM) using ANT as an underpinning framework (Atkinson 2000). He proposes to regard the methodology as a network or a "methodological actor network" in its own right that enrols and mobilises a heterogeneous set of human and non-human actors. At the same time, it is a node or non-human actant in the actor network of the real world. Its use in the real world is therefore shaped by the relationship it has with the other actants in the network into which it has been enrolled. Atkinson also suggests that the methodology can be seen as a network building in each stage of its application.

Some researchers find ANT useful for accounting for the introduction of a certain technology. For example, Aanestad and Hanseth (2000) explore the introduction of a multimedia technology in a medical surgery, presenting three detailed micro-level snap-shots of local instances of the case being studied (Aanestad and Hanseth 2000). Their analysis insightfully reveals the highly complex setting of technology and work practices, the highly emergent and evolutionary use of multimedia technology, and the complexity of the network of human and non-human alliances that needed to be recruited to use the technology. They show through ANT's conceptualisation how the demands of technology and medical work practices can coexist in a stable network and how they may be in conflict and hence translation is required to align actors and enrol them in a stable network. In the third story, Aanestad and Hanseth describe how the alignment of the network proved to be fragile as it broke apart. They conclude by arguing that the use of ANT offers a suitable and valuable conceptualisation of the use of multimedia technology to cultivate a hybrid of humans and non-humans; technologies and non-technologies.

Other researchers are interested in the theory itself and experiment with some of its concepts. Monteiro and Hanseth (1996) examine the relationship between IT and organisations in the light of ANT framework. They argue that ANT provides a firm grasp of the interplay between IT and organisational issues that take "IS quite seriously" (Monteiro and Hanseth 1996). Comparing ANT with Structuration Theory (Giddens 1984), they argue in favour of ANT. They find that ANT provides immediate benefits through its language, and that its "overall rationale is geared" towards providing an analysis that goes far beyond "IT enables/constrains actions." In their concern with standards and infrastructure, they attempt to briefly but broadly apply notions like actor network, translation, alignment, inscription, and irreversibility to understand how standards acquire stability and how they become increasingly "irreversible."

Bloomfield and Vurdubakis relate to one of the principles of ANT; that it does not set any a priori assumptions concerning the technical and the social, and their boundaries (Bloomfield and Vurdubakis 1994). Through two case studies, they follow the actors in their negotiations of the boundary between the social and the technical. They conclude that boundary setting is situated and an a priori distinction is far from being appropriate, as the content of the social and the technical is subject to ongoing negotiations between various actors.

Pouloudi and Whitley (2000) address the representation of non-humans, one of the problematic aspects in applying ANT. As ANT views human and non-human entities symmetrically, researchers tend to think that representing the non-human is far more problematic than the straightforward task of representing humans, as the latter can speak for themselves. Pouloudi and Whitley argue that this common concern is not as clear cut as it appears. They study an NHS-wide networking project, following the way two stakeholders were represented in the project: one human (patients) and the other non-human (an encryption algorithm). They show that the two actors that are different in kind (human and non-human) can share the same representation difficulties where many stakeholders seek to represent the actors.

There is also research on IT infrastructure development from a variety of angles. For instance, Hanseth and Braa (1998) apply ANT to understand IT infrastructure development and use in the European fertiliser division of Norsk Hydro (Hanseth and Braa 1998). They apply ANT to develop a broad account that conceptualises SAP as a non-human actor which shapes its environment as well as its own future. The authors follow the SAP technology as it builds and changes alliances with others. This assisted understanding of how the addition of an infrastructure gains momentum and influences future developments of that infrastructure.

Hanseth and Monteiro (1997) continue their interest in infrastructure spread and development by studying how it inscribes a certain pattern of use. They focus on the two ANT notions of inscription and translation to help analyse the phenomena more broadly (Hanseth and Monteiro 1997). In this process, they uncover, through the notion of inscription, the sociotechnical complexity of establishing an information infrastructure. They try to reveal how explicit anticipations of some actors were inscribed into the standards, who inscribe them, how these inscriptions were carried out, and the efforts taken to oppose them or work around them.

Also, Hanseth and Braa (2000) present the story of the evolution of the infrastructure in the Norwegian company Norsk Hydro (Aanestad and Hanseth 2000). They use ANT to offer an explanation of how the SAP part of the infrastructure drifted from the initial planning towards an almost opposite outcome. They question who is really in control, as people, departments, and divisions who once thought that they controlled SAP and could align it to their interests ended up being aligned, controlled, and locked-in by SAP.

Cordella and Simon (2000) study the infrastructure accumulation in Astra Hässle, a Swedish pharmaceutical research company (Cordella and Simon 2000). They introduce a model for analysing infrastructure implementation based on the notion of inscription adopted from ANT, providing a framework that is a matrix of technology and organisational inscriptions.

There is also research on the evaluation of IT using ANT. For example, Lehoux et al. (1999) study the evaluation of a computerised medical record system in four Quebec hospitals. They illustrate and discuss the integration of the two ANT concepts of problematisation and script of use within the evaluation framework employed. They suggest to study: the developers' "problematisation" or initial definition of the roles, tasks, skills and objectives of a large set of actors; and the "script of use" within the developed innovation, prior to examining the users' confinement to their assumed roles.

The role of IT external consultants has also been studied within the ANT framework. For example, Bloomfield and Danieli (1995) use some of the ANT vocabulary to explore and conceptualise IT consultants' practices in IS development (Bloomfield and Danieli 1995). They are particularly interested in revealing the ongoing negotiations and conflicts over who has the legitimate voice to speak on behalf of IT and the organisation. They also reveal the consultants' endeavour to overcome resistance and to hold a network of interlocking agreements. However, although they seem to be influenced by the ANT vocabulary and some of its concepts, nearly no direct reference is made to the theory as such.

Bloomfield and Vurdubakis (1997) also use ANT to interpret a consulting document for an NHS projects (Bloomfield and Vurdubakis 1997). Here, they are concerned particularly with the intermediary role of that document as an attempt to bring together IT and the organisation (doctors, managers, etc.), while at the same time respecting their separation and differences. They build on the assumption that "all forms of administrative, political, and managerial intervention are not reactions to reality as such but to reality socially and discursively constructed within documents." This assumption underestimates other forms of communication within the organisation that contribute to the construction of its social reality.

Elbanna (2009) applies ANT conceptualisation of the local and global to explore how the taken for granted project's boundaries are defined in practice. The study examines a case study of an ERP implementation project in an international organization. The findings show the busy multiple-projects platform of contemporary organizations that ERP project cannot be isolated from. They also reveal that project management boundaries are continually crossed and that project's boundaries in practice are malleable and changeable. They are defined through negotiations with other projects and programs where what is inside or outside a project is subject to change according to the outcomes of such negotiations (Elbanna 2010a).

7.4 Managing Controversy

However, many researchers believe that ANT has much to offer IS research (Walsham 1997), the application of the theory usually attracts criticism from doubting reviewers. This section highlights the typical criticism that an ANT application would receive and suggests ways to respond to it.

7.4.1 Social Network Not Actor Network

It is expected that any ANT analysis would consider non-human actors as well as human actors. Some reviewers might like to see more emphasis on non-humans and consider any subtle analysis that includes non-humans without particular highlighting as unsatisfactory. The application of ANT might then be criticized as nothing new and being similar to social networks or stakeholders analysis (Cornford et al. 2005). Reviewers might also advise you to adopt a social network analysis rather than ANT. In response, it is important to explain that network analysis is part of ANT but ANT is not just about social networks. In this regard, Latour (1997) assures researchers that "social networks will of course be included in the description but they will have no privilege nor prominence" (Latour 1997). Highlighting the non-human actors is part and parcel of ANT but this highlighting differs in scale from one research to another. ANT gurus such as Law, e.g., while sometimes focus the analysis on human actors, he briefly states the non-human actors and mentions that the analysis could have focused on other actors including non-humans (Law 1994; Law and Callon 1992).

7.4.2 The Problem of Contingency

ANT is seen as a theory of contingency that no patterns could be drawn out of it. It depends on collecting and analysing specific case studies with no attempts should be made to draw pattern in the case studies and hence general lessons or conditions should be avoided. However, this view is supported by many of Latour's work, yet Law and Callon conducted sound research that aimed at drawing frameworks that could be applied in other cases. For example, Law and Callon (1992) have developed a two-dimensional model for the conceptualisation of the local/global mobilisation. They state that their "object is to move beyond the claim that outcomes are the product of contingency. Though this is right, it is also unhelpful unless we are content to accumulate specific case studies. Our aim is rather to seek patterns in the case studies." They present their framework as "a tool" to describe their studied project "in a way relevant for the analysis of other projects and technological innovation" (Law and Callon 1992, p. 21).

7.4.3 Where Is the Translation?

The moments of translations have dominated many ANT-based research in IS. Somehow, they became equivalent to ANT. Therefore, in the application of ANT, some reviewers would be susceptible if the moments of translations are not part of the ANT presentation and case study analysis. In response, you should acknowledge that the moments of translations provide a background upon which many ANT ideas stand. In the application of different ANT ideas such as the local/global mobilisation, the researcher could choose to adopt Law and Callon (1992) framework, for example. In this case, the researcher has to foreground the adopted framework and background the moments of translations. A clear acknowledgment of which concepts have been foregrounded and which ones have been backgrounded satisfies reviewers in most cases.

7.5 Final Remark on the Application of ANT

ANT is not a panacea or a theory that could explain each and every phenomenon. It should be noted that "all theories are limited" and ANT is no exception. The choice of theory hinders seeing other things and affects the research method. Thus, the use of theory might "impede understanding… [and] act as blind spots" and consequently could be a way of seeing and not seeing (Walsham 1993). This should be accepted and "cannot be avoided" (Weick 1984). The theoretical substance is unavoidably tightly woven with the methodology and inevitably direct researchers to see what they "want to see" (Boland 1985) or what their adopted theories influence them to see. Boland insightfully addressed this issue and highlighted its inevitable existence saying: "I myself try to bracket my structuralist assumptions while doing interpretive analysis. Yet, why does Levi Strauss always seem to be waiting there in the data?" (Boland 1985). The unavoidable bias of the research stemmed from the theoretical choice should not be confused with deliberate bias that is unfavourable and could be avoided such as the deliberate channelling of data towards a certain predetermined end. Thus, theory-orientated bias should be only accepted as part of the subjectivity of doing research and should be acknowledged and reflected upon.

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Chapter 8
Using Concepts from Structuration Theory and Consequence of Modernity to Understand IS Deployment in Health-Care Setting

Urvashi Sharma, Julie Barnett, and Malcolm Clarke

Abstract The use of structuration theory in the field of information systems is long debated. Questions on its applicability and suitability have led to many insightful studies and papers in this area. We, in this chapter, draw on these studies and provide a complementary view on use of ST in studying IS deployment. While doing so, we draw on Giddens's recent work and utilise telehealth implementation case study as an example.

Keywords Structuration theory • Telehealth • Technology acceptance

Abbreviations

CM	Consequence of modernity
ICT	Information communication technology
IS	Information systems
ST	Structuration theory

8.1 Introduction

This chapter introduces the use of concepts from Giddens's structuration theory (ST) and his recent work in "The Consequence of Modernity" (CM) to expound issues faced while implementing a telehealth project as an example of information systems (IS) deployment. What follows is an exploration of telehealth, how it fits within the

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IS spectrum, and its deployment within a modern health-care system that utilises digital equipment to facilitate optimal care delivery. Next, we outline the theoretical concepts adopted and provide a summary of results obtained from our work in this area. Finally, we present our thoughts on how coupling ST and CM gives a broader and richer framework which would allow an IS researcher to develop a deeper understanding of impact of IS deployment on its potential users within a given context.

8.1.1 Telehealth and Information Systems

IS can be described as a system that encompasses information communication technology (ICT) through which data is collected, and used by the user to interpret the data gathered as information and becomes constituted as knowledge resource for its user. Human agents who are the users of IS are continually engaged in use of these ICTs to aid in decision making and enhance their productivity (Avgerou and Madon 2004; Walsham 1997). Furthermore, the contextual nature of such engagements facilitates and constrains the interaction between human agents and technology due to the available resources and rules that apply to such interactions (Barley 1990, 1986; Giddens 1984, 1979; Orlikowski 1992, 2000). Within the context of modern health care, many types of IS are deployed to achieve effective, efficacious, efficient and optimal health-care delivery. One such system is telehealth (Peddle 2007).

Telehealth involves installation of equipment at patient's home that allows a clinician (nurse, doctor or a medically trained technician) to monitor any deterioration in patient's health suffering from long-term chronic conditions such as chronic heart failure (Kobb and Chumbler 2006). The equipment is connected to peripheral devices that may include blood glucose monitor, blood pressure monitor, weight scale and in some instances, the portable electrocardiogram (ECG) which the patient uses to measure his/her daily physiological parameters. These parameters are then transmitted by the patient to the clinician, who uses computers to assess the trends in patient's health and decides on appropriate intervention (personal visit or phone consultation) based on the nature of the physiological measurements received. Telehealth service can be configured in many ways such that the level and complexity of technology can vary from simple peripheral devices to the use of complex modalities such as videoconferencing. Potentially, there is an equal range of complexity relating to the service provided alongside telehealth equipment (where, by service we mean the support network of clinicians involved in delivering care to the patients). For instance, provision of care by nurses to their patients through telehealth can be considered as an example of a simple service arrangement. Whereas, when there are number of clinical users involved such as general practitioners, nurses and technicians in delivery of care facilitated through telehealth, the service is complex (Kobb and Chumbler 2006; Clark et al. 2007).

Although telehealth service has been hailed as a success story in countries like Norway and Australia, in the U.K. its fate has been rather different (May et al.2003a, b, 2005, 2001). Many clinical trials have assessed the effectiveness of this service and have generally converged on the conclusion that there is a need for such a service but have diverging views on understanding the main reasons behind its limited adoption. One of the factors that can be seen as contributing to non-adoption is resistance by clinical users, and according to Heeks and Davies (1999), this causes 80% of IS deployment efforts to fail (Heeks and Davies 1999; Heeks 2006). With such a high percentage of failure, the user perception on IS acceptance indeed seems to be an area worth investigating. Arguably, such an investigation calls for employing tools and techniques that are interpretative and sociological in nature than deterministic and mathematical as the research is aimed at evaluating user perception and understanding their reaction towards the change introduced due to new technology implementation. Our approach complements such an understanding by using concepts developed by Giddens in ST and CM, and by using this we will be keeping in line with IS tradition of employing theoretical concepts to enhance understanding of underlying dynamics and contribute to its vast literature by applying this in a health-care setting.

8.1.2 Structuration Theory

Giddens introduced the foundations of ST in 1979 in his book "The Central Problems in Social Theory", and later discusses the full theory in "The Constitution of Society" in 1984. He argues that ST bridges the wide and ever-deepening gap between the functionalist and structuralist perspectives employed within the field of social science dedicated to study social change. According to Giddens, the changes in social systems are not simply an outcome of either human action (subject to knowleadeability) or social structures, but a product of their interaction. Temporally however, the influence of one might seem dominant than the other (Giddens 1984, 1979). This relationship of simultaneous mutual shaping came to be known as the "duality of structure", which is "that the structural properties of social systems are both the medium and the outcome of practices that constitute those systems" (Giddens 1984, p. 69). Understanding this reciprocal and recursive relationship involves three main concepts: the social system, structure and the human agency.

Social systems are expressed as the reservoir of recursive social practices that human agents perform during their daily lives. In modern social system, these practices are institutionalised, thus constituting deeply embedded routine work. Change to these routines is resisted. The rules and resources that human agents draw on, and simultaneously enact while accomplishing their daily routine through interaction within the social systems, are known as structures. Structures do not exist in time and space as social systems do, but reside in human "memory traces." Therefore, structures are solely dependent on human engagement, and at the same time are both the facilitators and the constrainers of this engagement (Giddens 1984, 1979).

Both the structure and human interaction encompass three dimensions and these are interlinked by three modalities in the "duality of structure" (Giddens 1984). The structure has dimensions of signification, domination, and legitimation and interaction has dimensions of communication, power and sanction. These dimensions are interlinked by the modalities of interpretive scheme, facility and norm, respectively. By the structure of signification, Giddens refers to the structures of meaning that human agents enact by drawing on their interpretive scheme, through communication, to evaluate the underlying motive of their actions and those around them. The structure of domination is enacted when human agents exercise power through facilities such as ability to locate resources (Walsham 1997; Walsham and Han 1991). The structure of legitimation is enacted when agents assess their actions and sanction them through norms (morality and ethics).

The production of new and reproduction of old structures through human interaction implies that human agents have inherent capacity to act and transform. This capacity to act is called the "agency." The same capacity is understood as transformative capacity when agency is exercised with power, which, according to Giddens is an intricate part of agency. Human agency is also reflexive, that is human agents continually monitor their actions and that of others. Certainly, in order to enact new routines, the agents utilise reflexivity and transformative capacity to enhance their knowledgeability that, in turn, reciprocates their decisions (Giddens 1984, 1979).

The current section outlined some of the most important terms associated with ST and its underlying concept of duality. In the next section, we outline the use of ST within the IS literature.

8.1.2.1 Application of ST in IS Literature

As outlined above, ST originates from social science where emphasis is on the social dynamics leading to change. Many authors have used ST and moulded it to study technology and organisationally driven change in the field of IS. Some authors have used ST as a meta-theory where contextual factors such as organisational structure, political and economical factors are taken into account (Walsham 1993; Orlikowski 1996; DeSanctis and Poole 1994). Other authors have favoured the use of single concepts that under given circumstances might enable better understanding of underlying dynamics such as power shifts, time and space analysis (Sahay 1997; Walsham and Han 1991). Many more have strived to combine ST with theories such as actor-network theory, and Soft system methodology (Rose 2002; Sahay and Walsham 1997). A more comprehensive review of Giddens work and its contributions to IS research and general research can be found in works of Bryant and Jary (2001) and Jones et al. (2004).

Pozzeben and Pinsonneault (2001, 2005) in their work outlined the three ways in which ST has been employed within the field of IS-adaptive structuration, mutual shaping and actor's organizing. We encompass these in the section below where we outline the limitations that an IS researcher using ST might face and how a study on telehealth implementation addressed some of these dilemmas. While doing so, we reflect on some of the classic studies that have used ST in a specific context and report on their outcome.

8.1.2.2 Limitations of Structuration Theory to Study IS Deployment

In the field of IS, ST has been employed to address various issues surrounding technology acceptance and organisational change. In this section, we discuss key challenges in using ST to study IS deployment in complex settings such as health care.

First, one of the main challenges faced when using ST is that it is emblazoned with various concepts that are used to elucidate the "duality of structure." This issue is more general as it determines the applicability of ST in the field of IS, and as many authors have noticed, causes a dilemma for IS researcher on whether to use the theory in its entirety (as a meta-theory) and risk abandoning salient concepts, or use specific concepts and risk losing its overarching perspective (Walsham and Han 1991). Using theory in its entirety can prove inordinately cumbersome for an applied research problem. On the other hand, cherry picking specific concepts from theory runs the risk described by Johnes "…Giddens' work can appear at times to resemble the Bible, in the ways in which it is usually possible to find a passage supporting (out of context) whatever standpoint one wishes to adopt …" (Jones and Karsten 2008, p. 7). However, one can find a solution to this potential bifurcation by adopting an approach that Giddens himself advocates. He favours using specific concepts within his theory to allow more detailed and meaningful exploration of a problem than vain efforts of defining contextual boundaries and finding oneself imprisoned within them. Walsham and Han (1991) argue that the concepts of ST are particularly pertinent when exploring a dynamic situation such as is often the case in IS. Care should be taken, however, to maintain the sense of what these concepts were intended do within ST.

The second potential challenge of applying ST to the area of IS is its lack of focus on technology. Many IS researchers have acknowledged this as a critical gap and have provided ways in which this can be addressed. Three main classic studies that have added an insight to the subject of how ST can be employed in IS are discussed here briefly.

One of the first studies to use ST to study the effects of technology introduction was by Barley. In 1986, Barley used ST to expound how same technology used in the same context enabled enactment of completely different structures. The technology in question was the computer tomography scanners introduced in the radiology department of two hospitals. In order to overcome the lack of emphasis on technology in ST and its affect on agents' interaction and thus the structures enacted, Barley relied on defining technology as "an intervention into the relationship between human agents and organisational structure, which potentially changes it" (Orlikowski 1991, p. 6). He essentially used the duality of structure in his study, sidelining other peripheral concepts within ST. Barley's use of ST to understand technology acceptance within IS has been designated as an emergent perspective (Jones and Karsten 2008; Jones and Orlikowski 2007).

Building on Barley's and Giddens's work, Orlikowski introduced the concept of "duality of technology," where technology is considered to be embedded with structure, and is used by human agents to carry out their routines (Orlikowski 1992). However, this notion contradicted the definition of structure as proposed by Giddens that structures are enacted by human agents who are knowledgeable, reflexive and not embedded. In response, Orlikowski proposed the technology-in-practice lens, where she distinguishes between technology artefact and technology-in-practice (Orlikowski 2000). She argues that when a given technology is not used by knowledgeable agents in a given context, technology could be seen as any other artefact. However, when agents in their daily routines use technology, then through its use agents enact new structures and technology can be seen as "technology-in-practice" (the reasons for which agents used technology) (Orlikowski 2000).

Adding to the above two examples (from interpretative paradigm), is a study by DeSanctis and Pool from positivistic paradigm that combines ST with concepts of "spirit" and "appropriation" to propose the Adaptive Structuration Theory (AST). The "spirit" according to DeSanctis and Poole (1994) is the ""official line" which the technology presents to people regarding how to act when using the system, how to interpret its features and how to fill in gaps in procedure which are not explicitly specified" (DeSanctis and Poole 1994, p. 126). Appropriation of technology on the other hand is defined as "the immediate, visible actions that evidence deeper structuration processes" (DeSanctis and Poole 1994, p. 128). However, on closer inspection we found that DeSanctis and Poole arguably discount Giddens continuous request to the readers on acknowledging that, first, structures are mentally accessed and continually changed by agents as they interact with their surroundings. DeSanctis and Poole (1994), however, argue that structures are temporally and spatially situated. Second, where Giddens proposes that it is not the structures that are institutionalised but the practices of agents over a given time that constitutes social system, DeSanctis and Poole (1994) contradict this argument and suggest that structures are institutionalised.

Taking on board the variability in using ST and adopting different views, and to accommodate for the limitations discussed in this section, we set on using specific concepts from ST and complemented them with concepts from Giddens's more recent work in the "Consequence of Modernity." In the following section, we present the concepts used and how these can be employed to explain IS deployment.

8.2 Use of Specific Concepts from ST and CM to Study IS Deployment: The Telehealth Story

We use a combination of concepts from Giddens's work to enhance understanding and see things from a different perspective at two levels of analysis, the macro and the micro. At a macro level, Giddens's notion on social change, and modern social systems that are constituted of disembedding mechanism, are employed to make some observation about the implementation of telehealth. At micro level, we explore issues surrounding the users of this service (doctors, nurses and patients) to elucidate user perceptions on breaches of trust and change in routines. We discuss this view in detail below.

8.2.1 Change and Social System: Macro Perspective

The introduction of telehealth services in health-care system introduces a number of changes to overall health-care delivery, including the context where care is delivered and the way in which it is delivered, thus leading to the potential factors contributing to conflict among its users and contradiction in overall goals (May et al. 2003a, b). Studying and understanding such contextual changes is contained within the macro analysis and ST can be employed to evaluate these changes (Peddle 2007; Lehoux et al. 2002). However, to apply this approach appropriately, we first have to equate modern health-care system with the social system, and define telehealth as an extension of this social system that spans across time and space. And, to do this, we call upon Giddens's definition of social system and concept of disembedding mechanism. Since health-care system involves institutionalised practices, by recalling the definition of social system presented in previous section we argue that modern health-care systems can be perceived as large social system that contains various individuals interacting with each other who enact various structures through continuous reflexive monitoring of their actions. Endogenous to these social systems are the disembedding mechanisms, to which, Giddens alludes to as "'lifting-out' of social relations from local contexts of interaction and their restructuring across indefinite spans of time-space" (Giddens 1990, p. 20). The concept of disembedding mechanisms was introduced by Giddens in CM, where as opposed to his earlier work, Giddens reflects on the role of technology as a facilitator and contributor to the "stretching" of the modern social systems through its use in disembedding mechanism (Giddens 1990).

There are two types of disembedding mechanisms, the symbolic tokens and the expert systems, which collectively are termed as abstract systems (Giddens 1990). Symbolic tokens such as money are defined as "media of interchange which can be 'passed around' without regards to the specific characteristic of individuals or groups that handle them at any particular juncture" (Giddens 1990, p. 22). Expert systems on the other hand are described as "systems of technical accomplishment or professional expertise that organise large areas of the material and social environments in which we live today" (Giddens 1990, p. 27). Comparing the definitions provided above, telehealth can be understood as an expert system that combines "technical accomplishments" of telehealth equipment *with* "professional expertise" of clinicians aimed at organised delivery of care for patients with long-term condition in a modern health-care system. As we notice that Giddens provides no reason for calling the two disembedding mechanisms taken together as abstract systems, we modified the definition of an abstract system for our study, where we depict an abstract system to encompass an expert system and the faith in care delivery processes. This modified perspective has two inherent advantages as it, first, from theoretical point allows to acknowledge all the pivotal concepts related to abstract system without losing central meaning (no interdependence is described between expert system and symbolic token by Giddens; therefore, subtracting symbolic tokens from abstract system studied should not affect its functionality). Second, from practical view, this perspective allows to: (1) distinguish the contextual differences between traditional care delivery practices and telehealth, and (2) factors that can affect the acceptance of telehealth due to such contextual differences. Having presented our perspective on understanding telehealth as an abstract system that is a part of larger social system (of health care), we now present the salient concepts that allow evaluation of issues at a macro level that affect telehealth implementation and its adoption.

As an expert system within an overarching abstract system, telehealth involves "faceless commitments" that are based on trustworthiness vested at access points. These points can be described as the ground where the experts within the system meet lay people (Giddens 1990) (in our study, the experts are clinical users and the lay people are patients). Nursing practice without telehealth, however, involves trustworthiness established between different individuals based on "facework commitments," that relates to physical presence of those involved. Thus, one can see how the introduction of telehealth creates "lifting out" of care delivery processes by changing its context which previously would be at patient's home facilitated through one-to-one interaction during home visit by the nurse. But now, it would be at nurse's office facilitated through telephone conversation after the nurse has evaluated patient's health trend on her computer. In other words, telehealth implementation causes a transformation in what previously was social integration to system integration and therefore influences the overall feedback dynamics of the social system. According to Giddens, social integration can be understood as "reciprocity of practices" during physical "face-to-face interaction," whereas, "system integration refers to connections with those who are physically absent in time or space" (Giddens 1979, pp. 76–77).

Moreover, such change also inculcates various questions in users' mind on the reliability of technology and the expertise of those involved in a given expert system, which leads us to the next vital concept from ST. This concept is of conflict and contradiction and can be used in conjunction with the concepts of social and system integration (Giddens 1984, 1979). The salience of conflict and contradiction as concepts within ST was highlighted by Walsham and Han (1991) in their classic review on how ST can be employed by IS researchers. They define contradiction as a "disjunction between different principles of system organisation" and conflict as "a struggle between actors and collectivities which tends to coincide with structural contradiction along its main 'fault lines'" (Walsham and Han 1991, p. 83). According to Giddens, conflict occurs at social level whereas contradiction occurs at the system level. We found examples of conflict and contradiction in our study of telehealth implementation. An example where conflict arose among users in regards to telehealth use includes various factors such as inadequate training, support (usually technical) and information on the equipment use, installation etc. Clinical users were unable to justify the need for telehealth and found procedures to implement such service particularly inappropriate and out of context. On the other hand, contradiction occurred in the way that telehealth and traditional care delivery processes differed from each other. Factors that contributed to contradiction at a system level included the procedures of patient selection and education, and monitoring of staff for their effectiveness levels by Primary Care Trust.

Having discussed the macro issues above, we now move to the concepts that can elucidate issues at micro level or in other words, issues that affect human agents due to the introduction of new technology.

8.2.2 Change and Human Agent: Micro Perspective

Micro perspective involves investigating influence that a new change has on the human agents who will be subjected to this change. It includes analysing users' attitude towards the change, how this change affects their work practices and their daily interaction. We use concepts proposed by Giddens in CM on trust and ontological security and explore their relationship to daily routines of human agents in contemporary social system. We then extrapolate these findings to the notion of acceptance of telehealth service.

Giddens argues that trust is focal to the functioning of abstract system, as all disembedding mechanisms "depend on trust" which is required due to the absence of face-to-face interaction, and hence lack of the complete information available through facial expressions and body language. He highlights that "trust here is vested, not in individuals but in abstract capacities" (Giddens 1990, p. 26). In telehealth service, there are number of scenarios where his analysis has particular resonance. For example, if we take a scenario, where a nurse is assessing patient's health based on the physiological measurement that the patient sends, s/he is vesting her/his trust not only in the abstract capacity of the patient using the technology correctly and taking the measurements in an appropriate manner, but also in the technological modality that is being used, i.e., it is functioning well and there are no errors involved. However, in scenario, where let's say, a technician is responsible for reading the measurement and informing the nurse if signs of deterioration in patient's health are observed, the nurse in this case is vesting her trust in the capacity of the technical staff such that they know what is expected of them and are doing the task accurately. Hence, one can argue that telehealth implementation implants the notion of interrogation in users mind as to whether their trust in the patient as a user, their colleague as a user, themselves as user and the technological modality itself is reliable and valid or not. This interrogation is part of the reflexivity of self and affects the agent's daily routines by disturbing their normal patterns of work and interaction, due to the change introduced, as now these agents are continuously engaged in evaluation of action of oneself and the others more seriously than what previously would have been "taken for granted."

Another concept at micro level is that of ontological security. Giddens refers to ontological security as "one form, but a very important form, of feelings of security" that is fundamental "to the confidence that most human beings have in the continuity of their self-identity and in the constancy of the surrounding social and material environments of action" (Giddens 1990, p. 92). He argues that agent's daily routines and ontological security are connected to each as "routines which are integrated with abstract system are central to ontological security" (Giddens 1990, p. 113). This notion explains how disturbance in daily routines due to changes such as telehealth implementation threatens the security of an agent within that system. In addition, he argues that agent's daily routines and ontological security are connected, and disturbance in daily routines due to changes such as telehealth implementation threatens the security of an agent within that system. Furthermore, it is suggested that ontological security is also interlinked with trust, and therefore, perturbence in one's ontological security would lead them to question their trust in the system and other people around him/her. From this we can deduce that human agents invest a great deal of effort in establishing and developing their daily routines and pattern of interaction within the system. Woven around these routines is the delicate web of trust and ontological security. Any external shock such as the implementation of new technology (IS deployment) with an objective of instigating new changes that might affect this web, will be perceived as threatening by the human agents and will encounter resistance.

From above, we can say that once the difficulties that might arise due to IS deployment initiatives are identified, strategies and steps to overcome these difficulties can be designed. At macro level, e.g., where telehealth changes the context of care delivery, one can learn from successful cases in other countries and develop regional model of integrating such a service with already established care delivery routines. At micro level on the other hand, acknowledging users' perception is a key lesson to be taken on board. Our research clearly elucidated the role that trust and ontological security play in agents' decision on changes introduced, and therefore would propose application and appropriation of efforts that aim at ironing out issues that may be perceived as threatening. This can be facilitated by discussing the possible conflicting situations and scenarios, and provide more one-to-one support complimented with detailed information and tailored training packages.

8.3 Conclusion

This chapter draws on various concepts introduced by Giddens in his early and later work, and elucidates their applicability in studying IS deployment. In particular, we draw on the case of telehealth implementation and elicit that if carefully defined and chosen, Giddens work constitutes of various unexplored concepts whose potential can be harnessed to analyse issues at macro- and micro level. We also suggest that instead of trying and complementing ST with other theories, researchers can look into Giddens's own recent work, thereby providing more insight and maintaining the integrity of their work and that of Giddens's himself.

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Chapter 9
Hubble Bubble Toil and Trouble: The Special Case of Emergency Services

Dr. Polly Sobreperez

Abstract The author outlines the technological frames strand of social shaping of technology theory and posits that the dimensions used by the major proponents of the theory to not necessarily apply to all situations. The proposal is to use an analogy of a technological bubble rather than a frame to describe in particular the interaction of emergency services personnel in emergency situations. The qualities of the bubble as soft-edged, three-dimensional and ephemeral lends well to the correlation between the tasks, beliefs and attitudes of emergency workers and their relationships with technological artefacts.

Keywords Emergency work • Technological frames • Social shaping • Technological bubbles

Abbreviations

ERP Enterprise resource planning
NHS National Health Service

9.1 Introduction

The work of emergency services and similar tasks in emergency medical situations seems to pose several issues with regard to supporting information systems. This chapter applies the theory of technological frames from the social shaping of technology theory, to the very particular work of the emergency services and those

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employed in allied types of work. Studies from across the spectrum of those involved in emergency work are consolidated and synergised and common themes are recognised. The particular elements of information systems that apply to this type of work are identified and technological frames theory is then used to explain the views of emergency work professionals towards different types of information systems. The author suggests that technological frames are inappropriate to describe emergency situations and proposes a new analogy of the "technological bubble" which corresponds more closely with those factors particular to emergency services.

9.2 Social Shaping of Technology Theoretical Background

Social shaping theorists (Mackenzie and Wajcman 1985; Edge 1988) argue that technologies are socially shaped in that their resulting material form reflects the political, economic and social circumstances of their development. They posit that the practices, assumptions, beliefs and language involved in design and manufacture are built into the technology and have consequences for deployment and implementation.

9.2.1 Relevant Social Groups

The theory of technological frames (Bijker 1993; Orlikowski and Gash 1994) furthers this explanation and brings in the notion of shared technological frames of reference, where members of relevant social groups (Pinch and Bijker 1984) share perceptions, attitudes and approaches to technological artefacts and their usage, and are said to share technological frames of reference. Many such groups are likely to emerge in and across organisations, and some individuals may be members of several groups in that, e.g., they may be both a manager and a user.

Group members may be technical specialists, suppliers, consultants, policymakers, existing users with knowledge of preceding systems, new users with no experience, users with experience of alternative or competing systems, managers, supervisors and other consumers of resultant data, both internal and external to the organisation. Significantly, group members may also include those who do not interact directly with the technology, known as secondary users (Ferneley and Light 2006).

It is clear from the diversity of identified relevant social groups across a variety of studies (Iivari and Abrahamsson 2002; McGovern and Hicks 2004) that these groups will have differing understandings of the purpose and utility of the technology; differing views of the usefulness and accuracy of the data produced; and differing views of data ownership[1] and resultant implications.

[1] The issue of data ownership in this instance does not refer to the legal control of information and access rights to it, but rather to the feeling of possession of and responsibility for data generated as a result of one's own work.

9.2.1.1 Review of Technological Frames Theory

The notion of technological frames states that relevant social groups share assumptions, knowledge and expectations expressed through language, visual images, metaphors and stories (Orlikowski and Gash 1994).

Frames are constructed as an interaction around an artefact or process, and comprise shared elements such as tacit knowledge, objectives, organisational constraints, shared methods and procedures and problems. In this way, the relationships between relevant social group members are captured but made fluid and open to change where the elements change. Frames are flexible in structure and content and have variable dimensions that shift in relevance and content over time and according to changing context. According to Orlikowski and Gash (1994), frames typically operate in the background and can be helpful in that they reduce uncertainty of conditions, structure organisational experience and allow common interpretations of ambiguity. They can also have constraining effects in that they reinforce established and possibly negative assumptions and knowledge, inhibit creative problem solving and distort information to fit existing cognitive structures (Orlikowski and Gash 1994). Orlikowski and Gash use framework dimensions that are common to most organisations and use three main domains to contrast their case study frames. These are: nature of technology, technology strategy (including motivation and criteria of success); and technology in use (including priorities and resources, training, ease-of-use and security and quality policies).

Another issue regarding technological frames is the concept of congruence and incongruence (Orlikowski and Gash 1994). Congruence of technological frames implies similar expectations around the role of technology in business processes and incongruence implies important differences in expectations or assumptions around key technological aspects. Sobreperez (2008) suggests further preconditions for frame incongruence such as enforced proceduralisation, and cultural issues. A more recent study (Prell 2009) develops a useful alternative method for analyzing technological frames by identifying congruent or differing goals, problems and strategies as well as tacit knowledge and key material resources, reverting back to the original frame dimensions as outlined by Bijker (1993).

Davidson's (2002) review of technological frames theory suggests that most applications of theory fail to investigate; the process of "framing"; the cultural and institutional foundations of frames; and the characteristics and consequences of frame structure. She points out that the majority of studies are by their very nature contextually bound as case study scenarios and fail to further the theory, simply recognising their existence in a particular case study setting.

One implication of social shaping of technology theory is that the specific usage of systems in all workplace situations is often not known at the time of design and implementation. This is particularly true in emerging technologies where potential uses and usefulness are often not well understood by suppliers, users, developers or managers (Gasser 1986). To include and consider these users, both final and intermediate, draws attention to the full range of groups of people included in systems development, implementation and deployment.

9.2.2 *Differing Attitudes to Data Collection and Usage*

Differing attitudes to data collection and usage are often the result of incongruence in technological frames of reference. Often, and across several studies (Lankshear and Mason 2001; Ferneley and Sobreperez 2006; Sobreperez 2008), there is little understanding at operator level of the usage of information. Operators view this with some acrimony as surveillance leading to personal performance monitoring. The data is often used to calculate bonuses and feeds forward into informal verbal reward and admonishment situations and into formal annual appraisals. However, it is also used by managers to review and plan workflow, site new equipment and forecast expansion potential. The very hierarchical and adversarial nature of the organisational culture may lead to an ethos of mistrust and misunderstanding, so that each faction or group not only do not understand but do not want to understand the requirements of the others.

This perspective is highlighted by Wilson and Howcroft (2000) who discuss the politics of IS evaluation concluding that the issues, factors, measurements and benchmarks attended to and studied in evaluations are determined by those with a particular political agenda. They are likely to justify decisions and investments already made, likely to be heavily influenced by those who selected and ordered systems, may be from the same department or may even be the same individuals. They are also unlikely to measure such soft factors as usability, user satisfaction or ease of use. Wilson and Howcroft (2000) argue that despite protestations of objectivity and independence, there are often factors involved in IS evaluation which would be viewed differently by different relevant social groups, and that the evaluation process is distorted by those with the power to legitimize views of systems.

This position is also evident in a Fire Service study (Ferneley and Sobreperez 2006) where visits to the local statistics office of the County force and to the Office of the Deputy Prime Minister revealed quite different attitudes to the information systems including those of acceptance, approval confidence and trust. The very idea of communicating and cooperating with users undermines the status, power and privilege of managers, developers and those that “know best” how to organise work activity (Markus 1983). The groups involved in the development and usages of information systems often have different priorities and goals and this creates the potential for conflict and controversy.

Although this may be true in a standard organisational setting, the very opposite is true in the emergency situation. The technology is not shared, but the problems, priorities and goals are shared and in this way, a technological frame’s dimensions are better described using these concepts. This position is more in line with the original frame dimensions identified by Bijker (1993) than with those identified by Orlikowski and Gash (1994).

9.3 Emergency Services

The complexity of interactions between groups has been highlighted (Fincham et al. 1995) as a probable cause of even further problems where complex human action, not necessarily understood in depth by developers and technical specialists, is intended to be supported using information systems. This is particularly true where each incident is different and stakeholders, both individually and as a group, bring a large amount of tacit experience and knowledge to a situation. In emergency services, each incident is extremely idiosyncratic and must be dealt with so dynamically that there can be no "right answer" to the way it is handled. Although organisations such as police or fire authorities and individual hospital and ambulance services issue risk management policies in an attempt to improve practice and minimise risk, the particular circumstances of each incident render these into guidelines at best.

Approaches are and must be contingent on the location and severity of the incident; the speed of occurrences, events and responses; the skills and expertise of those present; and the response of the control centre and senior employees present or not present. As each incident is unique, it becomes difficult to draw up and apply rules and guidelines, and it may be that what superficially appear to be similar incidents are dealt with entirely differently in response to a variety of factors which will be complex and problematic to identify. In view of this, it becomes increasingly challenging to create information systems to match and support workforce action or to manage knowledge across an organisation involved in highly complex individualistic, distinctive incidents which need to be grouped and consolidated in a variety of ways to be presented to policy makers and managers.

9.3.1 Emergency Situations

Recent studies which involve workplaces associated with the public sector and in particular health services, emergency services and social work highlight situations which seem unique to emergency situations. These include papers covering issues of acceptance and resistance in the fire service (Xiaodong et al. 2004; Ferneley et al. 2005; Ferneley and Sobreperez 2006); papers covering workarounds and success or failure perceptions in the UK NHS including surgeons, nurses and midwives (Lankshear and Mason 2001; Timmons 2003; Kobayashi et al. 2005; Lankshear et al. 2005; Blegind Jensen and Aanestad 2007), in the ambulance service (Beynon-Davies 1999) and in social work (Broadhurst et al. 2010). This chapter is not confined to the recognised "classic" emergency services of police, fire and ambulance, but also extends to include emergency situations in social work and in hospital wards. In this case then, emergency then can be defined as situations where there is immediate threat to life, health, property or the environment.

Analysis of emergency situations covering literally life and death situations reveals that the work is highly complex and involves judgement and decision making and continuous dynamic risk assessment. In emergency decision making, there is often incomplete information and uncertainty; there may be a variety of "expert views" on the assumptions that can possibly be made and the most appropriate way forward in the light of incomplete and constantly changing information.

An emergency incident or medical situation is likely to include many professionals and specialists with in-depth knowledge and expertise of a single aspect of the emergency situation. For example, a road traffic accident may include police, fire and ambulance workers, and within these specialists in traffic management, chemical and fuel spillage, particular types of injuries, paramedics, trauma specialists, helicopter pilots, extrication specialists and a myriad of other skills and professions. An emergency in a hospital will include doctors, nurses of various levels, and again specialists such as midwives, anaesthetists and various technicians. Several have criticised technological frame theory for ignoring workplace hierarchies and assuming equality across groups (Russell 1986; Winner 1993), whereas in reality the hierarchy changes according to the unfolding subcomponents of the event. The traditional hierarchy is often not available and contingent decisions must be made.

9.3.2 *Emergency Decision Making*

Decision making in emergency circumstances is not an individual issue based on expertise and judgement, instead decisions are made in interactions among various members and categories of staff in relation to various risks. Individual decisions are often open to dispute, negotiation and occasionally the pulling of rank. This leads to difficulty in determining responsibility for and attribution of decision making. Often decisions emerge from a range of informal and tacit invisible consultations and conversations (Lankshear et al. 2005).

A study of birth delivery suites (Cioffi 2000) highlights the hierarchies involved in emergency decision making. When birthing situations hit complications, midwives, although they know well what should be done, and often have many more years experience than an individual doctor, often bring in doctors for "formal" decision making. Despite this, midwives are involved in continuous informal decision-making activities through constant monitoring and often pool this information leading to a "joint competence" (Hn Tjore 2000) by calling on the experience of a variety of colleagues and thus providing reassurance by legitimising decisions. Clearly, the decision to involve a doctor as a formal decision maker is one of the most important decisions. The minimising of risk in delivery suites occurred in this study when decisions regarding particular at-risk patients were collective. In this way then, it seems clear that, in practice, decision making in emergency situations is a socially negotiated activity (Horlick-Jones et al. 2001).

Formal methods of record keeping present decision making as individual, in that only an individual can log into information system under their personally allocated user name and password and thus the recording of a decision becomes attributable to them. Recognition that there may be a variety of expert opinions and views has led NHS administrators in an attempt to regulate decision making, to minimise risk and improve practice through policy. This has led to regular clinical audit and increased support for technological interventions, and most importantly the issue of accountability. Typically, public information systems serve multiple users and users crossing political jurisdictions (Newcomer and Caudle 1991). This includes policy and practice on primary purpose of the data, freedom of information requirements, privacy and confidentiality safeguards, data sharing and attribution of data entry.

9.3.3 Accountability and Information Recording

The increasingly litigious and "heads will roll" accountability of the public sector in the light of errors, omissions and oversights makes the fear of litigation paramount in the minds of professionals in emergency situations. Several authors (Symonds 1987; Clements 1991; Symonds 1993; Symon 1998) have concluded that risks are avoided in order to prevent litigation (James 1993). In the NHS, within this risk-avoidance culture, strategies are developed to ensure any patient's accusation that the provision of care was less than satisfactory cannot be "blamed" on individuals or teams and this has been entitled "defensive medicine" (Kessler and McClellan 1996).

These two issues; fear of litigation and enforced individual data entry, can lead to distrust of and resistance to information systems in emergency settings. For example, consider Lankshear and Mason's (2001) study of situations in a maternity ward where midwifes and practitioner users did not appreciate the ramifications to the dataset of circumventing various data capture processes. So, whilst from the user's perspective the system hindered their working practices, from a management perspective the workarounds had negative ramifications as they destroyed the information system's data integrity. This ties in with the concept of technological frames from the Social Shaping of Technology theoretical framework (Orlikowski and Gash 1994) in that the differing "relevant social groups" have differing technological frames for perceiving, understanding and accepting the information systems within their organisations.

Technological frames theory suggests that a process of action and interaction involving communication and collaboration between relevant social groups form and shape the technology (Van Maanen and Schein 1979; Porac et al. 1989). The different levels and areas of expertise in many overlapping fields, and the different objectives, priorities and concerns of these groups suggests that there is considerable potential for poor communication, discord and conflict. This is particularly true of professionals working in the emergency services.

9.4 Emergency Workers

It seems clear that the public sector is different from the private sector in that many public sector workers recognise a vocational element to their work, and to their identity. This may be particularly true in the case of education, health and social care, and in emergency services in that these occupations are intrinsically different from the clerical, administrative and managerial public sector occupations that support rather than deliver the primary function. Many public sector organisations have a largely administrative function, such as local councils, government departments and their local and regional functions, but a large number also include this vocational element which might be characterised by a desire to support and assist those who are in need, either temporarily or permanently, of assistance and help. This is a very loose definition and can be traced to the work of Blum (1993) who describes a personal identification and personal engagement with values and ideals which engender a moral pull. Vocational professions are motivated by care and the specific needs of specific patients/pupils/people in danger in specific situations and employees respond to values external to themselves and appropriate to the occupation (White 2002). Blum identifies a transcendence of the personal in the name of the vocation.

Emergency services workers then are likely to have these vocational attitudes to their profession, but in addition they must have the personal resources to deal with dangerous and perilous situations often involving death and serious injury and the highly distressed individuals associated with such encounters. There has been some inconclusive work on the notion of the "rescue personality" where Mitchell and Bray (1990) suggest that in order to effectively implement information systems, professionals must have knowledge of the unique personalities of emergency personnel and the specialized jobs they perform in extreme environments.

Could it be then that there are issues particular to these emergency professions that do not apply, e.g., to production or banking scenarios? This is not to say that resistance is more usual, common or typical in these types of case studies, but it may be useful to identity the particular factors present in these types of situations which make it difficult for information systems to be supportive and useful.

The suggestion of the author is that the view of identifying relevant social groups by their job title oversimplifies the idea of technological frames in two ways. First, there is the assumption that people fall into groups and that each group has a particular unchanging view or frame of reference when considering technology. Second, there is an underlying assumption that group members already in a group identified socially, or in a work context, will share technological frames. For example, Ferneley and Sobreperez (2006) identify managers, firefighters and statisticians, Lankshear et al. (2005) identify nurses and doctors and Prell (2009) identifies academics and professors, youth service workers and students.

This assumption is over simplistic, there may be many senior managers in any organisation who feel that systems are imposed from above, that they have no ownership of the data and that there are significant differences between what actually happened and the recorded version. In this way then, members of a particular relevant social group, who share attitudes, opinions and points of view over their interaction with technologies, may cut across management hierarchies, job titles and salary scales. It may also be pointed out that management takes many forms from supervisor to managing director and that rather than viewing a polarity between managers and workforces, there is a continuum which includes many different levels of management, with all but the top-level subordinate and answerable to the level above.

9.4.1 Emergency Workers and Technological Frames

In addition, members of relevant social groups may have different attitudes to different types of technologies. An example is that in the fire service, a working class, masculine culture prevails. Firefighters see themselves as brave men and heroes, unconcerned with the “paperwork” of recording systems and emphasize their “proper” work is facing danger to save lives and property. In the UK, they are strongly unionised, protective of their masculine role as “breadwinner” and resistant to the introduction of female firefighters (Sobreperez 2008). Firefighters hold differing attitudes to different categories of technology, as did nurses and medical staff in the Lankshear et al. (2005) study. The workforce seems to separate technologies into those which support their primary role, i.e., nursing or firefighting, and those which are seen as bureaucratic. A study of surgeons’ acceptance of EPR systems (Blegind Jensen and Aanestad 2007) found that surgeons were happy to use patient health monitoring technology to check vital signs during surgery and to facilitate the surgery, such as imaging, x-rays and scanning. However, resistance was met when surgeons were required to undertake tasks previously done by others such as creating prescriptions, rather than leaving this to an administrator, and resistance to the keyboard and screen in the operating theatre was vocal, where such artefacts are seen to belong to other groups of lower-level workers, variously described as secretaries or administrators. The introduction of performance management techniques in the UK public sector in the 1980s has become entrenched and the associated determination of performance targets and the link to resource allocation is now widespread. This has been termed New Public Management (NPM) and includes financial monitoring and accountability, the establishment of “internal markets” between service providers and within organisations, and the development of a range of performance measures and benchmarking techniques by which individuals, units, departments, sections, divisions and entire organisations are compared and judged by their managers, by service receivers and by the taxpayer and politicians through the media (Hood 1991; Osbourne and Gaebler 1992; Hoggett 1996; Pollitt 1997; Hood et al. 1999; Thomas and Davies 2005). It is the information overhead imposed by this development that ensures professionals at all levels must micro-record much of their activity and compare it to national and local benchmarks, league tables and performance monitoring systems. Often emergency professionals must undertake this, as the only personnel “in situ” at an emergency, and this often causes resentment due to incongruent technological frames between administrators and emergency workers.

Information users in emergency health care or blue-light emergency services are often highly trained professionals in firefighting, health care or social work and crucially do not see record keeping as part of their job. They are frustrated and annoyed at having to keep records which may be seen to undermine their professional autonomy. They see computer use and record keeping as someone else's job; they often do not have ownership of information and consider it "nothing to do with me." Their "real" job is nursing, putting out fires, or assisting vulnerable children or adults from dysfunctional families which may include emergency crises arising from mental health and drug abuse issues (Lankshear et al. 2005; Sobreperez 2008; Broadhurst et al. 2010).

9.4.2 Relevant Social Groups and Frame Dimensions

With reference to information technology in organisations, there are generally a number of social groups critical to the development of technological change (Kling and Gerson 1978). These include at least managers, systems developers and users, and of course several categories of each may share or overlap frames. The different groups of users then are open to amendment and an individual may belong to several groups at any one time. This implies that technological frames are fluid and individual and may appear to negate and subvert the idea of shared technological frames. However, if we use the goals, problems and strategies structure identified by Prell (2009) and taken from Bijker (1993), we can see that the notion of congruence can be underpinned by the notion that where these three structural items are shared, the technological frame can be shared, across professions, agencies and specialisms. During the ephemeral time period of the emergency incident, sharing of frames is given great relevance; however, once the danger is past, those who need to use technology to make records, or to monitor stability, will be left to their own particular specialisms.

9.4.3 Emergency Incidents and Technology

In an emergency situation, the problems might be exemplified as extricating trapped people, managing traffic flow around the incident, putting out fire or managing individual injuries. The goals might be to solve these issues while at the same time preserving life and property, reducing damage to people and property, minimising disruption to traffic flow, etc. The strategies will include the assessment and prioritisation of necessary action and communication with additional support systems such as air ambulance or additional specialist equipment. This brief outline gives very general scenarios where problems, goals and strategies are shared which is important for the next stage of the analysis.

Firefighters are willing to use sensors to check toxicity, temperatures and location, and medical staff are happy and willing to use all kinds of technologies to monitor and check patient progress. However, when it comes to the record keeping and the compilation of statistics for benchmarking, performance monitoring or comparison, a marked lack of compliance is evident. Thus, actors are members of several differing technological frames, which may conflict or overlap. It seems clear that resistance displayed is not resistance to the technology, but to the task. Many emergency workers are very well aware of and protective of their professional discretion and thoroughly reject managerial standardisation, regulation, bureaucratisation and monitoring of their role (Horlick-Jones 2005).

The cultural and institutional foundations of differing frames (Davidson 2006) can be distinguished by the differing educational backgrounds, career paths, workplace and data usage of the relevant social groups which may account for incompatible attitudes to data collection and utilisation. Understandings, interpretations and expectations of information systems are framed and reframed through the exercise of power (Lin and Silva 2005), thus in the context of data collection and usage, emergency workers are in the least powerful position. In the exercise of their skill in emergency situations however, they are in the most powerful position, through the tacit knowledge and skills they have and through the professional autonomy they hold.

Technological frame theory suggests a fixed view by individuals who work as a group. These groups are identified as such in that they share elements of knowledge, agree over meanings, have a set of beliefs in common and share assumptions and expectations. They are referred to, and in many ways behave in some situations, as a unit. The emergency situation though, includes the following

- Life and death situations
- Dynamic fast-changing situations
- The need for immediate and robust decision making.

9.5 Technological Bubbles

The author presents an alternative notion; that of the technological bubble – an attitude to technology shared by groups of individuals who only temporarily share the beliefs, requirements, trust and knowledge of a certain technology. Once the moment has passed, the shared belief is no longer required and the bubble is burst. Rather than viewing attitudes and approaches to technology as framebound, it may be more appropriate to look at a less rigid model. The notion of the technological bubble arises as an analogy which may be more appropriate. Particularly in circumstances which involve factors such as dynamic decision making, fast-changing situations with far-reaching consequences and a mixture of professionals and specialists with individual technological knowledge and skills. The work of emergency services is an extreme example of this type of situation.

Bubbles are soft edged, they sometimes arise in numbers and sometimes the edges between them blend so that two or more bubbles become one. In an emergency situation then, technological bubbles arise around a particular event or component of the situation, e.g., freeing someone trapped, or dealing with chemical spillage. Those working on that component of the situation will share the technical bubble, such as sensors, monitors or cutting equipment, and although they do not all deal with the technology, they share an attitude to it, in that they give it priority, as a strategy to solve the shared problem and reach the shared goal.

Bubbles are ephemeral; they last only as long as the surface tension is sufficient to hold them in place. This matches the emergency service technological bubble as the goals and priorities will merge and shift as different components of the incident take priority, but the bubble will be over when the goal is reached. Technological bubbles then will also blend, merge and burst as different technologies are used and supported by sets and subsets of people involved in the incident. In some emergency situations, people come together from different agencies and from across regions, they may be complete strangers and never meet again; however, for a brief time period, they share a technological bubble. There will often be multiple bubbles, indeed a foam of bubbles, present at the same incident and in a constant state of emerging, merging, dividing and bursting.

Technological bubbles are three dimensional and can include many factors, underlying dynamics and structures such as targets and benchmarks, and the complex relationships between differing professions, specialists and agencies present at an emergency incident.

9.6 Conclusion

To conclude, technological frames theory is a well-used model which may be entirely appropriate for many standard organisational situations. However, there are many situations for which it is not a suitable and appropriate tool. The work of emergency services is an extreme example of the type of work that does not lend itself to the notion of technological frames and the author suggests that the notion of the technological bubble is a more appropriate analogy due to the properties of dimension, transience and shape changing.

It seems then that where technology is seen to support the primary function of the emergency worker in an emergency situation, it will be seen with one lens and will fall into a technological frame which views this as acceptable and adoptable. Where the technology is perceived to support an organisational function not accepted as part of the emergency workers tasks, i.e., when the bubble bursts and routine bureaucratic tasks retake priority, it will fall into a different technological frame and will be resisted or rejected.

Several previous studies involving emergency situations have been referred to in this analysis, but currently the notion of technological bubbles is not supported by empirical primary data collection. An empirical study is necessary to observe and substantiate the notion and amend or adapt the suggested bubble representation.

Although the emergency services are used here, this may be a useful model for examining other ephemeral situations such as sports events, theatrical- and arts-based events, conferences and sales fairs and other similar situations.

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Chapter 10
ERP Diffusion and Assimilation Using IT-Innovation Framework

Husam Abu-Khadra and Khalifeh Ziadat

Abstract This chapter introduces information technology (IT) frameworks as a mean of studying the IT "diffusion and assimilation" process. The chapter consists of three main sections; the first section introduces the reader to the topic and chapter structure, the second section defines the related terminologies in this field and illustrates the different frameworks and theories that explain and interpret the IT-innovation diffusion success. The third section formulates and proposes the specifications of a hybrid integrative conceptual framework for IT adoption and diffusion. This framework encompasses three main clusters: the external environment, the internal environment, and the technology characteristics. These clusters contain a total of 17 attributes drawn from the different theories and frameworks in this field and proven to be significant. Overall, the chapter serves several goals; it provides the reader with better understanding of IT-innovation diffusion theories, IT-assimilation practices, implementation pitfalls, and IT-diffusion practices trend.

Keywords ERP Diffusion • Assimilation • IT-Innovation • IT Theory

Abbreviations

CAT	Consumer acceptance technology
CIP	Cognitive instrumental process
DOI	Diffusion of innovation theory
EDI	Electronic data interchange
ERP	Enterprise resource planning

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IOS	Interorganizational information systems
IS	Information systems
IT	Information technology
OLAP	On-line analytical processing
PEU	Perceived ease of use
PU	Perceived usefulness
RD	Result demonstrability
SET	Sensory enabling technology
SN	Subjective norms
TAM	Technology acceptance model
TOE	Technology–organization–environment
TPB	Theory of planned behavior
TR	Technology readiness
TRA	Theory of reasoned action
TRI	Technology readiness index

10.1 Introduction

Enterprise Resource Planning (ERP) systems have become very important elements of information technology (IT) in the past 2 decades due to their wide adoption (Stewart et al. 2000). ERP systems become more and more attractive as they foster consistency, efficiency, integration, and enhance intra-organizational communication (O'Leary 2000). Moreover, they have been credited with reducing inventories, shortening cycle times, lowering costs, improving supply-chain management practices, and increasing the speed of information flow (Davenport 1998). All of these features facilitate better organizational planning, communication, and collaboration. Therefore, it is understandable why the ERP has revolutionized the information system/information technology (IS/IT) field.

Unfortunately, this has not always been the case when the organization acquires an ERP system (Martin 1998); software projects can often spiral out of control to become "runaway systems" that far exceed original budget and schedule projection (Keil et al. 2000). That failure could represent a significant loss in a market with billions of investments and opportunity cost (ARC Advisory Group 2003). Organizations were not always successful in finding the key practices that should be applied to get the ERP desirable value (Alsheikh and Abu Khadra 2009).

Knowledge advancement in technology and related practices in the current age verifies that the right practice is the key factor of technology and knowledge success. So what is the best practice that ensures having a successful ERP system? What are the factors or circumstances that affect the ERP diffusion or even its survival? This chapter will try to answer these questions and provide the reader with an extended vision of this topic, accompanied with critical review and meta-analysis of the literature. The context of this chapter is designed to motivate the reader to address new questions to one of the most important issues within the context of IT literature, which is *diffusion and assimilation of IT innovation.*

The conclusions of this chapter are expected to have several implications for the researchers, the providers of ERP systems, and the potential users of ERP systems. For the providers, the results can help them assess a company's receptiveness to breakthrough innovations (ERP systems) and, hence, help decide on the best sequence of rollout of their ERP systems and identify their targeted market. But, even more, it can help suppliers to adjust their communication and distribution strategies according to each company's traits. For the researchers, this chapter brings their attention to the importance of investigating issues related to ERP systems as a vital and dynamic area within the information systems research domain. Furthermore, the chapter provides a road map of the development of this area of research, starting with the roots of this topics and ending up with an overall picture through the concluded framework that may encourage launching their own research. For the users, the chapter is supposed to guide the potential users of ERP systems to assess their own receptiveness to install ERP innovations in order to assess their readiness for successful implementation.

The rest of the chapter consists of two main sections; the first presents the historical and conceptual background of the main notions and concepts related to IT diffusion and assimilation in order to enable the reader to gain his or her initial understanding of this topic. The second compares matches and identifies the overlaps among the IT-diffusion frameworks. Also it recognizes the conceptual and empirical similarities across these models, accompanied by meta-analyzing of their empirical evidence. Such revision enables the construction of a relatively more comprehensive framework that contains a list of potential determinants of IT-innovation adoption, focusing on factors that have been predicted to promote the IT adoption and diffusion.

10.2 IT-Assimilation and IT-Diffusion Theories

To start with this area, we believe that the reader should have a clear-cut understanding of the different concepts in this field. Consequently, we will explain briefly the following three concepts: *Innovation*, *Diffusion*, *Assimilation*, and *Innovation Diffusion Theory*.

Mckeown (2008) defined innovation as the change in the process of doing something or "new stuff made useful"; it may refer to revolutionary changes in thinking, processes, or products. Not far away from the first definition but in a more sophisticated way, Baregheh et al. (2009) defined *innovation* as a "[m]ulti-stage process whereby organizations transform ideas into new/improved products, service or processes, in order to advance, compete and differentiate themselves successfully in their marketplace." Therefore, *innovation* is not only a new idea that exists on a piece of paper, despite the fact that it may have great implementation potentials. So can we consider the IT-software product as an innovation by itself? Is it useful?

Amabile et al. (1996) proposed that any *innovation* begins with creative ideas; we define innovation as the successful implementation of creative ideas within an organization. In this view, creativity by individuals and teams is a starting point for innovation; the first is a necessary but not sufficient condition for the second.

In the IT-*innovation* context, Rogers's (1995) definition could be widely accepted; his definition states that "[a]n innovation is any idea, object or practice that is perceived to be new by the members of the social system." Based on Rogers's definition, we will ask the same question again, can we consider the IT-software product as an innovation?

What about the *diffusion* process – can we have a clear-cut between the *innovation* and the *diffusion*? Upamaka and Mahanty (2007) defined the diffusion of technology as the movement of the technology from the place of its origin to its commercialization (utilization). This process involves many players starting with the raw idea and ending up with the stage where it takes the shape of a new ERP system. It sounds that we have an overlap between (Mckeown 2008; Baregheh et al. 2009) innovation definitions and (Upamaka and Mahanty 2007) diffusion definition.

Again, Rogers (1995) came up with the solution where he defined the diffusion of technology as the process by which technology "is communicated through certain channels over time among the members of a social system." According to this definition, the diffusion starts as soon we have the innovation of technology, regardless its timing.

After defining the innovation and the diffusion separately, we remain with one last concept. *Diffusion of innovation theory* is a theory of how, why, and at what rates new ideas and technology spread through cultures. The concept was first studied by the French sociologist Gabriel Tarde and by German and Austrian anthropologists such as Friedrich Ratzel and Leo Frobenius (Wiki, York 2010).

Finally Purvis et al. (2001) defined *assimilation* as "the extent to which use of technology diffuses across the organizational projects and processes." This definition corresponds to (Markus and Tanis 2000) "shakedown" and "onward and upward" stages of the ERP life cycle (Liang et al. 2007).

The following section reviews the previous work on the well-established IT-assimilation frameworks. The frameworks that have been recognized as being the most frequent cited theories in the literature includes Diffusion of Innovation theory (DOI), Technology–Organization–Environment Framework (TOE), Technology Acceptance Model (TAM), Consumer Acceptance Technology (CAT) Model, Technology Readiness (TR), and Delone and Mclean IS Success Model.

10.2.1 Diffusion of Innovation Theory (DOI)

Although there is a rich literature concerning the investigation of factors relating to the initiation, adoption, and implementation of executive information systems, many scholars and IT researchers still base their research on the DOI theory provided by the seminal work of Rogers (1983).

Rogers, in his theory, sees innovations as being communicated through certain channels over time and within a particular social system, individuals show different degrees of willingness to adopt innovations and even though the overall population might be seen as approximately normally distributed over time

(Rogers 1995). Breaking this normal distribution into segments leads to the segregation of individuals into the following five categories of individual-innovativeness (from earliest to latest adopters): innovators, early adopters, early majority, late majority, laggards (Rogers 1995). When the adoption curve is converted to a cumulative percent curve, a characteristic S curve is generated that represents the rate of adoption of the innovation within the population (Rogers 1995).

According to Rogers, the rate of adoption of innovations is impacted by five factors: relative advantage, compatibility, trialability, observability, and complexity. The first four factors are generally positively correlated with the rate of adoption while the last factor, "complexity," is generally negatively correlated with the rate of adoption. The actual rate of adoption is governed by both the rate at which an innovation takes off and the rate of later growth.

Low cost innovations may have a rapid takeoff while innovations whose value increases with widespread adoption (network effects) may have faster late-stage growth. Innovation adoption rates can, however, be impacted by other phenomena. For instance, the adaptation of technology to individual needs can change the nature of the innovation over time. In addition, a new innovation can impact the adoption rate of an existing innovation and path dependence may lock potentially inferior technologies in place (Rogers 1995).

The roots of Rogers's work could be referred to an early research work of Tornatzky and Klein (1982) who conducted a review of 75 articles concerned with innovation characteristics and their relationship to innovation adoption and implementation. The results of their research revealed that there are three innovation characteristics – relative advantage, compatibility, and complexity – that had the most consistent significant relationships to innovation adoption where the compatibility and relative advantage were both positively related to adoption while complexity was negatively related to adoption.

Following the work of Tornatzky and Klein (1982), Moore and Benbasat (1991) created eight factors that impact the adoption of innovation (voluntariness, relative advantage, compatibility, image, ease of use, result demonstrability, visibility, and trialability).

In an extension and update of Tornatzky and Klein (1982) and Moore and Benbasat (1991), Rogers's seminal work "Diffusion of Innovations" (1995) became one of the most often cited reviews of the perceived innovation characteristics literature (Al-Gahtani 2003). Rogers, in a survey of several thousand innovations studies, identified five antecedents – relative advantage, complexity, compatibility, observability, and trialability – affecting the rate of diffusion of a technology. Rogers argues that up to 87% of the variance in rate of adoption is explained by these five attributes.

Up to this point, the DOI theory sounds perfect, but unfortunately this is not the case; Rogers's theory has been criticized for not taking into account the particularities of complex ITs (Lyytinen and Damsgaard 2001). In addition, the theory has been judged as poorly equipped to facilitate the understanding of how different groups interact in the production and provision of an innovation as well as lacking attention to acts of reinvention and the consequences of innovation adoption (Papazafeiropoulou 2002).

The above-mentioned shortcoming has been confirmed by Light and Papazafeiropoulou (2004), who used Rogers' theory as a platform for understanding what might be seen as the rational reasons for packaged software adoption. Their paper argues that complex network of actors and their conflicting ideas or requirements can influence the adoption or rejection of a technology, which in turn elevates the interpretive approaches, such as those concerned with the social construction of technology emphasize the way that technologies are "configured" throughout the process of diffusion by various actors, or relevant social groups, such as professional associations, that they came consistent with (Beynon-Davis and Williams 2003).

Nevertheless, one of the most widely used rational theories, is Rogers's DOI theory (Rogers 1995, 2003). Models such as this, aim to trace and explain the path of an innovation's acceptance through a given social system, over time. There is a general agreement among researchers that DOI is a suitable and valid theory for examining the process of adoption (Golding et al. 2008).

Jeyaraj et al.'s (2006) (quoted in Golding et al. 2008) investigation of IT adoption by individuals and organizations, confirmed that DOI was recognized as the only theory which has been used to evaluate adoption on the individual and organizational levels. Looi (2004) suggested that the Rogers's innovation diffusion theory is perhaps the most frequently cited theory in most research on DOI.

10.2.2 Technology–Organization–Environment (TOE) Framework

In 1983, there appeared on the market a book that simply became known as the "big red book" among colleagues in the field of technology transfer and innovation. Louis Tornatzky (et al.) of the National Science Foundation published this book with the title "The process of Technological Innovation: Reviewing the Literature" and with unassuming government-publication format and soft cover, it became an instant hit; almost everyone doing research in this field requested a copy of the book. In 1990, the second edition of this book did not bring much improvement over an already excellent work, and deserves attention (Tansik 1991).

Along with the second edition of this book, Tomatzky and Fleischer (1990) were credited with being the first to develop the TOE framework to study the adoption of technological innovations (Pang and Jang 2008). They believed that the process by which a firm adopts and implements technological innovations is influenced by the technological context, the organizational context, and the environmental context, the so-called Technology–Organization–Environment (TOE) framework.

The (TOE) framework identifies three aspects of a firm's context that influence its assimilation of a technological innovation, while each of the three major constructs in the framework has its own minor sub-constructs: (a) technological construct, which describes both the existing (internal and external) technologies in use and new technologies relevant to the firm, technologies may include both equipment as well as processes; (b) organizational construct that refers to descriptive measures about the organization characteristics and resources such as scope, size, degree of centralization, degree of formalization, managerial structure, human resources, amount of slack resources, and linkages among employees; and (c) environmental construct, which represents the arena in which a firm conducts its business – its industry, competitors, the macroeconomic context, and the regulatory environment (Tornatzky and Fleischer 1990; Pang and Jang 2008; Zhu and Kraemer 2005).

The TOE framework has gained considerable empirical research attention over the past decade, which could be referred to such composition suggests that the TOE is consistent with Roger's (1995) general innovation diffusion theory. Furthermore, it has been found that the TOE is appropriate for studying contextual factors that influence e-business assimilation, and it can be used for studying different types of innovations (Iacovou et al. 1995; Chau and Tam 1997; Thong 1999; Zhu et al. 2003, 2004, 2006; Zhu and Kraemer 2005; Wu and Subramaniam 2009).

Subsequently, Bradford and Florin (2003) draw upon DOI theory and information systems success theory to specify a TOE-composition model of ERP implementation success. Their model specification proposed seven assimilation predictors within the three contexts of the TOE framework: Technology – technocal compatibility, perceived complexity, business process reengineering; Organization – top management support, organizational objectives consensus, training; and Environment – competitive pressure. Their results reveal that top management support and training are positively related to user satisfaction, while perceived complexity and competitive pressure show negative relationship.

Zhu and Kraemer (2005) employed the well-known TOE framework to focus on post-adoption stage, that is, the actual usage of e-business at the firm level. A unique dataset of 624 retail industry firms across ten countries (developed vs. developing countries) was employed to validate their conceptual model. Six potential determinants were considered within the TOE framework: technology competence, size, international scope, financial commitment, competitive pressure, and regulatory support. However, their empirical analysis confirms that the factors of technology competence, size, financial commitment, competitive pressure, and regulatory support are important antecedents of e-business use.

Henriksen (2006) investigated the adoption of Interorganizational Information Systems (IOS) in the Danish steel and machinery industry within the context of the TOE. His findings show that environmental and organizational attributes rather than technological attributes are the main determinants of the adoption of IOS.

Recently, Pang and Jang (2008) adopted the TOE conceptual model to investigate the adoption of ERP and focus on its relationship with selected factors that are considered important to Taiwan's communications firms; this research was based on the work of Tomatzky and Fleischer (1990), Iacovou et al. (1995), Chau and Tam (1997), Zhu et al. (2003, 2004), and Zhu and Kraemer (2005).

Since the primary focus of Pang and Jang (2008) is to determine which factors in the TOE framework were responsible for the adoption of ERP, the dependent variable in the conceptual model is a dichotomous measure that was used to determine whether or not a particular business had adopted or planned to adopt ERP. Their research model posits eight adoption predictors within the three contexts of the TOE framework: *Technology* (IT infrastructure, TR); *Organization* (size, perceived barriers); and *Environment* (production and operations improvement, enhancement of products and services, competitive pressure, and regulatory policy). However, their empirical test confirms that the factors of TR, size, perceived barriers, and production and operations improvements are found to be important determinants of the adoption of ERP solution.

To propose specific factors within the three TOE contexts, Zhu et al. (2006) first consider those factors that have been found to be significant for innovation diffusion by existing literature to determine potential determinants of e-business assimilation at the firm level. Their research model posits seven assimilation predictors within the three contexts of the TOE framework: *Technology* (TR and technology integration); *Organization* (firm size, global scope, and managerial obstacles); and *Environment* (competition intensity and regulatory environment). They employed a unique dataset of 1,857 firms from ten countries (developed vs. developing countries) to validate the conceptual model. To probe deeper into the influence of the environmental context, they compare two subsamples from developed and developing countries. Their analysis provided the following findings: (1) competition positively affects initiation and adoption, (2) economic environments shape innovation assimilation and that regulatory environment plays a more important role in developing countries than in developed countries. In addition, their results show that while TR is the strongest factor facilitating assimilation in developing countries, technology integration turns out to be the strongest in developed countries.

More recently, Wu and Subramaniam (2009) employed the TOE framework to investigate what factors are critical in Radiofrequency Identification (RFID) adoption decisions by incorporating some additional potential important factors that have not been included in prior TOE framework studies. For example, they theorized that the "*Development Status of Technology*" is an important factor for technology assimilation decisions, and it is reasonable to add maturation of technology as one of the determinants in the technology adoption and infusion model. Their conceptual research model posits 11 potential adoption predictors within the three contexts of the TOE framework: *Technology* (perceived benefits, complexity, compatibility, maturation of technology); *Organization* (financial resources, IT sophistication, top management support); and *Environment* (competitive pressure, trading partner, enacted trading partner power, and external support). However, although Wu and Subramaniam (2009) provided theorized model specification, they have not reported the empirical data analysis in their paper, proposing that the empirical testing of their model will be provided in a forthcoming paper.

10.2.3 Technology Acceptance Model (TAM)

TAM framework is an adaptation of the Theory of Reasoned Action (TRA) to the field of IS. TAM posits that "perceived usefulness" and "perceived ease of use" determine an individual's intention to use a system with "intention to use" serving as a mediator of actual system use. "Perceived usefulness" is also seen as being directly impacted by "perceived ease of use." Researchers have simplified TAM by removing the attitude construct found in TRA from the current specification (Venkatesh et al. 2003). Attempts to extend TAM have generally taken one of three approaches: by introducing factors from related models, by introducing additional or alternative belief factors, and by examining antecedents and moderators of perceived usefulness and perceived ease of use (Wixom and Todd 2005).

TRA and TAM, both of which have strong behavioral elements, assume that when someone forms an intention to act, they will be free to act without limitation. In practice, constraints such as limited ability, time, environmental or organizational limits, and unconscious habits will limit the freedom to act (Wiki, York 2010). Although many notions of IT-innovation assimilation frameworks have been proposed and validated (such as TOE, Rogers's Innovation Diffusion Theory (IDT), TAM, CAT, Delone-McLean Model, and IS Success Model: A.O. However, Hong et al. (2006) demonstrated that the TAM framework is the most widely accepted and employed as a powerful tool to represent and understand the determinants of users' IT-acceptance process, for the reason that TAM has proven to be a parsimonious model that explains much of the variance in users' behavioral intention related to IT adoption and usage across a wide variety of contexts. Hence, TAM is preferred over alternative models and substantial theoretical and empirical support has accumulated in favor of TAM compared to alternative models such as the TRA and the Theory of Planned Behavior (TPB).

As one of the main ideas in this field, Venkatesh and Davis (2000) introduce an attempt to extend TAM by empirically validating an extended version of TAM framework that concentrates and incorporates determinants of the "perceived ease of use" construct. They criticized the previous empirical TAM studies by demonstrating that although there is a large body of research on the "perceived ease of use" construct, very little work has been done to understand the determinants of this important driver of technology acceptance and use.

Venkatesh and Davis (2000) contribute to the empirical literature of TAM by introducing an extended model, referred to as TAM2, incorporates additional theoretical constructs spanning social influence processes (SIPs) (subjective norms, voluntariness, and image) and cognitive instrumental processes (CIPs) (job relevance, output quality, result demonstrability, and perceived ease of use) as determinants of perceived usefulness and usage intentions. CIPs: including job relevance, output quality, result demonstrability, and perceived ease of use. However, Venkatesh and Davis (2000), although having contributed to the literature by concentrating on the determinants and extension of the "Perceived usefulness" construct, they ignored the importance of extending the other major determinant of usage behavior in the TAM.

Another ERP-context cross-sectional study, which used a TAM-based survey, was conducted in an on-line analytical processing (OLAP) environment. Hart and Porter (2004) surveyed 65 companies in South Africa licensed to use an industry top-ranked OLAP product. The major criticism of the TAM2 used in their study is that they included only the independent variables collectively referred to as CIPs (namely, job relevancy, output quality, result demonstrability, and perceived ease of use) as previously provided by Venkatesh and Davis (2000), and ignored the three SIPs (namely, subjective norms, voluntariness, and image) as suggested by Venkatesh and Davis (2000). In addition, Hart and Porter's study ignored the importance of the extension of "perceived ease of use" as provided by Venkatesh and Davis (2000). However, Hart and Porter found that the variables "perceived ease of use," "result demonstrability," "output quality," and "job relevance" are positively associated to the dependent variable, "perceived usefulness." Therefore, they conclude that the extended version of TAM, referred to as TAM2, is relatively more fitting for the specification of TAM approach.

Recently, one more attempt to validate an extended version of the basic formulation of TAM was conducted by Kim and Forsythe (2008); their study proposed that sensory enabling technology (SET) can deliver product information that is similar to the information obtained from direct product examination, thus reducing product risk. In addition, the interactivity and customer involvement created by SETs can enhance the entertainment value of the on-line shopping experience. The proposed model examined this dual role of sensory experience enablers in the on-line soft goods shopping process for three types of SETs that are widely applied in on-line retail sites. Results of the study provided empirical support for perceived usefulness and perceived entertainment value as strong predictors of consumers' attitudes toward using all three of the SETs and had a significant impact on the actual use of all three SETs. However, their attempt to extend the formulation of TAM has been restricted by that it included only the constructs of "computer anxiety" and "perceived enjoyment," hence, they ignored the importance of other determinants of "perceived ease of use," such as "computer self efficacy," "facilitating conditions," and "computer playfulness" as suggested by Venkatesh and Davis (2000). Moreover, their study has been further restricted by ignoring the extending determinants of "perceived usefulness," as suggested by Venkatesh and Davis (2000).

More recently, Youngberg et al. (2009) employed TAM2 and were motivated by the original TAM and the criticism of previous studies, where very few studies have been conducted regarding technology acceptance within the context of ERP system, especially those dealing with autonomous end users. The constructs investigated in their study were "perceived ease of use" (PEU) and "perceived usefulness" (PU) from the original TAM and "result demonstrability" (RD) and "subjective norms" (SN) from the extended TAM2 as suggested by Venkatesh and Davis (2000). Youngberg et al. examine technology acceptance variables for highly educated, professionally autonomous end users of an ERP component to understand significant variables' correlation and predictive effective effects on perceived usefulness and usage constructs. However, although Youngberg et al.'s (2009) contribution to the literature is appreciated, a major criticism of their work is that they ignored the critical importance of the extension of "perceived ease of use" construct as suggested by Venkatesh and Davis (2000), while they considered and focused exclusively on the "usefulness" construct by referring to TAM2 as the extended model that represents the Venkatesh and Davis (2000) model.

10.2.4 Consumer Acceptance Technology (CAT) Model

Kulviwat et al. (2007) proposed a new model, namely, "Consumer Acceptance of Technology (CAT)", that was shown to significantly improve the prediction of intentions to adopt high-tech products by employing a unique model specification that integrates affect constructs and an additional cognitive construct into the well-known Technology Acceptance Model (TAM). The purpose of the current study was to examine issues that were beyond the scope of the first article. In particular, the dominance dimension of affect did not previously show the expected positive effect on attitudes toward adopting technology. The current study clarifies the role of dominance in technology acceptance by uncovering a significant interaction it has with another construct within CAT. In addition, CAT is explored across different types of consumer tasks performed with a high-tech innovation and is expanded by including a measure of social influence felt by the consumer. Finally, the CAT model is further validated using additional statistical analyses not applied in the initial publication (Wiki, York 2010).

10.2.5 Technology Readiness

The recently well-established notion, coined "technology-readiness construct" (TR), refers to people's propensity to embrace and use new technologies for accomplishing goals in home life and at work (Parasuraman 2000). Such a construct can be viewed as an overall state of mind resulting from a gestalt of mental enablers and inhibitors that collectively determine a person's predisposition to use new technologies (Parasuraman 2000) and, hence, TR is not a measure of competency or ability (Lai et al. 2004; Parasuraman and Colby 2001; Lai and Chong 2007).

Prior studies (Dabholkar 1994; Mick and Fournier 1998) asserted that a combination of positive and negative beliefs about technology underlies the domain of TR and that IT potential users (consumers) with more positive beliefs are more receptive and ready to use the various new technologies. Subsequently, Parasuraman (2000) suggested that people could be arrayed along a hypothetical technology–beliefs continuum anchored by strongly positive at one end and strongly negative at the other. People's position on this continuum can be correlated with their propensity to embrace and employ technology – hence, "technology readiness."

A combination of positive and negative feelings about technology underlies the domain of TR. Although the positive feelings propel people toward new technologies, the negative feelings may hold them back.

In order to operationalize the concept of TR, Parasuraman (2000) and Rockbridge Associates, Inc. suggested the technology-readiness index (TRI) as a multiple-item scale with sound psychometric properties that companies can use to gain in-depth understanding and measurement of the readiness of their customers (both external and internal (i.e., employees)) to embrace and interact with technology, especially computer/Internet-based technology. Parasuraman (2000) and Parasuraman and

Colby (2001) suggest that, on the individual level, positive and negative feelings about technology may coexist; the relative dominance of the two types of feelings is likely to vary across individuals, hence the multi-items TRI is suggested (Parasuraman 2000). The 36 belief items of the TRI might be analyzed into positive and negative beliefs about technology. Consequently, they suggest that the positive and negative beliefs might be clustered into four personality traits, which in turn, mirror four distinct TR dimensions, namely, (1) Optimism, (2) Innovativeness, (3) Discomfort, and (4) Insecurity. The first two dimensions, "Optimism" and "Innovativeness" are the enablers that may increase an individual's TR while the other two dimensions, "Discomfort" and "Insecurity" are the inhibitors that may suppress TR. Hence, the combination of scores on the four TR dimensions represents a person's overall TR.

Some studies incorporated TR into the well-known and well-established TAM framework to understand and explain the relationships between TR and technology acceptance by using the four TR dimensional constructs as reflective indicators to specify the detailed state of TR or aggregating the scores on the four constructs to form a composite measure of TR (i.e., Walczuch et al. 2007; Lai and Chong 2007; Lam et al. 2008; among others). However, Lam et al. (2008) asserted that aggregating the scores on the four TR constructs may be an over-simplification and may have limited value from the standpoint of both behavioral prediction and explanation, because the four TR dimensional constructs clearly have different meanings and relate to different psychological processes underlying technology acceptance. Therefore, an extended model and research design are needed to capture the effects of the four dimensional constructs on technology acceptance. Moreover, specifying the effects of the four TR constructs can be helpful to the IT-service providers in identifying potential adopters and heavy/light users of their technology-based offering.

10.2.6 Delone and Mclean Information Systems Success Model

In order to provide a general and comprehensive definition of IS success that covers different perspectives of evaluating information systems, 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 re-specify 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 2002, 2003).

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. The model can be interpreted as follows: A system can be evaluated in terms of information, system, and service quality; these characteristics affect the subsequent use or intention to use and user satisfaction. As a result of using the system, certain benefits will be achieved. The net benefits will (positively or negatively) influence user satisfaction and the further use of the information system.

10.3 Hybrid Diffusion Framework

As mentioned earlier, the purpose of this section is to formulate and propose the specifications of the hybrid, integrative, and relatively comprehensive conceptual framework for IT adoption and diffusion. This section encompasses two subsections; Sect. 10.3.1 introduces the procedures and provides the list of potential determinants along with their respective clusters, while Sect. 10.3.2 provides the narrative discussion of the proposed factors within the three-cluster context.

10.3.1 Procedures and List of Potential Determinants Along with the Clusters

To achieve the purpose of this section, the authors build on the revision provided in previous section by reviewing, comparing, matching, and identifying the overlaps among the restricted narrow frameworks, and recognizing the conceptual and empirical similarities across them, companied by meta-analyzing of their empirical evidence in a wide variety of technical, organizational, and cultural contexts, in order to commence the construction of a relatively more comprehensive list of potential determinants of IT-innovation adoption, focusing on factors that have been found and/or predicted to promote the IT adoption and diffusion.

Such construction of the potential determinants is derived by aligning and integrating the attributes of each of the narrow frameworks and notions of previously theorized and validated IT-assimilation frameworks into one hybrid integrative framework which is intended to be a relatively most comprehensive and exclusive theoretical model to diagnose and investigate the IT-assimilation mechanism. Hence, after undertaking careful analysis and matching of the antecedents of the restricted models in order to recognize their correspondences and conceptual similarities and overlaps, the identified list of potential determinants are lumped and clustered into three logical groupings called “major clusters” intended to be inclusive of all the potential determinants. Those clusters are:

1. External environment
2. Internal environment (organizational antecedents)
3. Technology characteristics

This selection is supported by the literature which has concentrated either on investigating the impact of external environment characteristics (Pierce and Delbecq 1977; Ettlie and Bridges 1982; Ettlie 1983; Ewusi-Mensah 1981; Gordon and Narayanan 1984; Galbraith 1973; Rai and Bajwa 1997; Chwelos et al. 2001; Iacovou et al. 1995; Premkumar and Roberts 1999; Bradford and Florin 2003; Vluggen 2005; among others), or on exploring the effects of internal environment characteristics (Pierce and Delbecq 1977; Kimberly and Evanisko 1981; Zmud 1982; Davenport 1998; Thong 1999; Vluggen 2005; among others), or on exploring the influence of perceived technology characteristics and relative advantages on initiation, adoption, and implementation of executive information systems (Downs and Mohr 1976; Tornatzky and Klein 1982; Bradford and Florin 2003; Premkumar et al. 1997; Vluggen 2005; among others).

Table 10.1 presents the list of potential determinants as lumped into the major clusters along with the corresponding restricted frameworks and selective literature.

10.3.2 Proposed Factors Within the Three-Cluster Context

The theoretically identified potential determinants are clustered as external environment (discussed in Sect. 10.3.2.1), internal environment (presented in Sect. 10.3.2.2), or technology characteristics (illustrated in Sect. 10.3.2.3).

10.3.2.1 The Impact of External Environment Characteristics

Environmental Uncertainty

An important environmental contingency is the attribute of "*environmental uncertainty*." Environmental uncertainty was conceptualized by Miller and Friesen (1977) into the components of heterogeneity, dynamism, and hostility. There are two main arguments for a proposed positive impact of environmental uncertainty on IT-innovation usage levels. First of all, environmental uncertainty has been shown to facilitate innovation in general (Pierce and Delbecq 1977). Ettlie and Bridges (1982) show that perceived environmental uncertainty promotes an aggressive technology policy. This means that firms respond to high levels of environmental uncertainty by aggressively adopting process, product, and service innovations (IT software being an example of a process innovation). This policy can be interpreted as a means of coping with an uncertain environment (Ettlie 1983).

The second argument is built on the information processing requirements that are introduced by high levels of environmental uncertainty. When an organization faces a complex and rapidly changing environment, information processing requirements will be more critical, as compared with a stable environment, organizational participants will look for additional information for planning and control purposes

Table 10.1 Clusters and potential determinants along with related literature

Cluster and related factors	Corresponding narrow model	Literature
Cluster 1: External environmental-related attributes		
1. Regulatory policy and environmental uncertainty	1. T.O.E.	Pang and Jang (2008), Zhu et al. (2006), Pierce and Delbecq (1977), Ettlie and Bridges (1982), Ettlie (1983), Ewusi-Mensah (1981), Gordon and Narayanan (1984), Galbraith (1973), Rai and Bajwa (1997), Vluggen (2005)
2. External pressure and IT-competitiveness	1. T.O.E.	Wu and Subramaniam (2009), Pang and Jang (2008), Chwelos et al. (2001), Iacovou et al. (1995), Premkumar and Roberts (1999), Bradford and Florin (2003), Vluggen (2005)
3. National cultural variables	Although not related to any narrow model, it has however been considered in the literature	Vluggen (2005)
Cluster 2: Internal environment-related (organizational attributes)		
1. Centralization of the organization	Although not related to any narrow model, it has however been considered in the literature	Pierce and Delbecq (1977), Kimberly and Evanisko (1981), Zmud (1982), Davenport (1998), Vluggen (2005)
2. Formalization of the organization	Although not related to any narrow model, it has however been considered in the literature	Vluggen (2005)
3. Information intensity		Porter and Millar (1985), Grover (1993), Thong (1999), Vluggen (2005)
4. Organizational readiness, maturation of technology, IT-infrastructure	1. T.O.E.	Pang and Jang (2008), Zhu et al. (2006)
5. Size of organization	1. T.O.E.	Pang and Jang (2008), Zhu et al. (2006), Frambach et al. (1998), Thong (1999)
6. Structure and complexity of organization		Vluggen (2005)
7. Organizational innovativeness	1. T.O.E. 2. TR-scale	Meng et al. (2010)
8. Management attitudes and attributes	1. T.O.E.	Wu and Subramaniam (2009)
9. Financial resources and budgetary restrictions	1. T.O.E.	Wu and Subramaniam (2009)

(continued)

Table 10.1 (continued)

Cluster and related factors	Corresponding narrow model	Literature
Cluster 3: Technology characteristics-related attributes		
1. Perceived innovation's complexity vs. perceived ease of use	1. Rogers' DOI 2. T.O.E. 3. TAM 4. CAT	Wu and Subramaniam (2009), Golding et al. (2008)
2. Perceived usefulness and perceived relative advantages and benefits	1. T.O.E. 2. Rogers' DOI 3. TAM 4. CAT 5. DeLone and McLean model 6. TR-scale	(Wu and Subramaniam (2009), Delone and McLean (2003), Meng et al. (2010), Golding et al. (2008)
3. Perceived compatibility	1. T.O.E. 2. Rogers's DOI	Wu and Subramaniam (2009), Golding et al. (2008)
4. Triability and observability	1. Rogers's DOI	Golding et al. (2008)
5. System, information, and service quality	1. DeLone and McLean model	Delone and McLean (2003)

(Ewusi-Mensah 1981; Gordon and Narayanan 1984). Such proposition is consistent with Galbraith (1973) that one way to respond to increasing environmental uncertainty is through the acquisition of additional information processing capacity. A sophisticated IT like an ERP system is a prime example of an investment in this area, because of ERP's capability to increase the availability of operational data.

External Pressure and IT Competitiveness in the Industrial Sector

A second important characteristic of the external environment is the attribute of the "*external pressure*." In the literature on interorganizational systems, external pressure (most often from a dominant party in the supply chain) has been often documented to influence adoption and usage levels (e.g., Chwelos et al. 2001; Iacovou et al. 1995; Premkumar and Roberts 1999; Bradford and Florin 2003; Vluggen 2005). External pressure can stem from a variety of sources, including competitors, the government, consultancy firms, etc. If a firm's competitors, suppliers or customers are adopting and using sophisticated software, this results in pressure for non-adopters to also use such sophisticated software. This pressure stems from the perception that adopters will have certain competitive advantages by using new systems. Subsequently, to "level the playing field," non-adopters will soon start using new software as well (Bradford and Florin 2003). Many IT applications soon become industry standard. If the IT innovation is perceived as a competitive necessity, firms will adopt and diffuse the IT-innovation technology in order to keep up with the competition. More recently, Millaire et al. (2009) emphasized the notion of "network peers exposure" as a potential determinant for ERP adoption.

IT Competitiveness in the Sector

According to Everdingen and Waarts (2003) competitors can be important drivers in adopting an innovation. It is known that competition generally increases the likelihood of innovation adoption (Gatignon and Robertson 1989; Kimberly and Evanisko 1981; Levin et al. 1987).

National Cultural Variables

Though meso- and micro-level variables can account for differences in diffusion patterns within countries or industries, it cannot explain differences in diffusion patterns across countries due to variances in the national cultural environment. A recent study by Png et al. (2001) on the adoption of frame relay, a type of IT infrastructure, not only signaled differences in adoption rates across countries but also explored the impact of two Hofstede dimensions of national culture (the uncertainty avoidance index and the power distance index) on the adoption behavior. Only for the uncertainty avoidance index a significant, negative, effect was found. Still, the study was limited to two countries (USA and Japan), and included only two of the five Hofstede dimensions.

Everdingen and Waarts (2003) extend Png et al. (2001) by investigating more extensively the influence of macro-level variables on the adoption and DOI, relative to the traditional meso- and micro-level variables. In addition, they extend the Robertson and Gatignon model (1986) by including macro-level variables (i.e., country-specific cultural variables as explanatory factors of organizational adoption and diffusion). They discuss two well-known classifications of culture (the Hofstede's cultural framework (2001) and the cultural classification by Hall (1976) and hypotheses were formulated linking these cultural classifications to adoption and DOI in order to demonstrate to what extent these classifications help in explaining cross-national organizational adoption behavior and diffusion patterns, in addition to the meso- and micro-level variables. For that purpose they use data on the adoption of a complex IT-based innovation, that is, ERP software, by more than 2,600 medium-sized companies across ten European countries. Their results indicate that variables describing national culture to have a strong, significant influence on the innovation penetration and adoption.

10.3.2.2 The Effects of Internal "Organizational" Environment Characteristics

One central assertion in the innovation literature has been that organic organizations are more likely to experience innovation than are mechanistic organizations (Zmud 1982). This distinction between organic and mechanistic organizations is usually operationalized using two organizational variables: centralization and formalization besides other factors such as information intensity and adopters' characteristics.

Centralization

Centralization indicates the degree of decision-making concentration. Generally, centralization is negatively related to initiation, because the low level of local autonomy does not support initiation. Arguments both in favor of negative and positive relations with adoption have been made (Pierce and Delbecq 1977; Kimberly and Evanisko 1981; Zmud 1982). The empirical evidence on the effect of centralization on adoption is ambiguous, which suggests that the effect of centralization on the usage of particular technologies depends on the type of innovation in question.

Formalization

According to Vluggen (2005), formalization has been documented to influence adoption and usage levels. *Formalization* is the second variable that is used to operationalize the mechanistic–organic distinction. Formalization reflects the degree to which a firm relies upon rules and procedures.

Bureaucratic organizations rely on codified rules, procedures, or behavior prescriptions when handling decisions or work processing (Pierce and Delbecq 1977). Through formalization, organizations try to increase the predictability of performance. Formalization tends to reduce the initiative of employees, because of this reliance upon rules and procedures. Hence, the advantage of adopting standardized “best” business practices is higher for firms that have high levels of formalization than firms that have low levels of formalization. In fact, one could argue that the rigidity of ERP packages will have severe drawbacks in an unformalized setting.

Information Intensity

The concept of *information intensity* was introduced by Porter and Millar (1985). Information intensity reflects the degree to which information is present in the product/service of a firm (Porter and Millar 1985). These products/services are difficult to produce and/or order. The complexity of the production process brings along more strict information needs in order to manage these complexities. For every step in the production process, accompanying information is needed. Grover (1993) and Thong (1999) provide empirical evidence that information intensity promotes the adoption of information systems.

Other Adopter’s Characteristics

Frambach and Schillewaert (2002) suggest three categories of adopter characteristics influencing a company’s adoption behavior: (1) the size of a company, (2) the structure, and (3) the organizational innovativeness. The size of an organization has been included many times in adoption studies, and has been found to positively influence the adoption decision (Frambach et al. 1998; Thong 1999). Structure of an organization refers to the level at which information processes and systems are integrated across various functional areas within the organization. A company's innovativeness refers to the attitude of a company toward the adoption of new products or, in other words, the receptiveness of an organization toward new ideas (Baldwin and Scott 1987). IT-savvy organizations, frequently pioneering and trying new ITs, are likely to adopt or invest in ERP sooner and faster than IT-conservative companies.

10.3.2.3 Technology Characteristics

Technology characteristics have been often documented to influence adoption and usage levels (Rogers 1983; Downs and Mohr 1976; Tornatzky and Klein 1982; Bradford and Florin 2003; Premkumar et al. 1997; Vluggen 2005).

The main construct of interest in this area is *perceived characteristics of IT systems*. Downs and Mohr (1976) point at the inconsistencies created by using primary characteristics of innovations. Primary characteristics can be perceived by individuals in multiple ways. Tornatzky and Klein (1982) performed a meta-analysis of frequently studied innovation characteristics, which shows that among as many as 25 attributes (a.o. cost, divisibility, social approval), compatibility, complexity, and relative advantage have consistently been shown to impact the adoption decision. However, Rogers (1983, 1995) identified five adoption attributes, namely, the relative advantage, compatibility, complexity, trialability, and observability. Therefore, those five attributes of the innovation (Rogers 1983) are included in our revision as potential determinants:

Perceived Complexity Versus Perceived Ease of Use

"Perceived complexity is the degree to which an innovation is perceived as being relatively difficult to understand and use" (Rogers 1995; Golding et al. 2008), and it can be related to the attribute of "perceived ease of use" as set out in the TAM notion (Millaire et al. 2009; Hernandez et al. 2008).

The perceived complexity of an innovation is negatively related to its rate of adoption. Alam et al. (2007) reported that previous studies on the adoption of innovations indicated that the adoption of complex technologies requires organizational personnel to possess sufficient technical competencies.

Perceived Compatibility

> The degree to which an innovation is perceived as being consistent with the existing values, needs, and past experiences of potential adopters. (Rogers 1995)

The more an innovation is perceived as being consistent with and fits existing systems, procedures, and value systems of the organization, the more likely it is that the innovation will be accepted and adopted by the potential adopter used. Schultz and Slevin (1975) distinguish between organizational and technical compatibility. Organizational compatibility evaluates the compatability with existing attitudes, beliefs, and value systems; technical validity evaluates the compatibility with existing systems. Any innovation is accompanied by changes to existing work practices.

Golding et al. (2008) suggest perceived compatibility is the degree to which an innovation is perceived as being compatible with existing beliefs, experience, and needs of potential adopters. A faster rate of adoption occurs when an adopter perceives an innovation as meeting the needs of the client. Alam et al. (2007) stated that an innovation is more likely to be adopted if it is compatible with individual job responsibility and value system. Alam et al. (2007) affirmed that organizations should determine the needs of their customers and then recommend innovations that fulfill those needs. It is, therefore, anticipated that as needs are met the adoption will occur.

According to Everdingen and Waarts (2003), in the case of IT innovations, besides relative product advantages, also the compatibility with the current IT infrastructure is an important consideration when deciding on adopting. Buying and implementing ERP is not a simple task; it may require huge changes in current work-related norms and procedures. Consequently, the product fit with current procedures, and the possibility of relatively fast implementation will be considered as important factors in making the ERP adoption decision.

Perceived Usefulness and Relative Advantages

"The degree to which an innovation is perceived as being better than its precursor or predecessor or the idea it supersedes" (Rogers 2003; Millaire et al. 2009). Perceived relative advantage attribute is of key importance in DOI and it can be related to the attribute of "perceived usefulness" as set out in the TAM notion (Millaire et al. 2009; Hernandez et al. 2008). It is the perception of benefits that provides economic and political legitimacy to the decision to invest in a new technology (Premkumar et al. 1997). ERP benefits stem from having higher integration levels. Firms that want to reap perceived ERP advantages will therefore do this by seeking higher ERP usage levels.

Golding et al. (2008) suggest it is the degree to which an innovation is perceived as being superior to its predecessor in terms of economic profitability, low initial cost, a decrease in discomfort, savings in time and effort, and the immediacy of the reward. Gemino et al. (2006) highlighted that relative advantage is expressed by perceived benefits. Aghaunor and Fotoh (2006) elaborated that the perceived benefits for managers could be direct, such as cost savings or income generation, or indirect, such as potential opportunities in new markets, marketing, or publicity. Gemino et al. (2006) conveyed that research has found that relative advantage is the primary reason for encouraging ICT growth and a positive relationship has been identified between perceived advantages and adoption. We, therefore, posit the following.

According to Everdingen and Waarts (2003), generally, a company's adoption decision will be made on the basis of comparing the expected situation after adoption to the current situation or available alternatives. The value of an innovation, in terms of the advantages compared to existing solutions, will be considered together with the costs of adoption, to make the adoption decision (Anderson et al. 2000). It has been found that the relative advantage of an innovation, as perceived by members of a social system, is positively related to its rate of adoption (Rogers 1995).

Triability and Observability

Rogers (1983, 1995) referred to "trialability" as the degree to which an innovation may be experimented with on a limited basis, which corresponds to (Millaire et al. 2009) delineate of "trialability" as the ability to try an innovation before you adopt it. However, being able to try these systems before buying them is nearly impossible. To be able to make the right choice, a firm must understand the acquisition process, including its needs and what the future system can offer. Furthermore, the potential purchaser has to observe what has been done in their own sector and others, to get a better sense of whether the system could fulfill their requirements or not (Millaire et al. 2009).

Rogers (1983, 1995) and (Millaire et al. 2009) referred to "observability" as the degree to which the results of an innovation are visible to others. Observability of enterprise systems requires a number of successful implementations large enough to give the buying firm confidence that a given system is best suited for its needs. In other words, the more a system can be observed, the more potential customers it will retain, which suggests that observability leads to network externalities.

10.4 Conclusions, Limitations, and Further Research

The objective of this study has been to provide the reader with better understanding of IT-innovation diffusion theories, IT-assimilation practices, implementation pitfalls and IT-diffusion practices trend. Furthermore, this chapter aims to formulate and propose the specification of a hybrid integrative conceptual framework for ERP adoption and diffusion.

The study takes as its starting point a review for the available IT assimilation and IT-adoption theories such as DOI, TOE, and TAM. Following the aforesaid step, the researchers reviewed the literature to support the construct of the study framework using a combination of the author-centric approach and concept-centric approach; such methodology shall ensure the relevance and comprehensiveness of the related literature which is the first step to move forward to draw concept-centric conclusions. In addition, providing both approaches alongside each other provides a reader-oriented and comprehensive view of previous work. Moreover, the author-centric approach illustrates how the individual non-hybrid frameworks are restricted and noninclusive.

The concluded framework encompasses three main clusters; the external environment, the internal environment, and the technology characteristics. These clusters contain a total of 17 attributes drawn from the different theories and frameworks in this field and proven to be significant by the revised literature. The external environment cluster contains three attributes; regulatory policy and environmental uncertainty, external pressure and IT competitiveness, and national cultural variables. While the internal environment cluster contains nine attributes; centralization of the organization, formalization of the organization, information intensity, "organizational readiness, maturation of technology, IT-infrastructure," size of organization, structure and complexity of organization, organizational innovativeness, management attitudes and attributes, and financial resources and budgetary restrictions. Finally, the technology characteristics cluster contains five attributes: perceived innovation's complexity versus perceived ease of use; perceived usefulness and perceived relative advantages and benefits; perceived compatibility; triability and observability; and system, information, and service quality.

As with all research, this study is subject to a number of limitations and these might be explored in future research. The study adopted the qualitative approach to build the study theoretical model, thus limiting the choice of empirical research due to time constraint, interview accessibility, and the availability of interviewees for a significant amount of time. Therefore, we encourage a future empirical research using the model developed in this study.

Despite the aforementioned limitation, this study has provided several important insights into issues relating to ERP diffusion and assimilation and hopefully this study will encourage researchers to conduct further empirical studies about the ERP diffusion and assimilation to clarify some of the complexity and confusion that have accompanied this topic.

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Chapter 11
The Yield Shift Theory of Satisfaction and Its Application to the IS/IT Domain*

Robert O. Briggs, Bruce A. Reinig, and Gert-Jan de Vreede

Abstract Information Systems/Information Technology (IS/IT) satisfaction is a key indicator of IS/IT success. For IS professionals and providers, satisfaction is critical throughout the life of a system because dissatisfied stakeholders can derail implementation, discontinue using an important system, erode IS/IT budgets, or even transfer their entire IT infrastructure to a different organization. The IS literature offers several perspectives on satisfaction, but none yet accounts fully for known satisfaction phenomena. We identify ten observed satisfaction effects, and summarize six existing models for satisfaction, identifying their merits, and the limits of their explanatory power. We then advance Yield Shift Theory (YST), a new causal theory of the satisfaction response that offers a more complete explanation of the phenomenon. YST derives two propositions from five assumptions to propose that the yield for a given goal is a function of the *utility* one ascribes to moderated by the *likelihood* one assesses of its attainment, and that variations in the *satisfaction response* are a curvilinear function of *shifts in yield* for an individual's active goal set. We argue the falsifiability and scientific utility of the theory, discuss its relevance to IS/IT, and suggest directions for future research.

Keywords Satisfaction • Theory • Yield Shift Theory of satisfaction • IS success • IS theory

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Abbreviations

IS Information systems
IT Information technology
YST Yield Shift Theory

11.1 Introduction

The success of an information system is not assured, and the cost of a system that fails can be high, both in terms of resources sacrificed to build it (Boehm et al. 2000) and in terms of the lost value that organizations might have derived from a successful system. Information systems and information technology (IS/IT) satisfaction is a key indicator of IS success (DeLone and McLean 1992; Lawrence and Low 1993). IS/IT researchers, therefore, give satisfaction a great deal of attention (e.g., Chin and Lee 2000; Lawrence and Low 1993; Seddon et al. 1999; Rai et al. 2002; Susarla et al. 2003).

The relevance of satisfaction to IS success begins with the earliest stages of systems development. A body of literature shows that, under certain circumstances, user involvement in the design and development phases correlates with higher judgments of system quality and higher user satisfaction when the system is deployed (e.g., Swanson 1974; Olson and Ives 1981; Lawrence and Low 1993).

Satisfaction continues to be of interest throughout the life of a system. Studies show that people who find their initial experiences with an IS dissatisfying tend not to use it in the future (e.g., Bailey and Pearson 1983; Ives et al. 1983) and that initial satisfaction with a system does not guarantee continued satisfaction (e.g., Khalifa and Liu 2003) or sustained use (e.g., Reinig et al. 1996). People who feel dissatisfied with a system, even for nontechnical reasons, may discontinue its use (Bhattacherjee 2001; Te'eni and Feldman 2001). User dissatisfaction can lead to an erosion of IS/IT budgets, making it even more difficult for IS/IT professionals to meet their goals and to provide satisfactory services (Galletta and Lederer 1989). Users who control their own budgets may choose to transfer their entire IS/IT infrastructure to a different organization if they feel dissatisfied with current results (Lawrence and Low 1993). For outsourcing providers, satisfaction may be a critical antecedent to customer retention (Patterson et al. 1997; Rust et al. 1995). Therefore, IS professionals often measure satisfaction to improve services (Conrath and Mignen 1990).

The IS/IT domain is replete with interdependent artifacts and aspects that are potential objects of satisfaction, among them are technologies, information, development practices, services, policies, IS departments, IT artifacts, and technology-supported work practices. The scope of IS satisfaction research has, therefore, been diverse, ranging from a narrow focus on a single technical component (e.g., Slaughter et al. 1995) to a broader look at technology-supported work practices (e.g. Alter 1999; Reinig 2003), and still broader to an organization's entire IS/IT service infrastructure (e.g., Cats-Baril and Jelassi 1994). A dissatisfier at any level could be detrimental to IS success.

We began to theorize about satisfaction as we developed and experimented with new IS. It is customary to report not only the instrumentality of such artifacts toward their design objectives but also stakeholder satisfaction. However, much of the IS/IT satisfaction research (including our own) was atheoretical. Satisfaction findings tended to be varied, even contradictory. To progress in our work, we needed a better theoretical understanding of satisfaction effects. We found useful clarity in the variety of perspectives on satisfaction in the IS literature, which helped make sense of the complex satisfaction effects we observed in the field. However, there remained a number of satisfaction phenomena for which existing perspectives could not account.

In this chapter, we identify ten satisfaction effects, phenomena that an explanatory theory of satisfaction should be able to explain. We summarize the value of six satisfaction perspectives already in the literature and highlight which of the ten effects these perspectives can explain, and which they leave unexplained. We then present the logic of Yield Shift Theory (YST), a new causal theory of the satisfaction response. This work builds on many concepts that precede it to suggest a new formal expression of relationships among causal and consequent constructs to both explain and predict the satisfaction response (Gregor 2006). Finally, we argue the falsifiability and scientific utility of YST, demonstrating that YST accounts for the ten satisfaction phenomena. We suggest directions for future IS/IT satisfaction research.

11.2 Satisfaction Effects

This section draws on the IS/IT literature and on observations from our own field experiences to identify ten satisfaction effects, phenomena for which an explanatory theory of satisfaction should be able to account. A *satisfaction effect* is a recurring pattern of satisfaction outcomes.

Goal attainment effects are phenomena where individuals feel satisfied if their goals are attained and feel dissatisfied if their goals are thwarted. Several authors have reported goal attainment effects (e.g., Briggs et al. 2006; Reinig 2003). We also have observed, for example, that military decision makers under crisis conditions manifest immediate IS/IT satisfaction upon goal attainment and immediate dissatisfaction upon failure to attain goals. Locke and Latham (1990) reported higher goal attainment effects for challenging goals than for easy goals.

C*onfirmation effects* are phenomena where individuals feel satisfied when outcomes match or exceed expectations or desires and feel dissatisfied when outcomes fall short of expectations or desires (Bhattacherjee 2001; Rushinek and Rushinek 1986). Confirmation effects differ from goal attainment effects in that, confirmation effects can manifest when expectations are met, even when goals are not met. In our own work, we have observed confirmation effects, for example, among individuals in IT problem-solving meetings who expect to, and do, find only partial solutions to the problems at hand.

With *disconfirmation effects*, individuals feel neutral when outcomes match expectations or desires. They feel satisfied when expectations or desires are exceeded and feel dissatisfied when outcomes fall below expectations or desires (see, e.g., Anderson 1973; Oliver 1996; McKinney et al. 2002). Disconfirmation effects differ from goal attainment and confirmation effects in that, with a disconfirmation effect, no satisfaction response manifests upon goal attainment when goals, expectations, and desires match. In the field, we have observed neutral responses on goal attainment with respect to many IS/IT artifacts embedded in day-to-day routines, e.g., e-mail systems. We have noted positive disconfirmation effects when routinely used systems exceed normal performance, for example, after an upgrade. We have observed negative disconfirmation effects when usually reliable systems fail.

We use the term *anticipation effects* for positive or negative satisfaction responses that manifest when individuals reflect on desired future states, although current conditions have not yet changed. We have observed anticipation effects in a number of system design meetings when users hear others voice support for desired features.

We use the term *nostalgia effects* when individuals feel positive or negative satisfaction responses as they reflect on past successes or failures, even though such reflection invokes no change with respect to current conditions. We have observed nostalgia effects during system requirements negotiation workshops and during post-implementation reviews when stakeholders relate anecdotes of earlier projects.

We use the term *differential effect* when different individuals evidence varying levels of satisfaction with outcomes, even though they appear to ascribe equivalent utility to those outcomes. We have observed differential effects among users upon the implementation of new features and functions in success-critical IS. One might be tempted to attribute these differences to personality differences among the users. However, we have observed that the same users can be on the high side of a differential effect for one project, and on the low side for another project.

The term *hygiene effect* means that individuals feel only neutral or negative toward a system or technology, but never feel positive about it, even when it performs flawlessly (Herzberg 2003). In such cases, only dissatisfaction with IS/IT manifests; never satisfaction. We have observed the satisfaction ceiling of hygiene phenomena with a number of well-established, frequently used IT artifacts such as LANs and printers.

We use the term *mentor effect* when users feel increased or decreased satisfaction with a system or policy after a conversation with a trusted friend or advisor, even though conditions have not changed. We have observed a number of cases of the mentor effect during the implementation phase for new systems.

We use the term *mixed feelings* where users experience feelings of both satisfaction and dissatisfaction with an IS/IT artifact. We have observed a number of cases of mixed feelings during transitions from old systems and work practices to new ones.

Finally, we observe that individual feelings of satisfaction or dissatisfaction are not permanent. Regardless of the initial effect, the arousal of a satisfaction response always diminishes over time. We use the term *attenuation effect* for this phenomenon.

Table 11.1 summarizes the satisfaction phenomena we have identified from the IS/IT literature or observed in the field for which an explanatory theory of satisfaction should account. The next section summarizes several models of IS/IT satisfaction that can account for some, but not all of these phenomena.

Table 11.1 Observed satisfaction effects for which a theory of satisfaction should account

Phenomenon	Definition
Goal attainment effect	Individuals feel satisfied on attainment of a desired state or outcome. They feel dissatisfied when the desired state or outcome is thwarted
Confirmation effect	Individuals feel satisfied when outcomes match expectations or desires, and feel dissatisfied when outcomes are less than expectations or desires
Disconfirmation effect	Individuals feel neutral when outcomes match expectations or desires. They feel satisfied when outcomes exceed expectations or desires; they feel dissatisfied when outcomes are lower than expectations or desires
Anticipation effect	Individuals feel satisfied or dissatisfied when thinking of future goal attainment, even though goals have not yet been attained or thwarted
Nostalgia effect	Individuals feel satisfied or dissatisfied when thinking about past goal attainment or past failure to attain goals
Differential effect	Multiple individuals manifest differing levels of satisfaction upon the attainment of goals to which they ascribe similar utility
Hygiene effect	Individuals feel only neutral or negative about an IT/IS, but never positive
Mentor effect	Individuals feel more satisfied or dissatisfied after discussions with a trusted advisor, even though current conditions have not changed
Mixed feelings	Individuals experience both satisfaction and dissatisfaction with the same IS/IT
Attenuation effect	Individuals' satisfaction responses diminish over time

11.3 Summary of IS/IT Satisfaction Perspectives

When we surveyed the IS/IT literature, we discovered several useful perspectives of satisfaction. These perspectives differ from one another in their purposes, their degree of theoretical rigor, the relationships they posit, and their predictions. Each contributes value toward understanding satisfaction, but each leaves some questions unanswered.

11.3.1 Measurement Perspectives

Several authors propose instruments to measure satisfaction with various aspects or features of an IS. These measures call for judgments of whether needs have been fulfilled or requirements accommodated (e.g., Doll and Torkzadeh 1988; Doll et al. 1994; Ives et al. 1983; McHaney et al. 2002). They ask, for example, about the timeliness, accuracy, and relevance of outputs, or ease-of-use. Measurement models can be classified as analytical and descriptive in that they measure system attributes, but their purpose is implicitly prescriptive (Gregor 2006) in that they are intended to guide practitioners on how to improve or assure the chances of system success. These models have proven useful to IS professionals who seek to identify issues of importance to their stakeholders, but they are not intended to serve as theoretical explanations or predictions of the onset and variation in the satisfaction response, and would not be useful to explain or predict the satisfaction effects listed in Table 11.1.

11.3.2 Attribute Perspectives

Attribute perspectives of IS satisfaction propose typologies of IS/IT characteristics that have been observed to correlate with satisfaction. They call for users to judge the degree to which certain attributes fulfill needs and meet constraints, and predict that those judgments will correlate with satisfaction. For example, DeLone and McLean (1992) proposed that satisfaction with a system correlates with system attributes such as flexibility, reliability, and usefulness. Others noted that user satisfaction correlates with attributes of the process by which systems are developed, for example, user involvement and empowerment in the design process (Hirschheim 1989; Mumford and Henshall 1979; McKeen et al. 1994; Lawrence and Low 1993). Like measurement models, these models are descriptive in that they characterize circumstances that seem to correlate with satisfaction, and they are prescriptive in that they serve as guidelines for practitioners to improve the chances of system success (Gregor 2006). A number of studies find empirical support for attribute models (e.g., Chin et al. 1988; DeLone and McLean 2003). System attribute models allow an IS professional to answer the important question, "Which parts of my system need attention?"

Attribute models point toward, but do not articulate, theoretical constructs and relationships that may give rise to the correlations they describe (Bacharach 1989; Sutton and Straw 1995; Whetton 1989). They do not explain satisfaction phenomena that manifest with respect to things other than the attributes they catalog, so new models must be developed for every new kind of IS/IT artifact, attribute, or aspect. Thus, they provide limited insight or guidance to IS/IT designers and managers about how new features or deployment strategies might impact user satisfaction. Finally, typologies of attributes are subject to nearly infinite decompositions, and so can quickly give rise to models of such complexity that they are too unwieldy to support scientific enquiry. They do not explain or predict the ten satisfaction effects identified above.

11.3.3 Goal Attainment Perspectives

Some authors induce predictive theories of satisfaction (Gregor 2006) from regularly observed effects, without deriving explanatory logic for such patterns. In this vein, some IS researchers propose models that posit satisfaction as a response to judgments that needs have been met, or that goal(s) have been attained (e.g., Briggs and de Vreede 1997; Reinig 2003). Using the observed phenomenon as justification, they predicted that users will be satisfied with a system that enables them to attain their goals, and dissatisfied when a system thwarts goal attainment. Several studies in the IS literature have reported empirical support for goal attainment models (e.g., Reinig 2003; Briggs et al. 2006). Goal attainment models can account for the confirmation effects where goals and expectations are aligned; however, they could not explain goal attainment effects where goals differ from expectations nor the other satisfaction effects listed in Table 11.1.

11.3.4 Confirmation Perspectives

Confirmation theories are also predictive models (Gregor 2006) induced from observed correlations. They predict that satisfaction with an IS will manifest when outcomes *match* or *exceed* expectations or desires, and predict dissatisfaction when outcomes fall short of expectations or desires (e.g., Bhattacherjee 2001; Rushinek and Rushinek 1986). Like goal attainment models, confirmation theories describe an effect and predict that it will recur, but do not attempt to explain it. The predictions of confirmation theories only match those of goal attainment models when expectations and desires match outcomes, but differ where expectations or desires are either higher or lower than outcomes.

Confirmation models of satisfaction have received empirical support in the IS literature (e.g., Bhattacherjee 2001; Igbaria and Wormley 1992). However, confirmation models also offer no explanation for satisfaction phenomena 3–10 in Table 11.1.

11.3.5 Disconfirmation Perspectives

Disconfirmation perspectives of satisfaction are also predictive theories (Gregor 2006) induced from observed correlations. Disconfirmation posits satisfaction as a function of the degree to which individuals perceive that realized gains and losses differ from expectations and/or desires (e.g., McKinney et al. 2002; Oliver 1996; Suh et al. 1994; Susarla et al. 2003). Expectations relate to the value one anticipates one is likely to derive from a projected outcome, while desires relate to the ideal value one wishes to derive from the outcome. Disconfirmation theories posit that, when the perceived difference between expectations/desires and outcomes is positive, users will feel satisfied; when the perceived difference is negative, users will feel dissatisfied. If outcomes are perceived to precisely meet expectations or desires, then neither satisfaction nor dissatisfaction will manifest.

Disconfirmation theories have received empirical support with respect to IS (McKinney et al. 2002), IS/IT services (Pitt et al. 1995), and web services (Srijumpa et al. 2002).

In cases where outcomes precisely match expectations and desires, the predictions of disconfirmation models directly contradict those of both confirmation and goal attainment perspectives. However, in all other cases, a disconfirmation model could account for goal attainment and confirmation effects.

Disconfirmation models also suggest explanations for hygiene effects and differential effects. Hygiene effects would occur when expectations and desires are for perfect performance. Thus, when an IS/IT performs flawlessly, such perfect performance would not constitute a disconfirmation, and so would not produce a positive satisfaction response. However, imperfect performance would constitute a negative disconfirmation, and so dissatisfaction would manifest. Differential effects could occur when different individuals have different expectations or desires about IS/IT. Goal attainment would produce different degrees of disconfirmations for each individual, which, in turn, would lead to different satisfaction responses. However, disconfirmation models can only account for satisfaction responses at the time an outcome is realized, and so cannot explain anticipation, nostalgia, mentor, or attenuation effects. Further, disconfirmation theories create a paradox when expectations differ significantly from desires. For example, if one were to hold low expectations but high desires for a system, then an outcome that fell somewhere between the two would constitute both a positive disconfirmation of expectations and a negative disconfirmation of desires, and thus the theory would yield two mutually exclusive predictions.

11.3.6 Aggregated Models

Several authors have argued the need to integrate various perspectives of IS satisfaction into a single aggregated model to more fully explain satisfaction effects in the IS/IT domain (e.g., Palmer and Griffith 1998; Khalifa and Liu 2003; Yoon et al. 1995). However, some of the assumptions of the source-models for these attempts are inconsistent with one another, which could lead to paradoxical results. For example, one source-model might assume that satisfaction arises in response to need-fulfillment, while another may assume it only arises when expectations are exceeded. Further, such models could quickly become so complex that they would be too unwieldy to support scientific enquiry. Table 11.2 summarizes the merits and limitations of each of the perspectives discussed above.

11.3.7 The Need for a New Perspective

Each of the perspectives of satisfaction in the IS literature is useful for some purposes. However, despite the fact that each has received empirical support, none of them offers an explanation for all the satisfaction phenomena identified in Table 11.1. Table 11.3 summarizes the extent to which each perspective can account for each observed effect. Further, none of the existing perspectives is a fully realized causal

Table 11.2 Merits and limits of existing perspectives of IS satisfaction

Perspectives	Merits	Limits
Measurement models	Useful for diagnosing and improving system quality	Posit no antecedents, new measures needed for each new feature, function, or service
System attribute perspectives	Useful for diagnosing dissatisfaction and system quality. Posit antecedents for satisfaction	Tied to specific objects of satisfaction. Prone to increasing complexity. Grow more complex with each new feature, function, service, or attribute. Descriptive and predictive but not explanatory
Process attribute perspectives	Useful insights for successful development process	Prone to increasing complexity, do not account for satisfaction of those who become users after completion of development. Descriptive and predictive but not explanatory
Goal attainment perspectives	Predict goal attainment effects	Propositions not derived from underlying assumptions. Cannot explain all observed satisfaction phenomena
Confirmation perspectives	Predict confirmation effects	Propositions not derived from underlying assumptions. Cannot explain all observed satisfaction phenomena
Disconfirmation perspectives	Predict disconfirmation effects	Propositions not derived from underlying assumptions. Cannot explain all observed satisfaction phenomena
Aggregate perspectives	Attempt to explain more satisfaction effects by combining other approaches	All the limits of the models they aggregate, and exploding complexity. May combine approaches with mutually exclusive assumptions and predictions, giving rise to paradox

theory, in that their propositions are not yet derived from underlying assumptions, and so would not be regarded as defensible under the disciplines of causal epistemology (Popper 1959). They are descriptive or predictive, but not yet explanatory (Gregor 2006). In the next section, we advance YST to provide an axiomatic foundation for existing perspectives, to resolve the seeming paradoxes among their predictions, to account for seeming conflicts among empirical findings, and to explain more fully the range of satisfaction phenomena listed in Table 11.1.

11.4 Yield Shift Theory

In this section, we present the logic of YST, a formal causal theory (Gregor 2006) of the satisfaction response. We begin by defining key constructs to reduce the ambiguity inherent in the informal language surrounding satisfaction, and to clarify the concepts used in the theory (Grover et al. 2008). We then derive a set of causal propositions from a set of assumptions (Popper 1959) about cognitive mechanisms that could give

Table 11.3 The utility of earlier satisfaction perspectives

Observed satisfaction effects	Theoretical perspective					
	Measurement	System Attributes	Process Attributes	Goal attainment	Confirmation	Disconfirmation
Goal attainment effect				**	*	**
Confirmation effect				*	**	*
Disconfirmation effect						**
Anticipation effect						
Nostalgia effect						
Differential effect						**
Hygiene effect						**
Mentor effect						
Mixed Feelings						
Attenuation effect						

One asterisk in a cell means that a theory explains some, but not all manifestations of an effect. Two asterisks in a cell mean that a theory fully explains an effect

rise to the satisfaction response. Taken together, the assumptions and the propositions form a deductive-nomological network of causal relationships (Bacharach 1989) to explain variations in the onset, magnitude, and valence of the satisfaction response.

11.4.1 Definitions of Satisfaction

The phenomenon of interest for YST is the satisfaction response. The definition of the phenomenon of interest in an explanatory causal theory should be sufficiently specific to differentiate the construct from other closely related constructs (Straub 1989). Although satisfaction has been studied extensively in the IS literature, no widely accepted definition of the construct prevails. We, therefore, begin by discussing various connotations of the word *satisfaction*. We then define the term *satisfaction response* to demarcate the phenomenon whose variations YST seeks to explain.

11.4.1.1 Satisfaction-as-Judgment

The word *satisfaction* has at least two connotations in the IS literature. Although many researchers do not explicitly define satisfaction, some implicitly frame IS satisfaction as a judgment by using items in satisfaction instruments that ask, for example, how well user information needs are being satisfied (Powers and Dickson 1973), or that call for judgments of system outputs in terms of information content, accuracy, ease-of-use, and timeliness (Torkzadeh and Doll 1999).

11.4.1.2 Satisfaction-as-Affect

Other satisfaction researchers implicitly frame satisfaction as an affective response. For example, one study asks executives to rate their enjoyment and satisfaction with an IS (Lucas 1981). Another asks for a response to the statement, “All things considered, I am (delighted/disappointed) with using the system” (Chin and Lee 2000, p. 559). Briggs et al. (2003) asked a set of questions about the degree to which technology users felt good about, felt happy about, or felt satisfied with certain objects of satisfaction.

11.4.1.3 Mixed Definitions

Some researchers blend judgment and affect into the same definition. Oliver (1996), for example, defined satisfaction with a service as “a judgment that a service provided a pleasurable level of consumption-related fulfillment.” Susarla et al. (2003) define satisfaction with application service providers as “a positive affective state resulting from the appraisal of all aspects of a firm’s working relationship with another firm” (p. 96).

Because judgment is a construct different from emotion, it is useful to distinguish between affective and judgmental connotations of the term, satisfaction, to avoid confounding of results. For this research, we sought a theoretical explanation of satisfaction-as-affect because we had observed many cases where users abandoned systems they *judged* to be useful and easy to use, but with which they nonetheless *felt* dissatisfied. In one case, an executive team used a group support system to complete an annual strategic planning session in just 4 h, when they had expected it would require 3 days. A senior leader said he felt dissatisfied with the system. When asked if he found the system difficult to use; he said “No, it was very easy. We didn’t even need training.” When asked if the quality of results had suffered, he said, “No, we actually got a much better plan than we ever have before.” When probed about the root of his discontent. He said, “We just did the work …. It was kind of mundane…. It didn’t feel satisfying.” The team declined to use the system again. This and similar cases suggest that a better understanding of satisfaction-as-affect could be important to an overall understanding IS/IT success.

11.4.2 Definition of the Satisfaction Response for YST

The phenomenon that YST seeks to explain is an emotion – the satisfaction response. We define the satisfaction response as an affective arousal with a valence that pertains to some object having reference to some state or outcome desired by an individual. Objects of satisfaction in the IS/IT domain could include, for example, hardware, software, people, data, information, and procedures.

Herzberg, in his work on job satisfaction, framed satisfaction and dissatisfaction as two different constructs (Dubin 1976). To explain all the observed IS/IT satisfaction effects, however, we found it useful to define the *satisfaction response* as a single construct that encompasses both positive feelings, commonly called *satisfaction*, and negative feelings, commonly called *dissatisfaction.*

It is important to note that under the YST definition, satisfaction and dissatisfaction are not two ends of a continuum with a neutral point in the middle. Rather, the continuum is from not-aroused to fully aroused. The valence characterizes the arousal as positive or negative, but does not define its magnitude (Young 1968). We use this conceptualization because an individual may experience a switch of valence from negative to positive or vice versa without passing through a neutral state of nonarousal. The labels commonly used to describe a satisfaction response nonetheless tend to suggest both its magnitude and its valence. A satisfaction response with a positive valence may be labeled as satisfaction, delight, elation, or ecstasy, depending on its magnitude. A satisfaction response with a negative valence might be labeled dissatisfaction, disappointment, frustration, or outrage, depending on its magnitude. Thus, under this definition of the satisfaction response, a theoretical explanation should account for both its magnitude and its valence.

11.4.3 The Assumptions and Propositions of YST

In this section, we derive the logic of YST to explain the onset of, and variation in, the magnitude and valence of the satisfaction response. We express the theory formally as a set of *assumptions*, which suggest mechanisms that could give rise to the phenomenon of interest, and *propositions*, which are functional statements of cause and effect derived from the assumptions by deductive logic. In causal epistemology, an explanatory theory's assumptions are advanced as a starting point for the logic that follows. They imply the suppositional question, "What if we were to assume X; would that be sufficient to explain the variations we observe in the phenomenon of interest?"

The propositions of an explanatory theory are functional statements of cause and effect relationships among constructs. We present the propositions of YST with the convention, "Y is a function of X," where X is a causal construct, and Y is a consequent construct. These statements can be interpreted as meaning, "Changes in X cause changes in Y."

11.4.3.1 Yield Assessment for a Given Goal

A *goal* is any state or outcome that an individual desires to attain (Locke and Latham 1990). YST considers only internally held private goals, not externally assigned or mutually agreed group goals. An individual's private goals may be diverse, ranging from the most basic biological needs, like air and food, to esoteric desires like discovery or self-actualization (Maslow 1954). When individuals use an IS, they may attend to instrumental work-related goals such as sustaining a competitive advantage, or timely access to accurate and complete information. They may also attend to more fundamental goals like food and shelter. Because human cognitive resources are limited, individuals may not be able to attend to all their goals simultaneously. Goals that are currently the focus of cognitive activity are said to be *active.*

Because individuals hold many goals, and because human cognitive resources are limited, individuals make choices about which goals to pursue and in what order. YST posits cognitive mechanisms that may have evolved because individuals must constantly and effectively make such choices to survive in their dynamic environments. Locke and Latham (1990) suggest that affective responses may arise from some automatic, subconscious cognitive mechanism that appraises the degree to which objects of satisfaction further or block the attainment of one's values. They do not articulate the nature of these mechanisms. In order to explain satisfaction responses, YST starts with assumptions about a set of such mechanisms.

First, for every goal an individual holds, YST assumes:

Assumption 1 *Automatic Utility Assessment. A cognitive mechanism automatically and subconsciously ascribes some level of utility to attaining a given active goal.*

By *utility*, we mean a sense of goodness, worth, or value (Mobley and Locke 1970; Locke and Latham 1990), but not just in the monetary sense often connoted by the word. Utility may also be found, for example, in physical, emotional, social, political, esthetic, and cognitive states or outcomes. Because this mechanism is *automatic*, individuals are incapable of holding goals without subconsciously ascribing some level of utility to their attainment. Every goal that becomes active will have some level of utility ascribed to it.

Not all goals hold equal utility for an individual. For instance, survival goals often (although not always) have higher-utility assessments than social goals. The utility an individual ascribes to attaining a goal may be fluid, changing in response to new information and experiences. If an individual ceases to perceive utility in attaining a goal, by definition, it ceases to be a goal.

Given that cognitive resources are limited, an individual could choose to pursue higher-utility goals to the exclusion of lower-utility goals. However, that strategy could be detrimental to an individual's survival because some high-utility goals are difficult or impossible to attain. Effort spent pursuing these goals might deter pursuit of lower-utility, higher-likelihood goals that would ensure survival. YST, therefore, makes two further assumptions to explain how utility perceptions may be moderated:

Assumption 2 *Automatic Likelihood Assessment. A cognitive mechanism automatically and subconsciously assesses the likelihood that an active goal may be attained.*

Individuals assess some goals as being more likely to be achieved than others. For instance, a system user might perceive that the likelihood of acquiring a new virus scanner for an e-mail system is high, while the likelihood of gaining the budget and time to develop a worldwide community of practice for virus protection is low.

Next, YST assumes that:

Assumption 3 *Automatic Yield Assessment. A cognitive mechanism automatically and subconsciously generates a perception of yield for an active goal based on the utility ascribed to it***,** *but reduced in inverse proportion to the likelihood assessed for attaining the goal.*

Thus, if an individual were to ascribe high utility to a goal, and were absolutely certain of its attainment, then the subconsciously generated yield perception for that goal would be approximately equivalent to the utility ascribed to it. By contrast, if an individual were to ascribe high utility to a goal, but were absolutely certain that the goal could not be attained; the individual would perceive the goal as having little or no yield, despite its high ascribed utility. Thus, a goal of modest utility but high likelihood could be perceived as having a greater yield than a goal of high utility but low likelihood.

Because a perception of zero likelihood of goal attainment would mean no yield, regardless of utility, and because a perception of full certainty would mean yield perceptions equivalent to utility, we can characterize likelihood as a moderator of the direct relationship between ascribed utility and yield, with assessed likelihood assuming values ranging from 0 to 1. Under this framing, individuals might decide how to prioritize time and resources based on the perceived yield of active goals, rather than solely on their ascribed utility.

Reasoning from Assumptions 1–3, YST proposes that:

Proposition 1 *Perceived Yield. At a given moment***,** *the Yield an individual subconsciously perceives for a given goal is a function of the utility ascribed to the goal moderated by the assessed likelihood of attaining the goal*

YST deems ascribed utility and assessed likelihood to be necessary and sufficient to explain variations in perceived yield. The relationships expressed in Proposition 1 can be represented formally as follows:

Formula 1:

$$Y_G = f(L_G U_G)$$

where

G is the given goal
Y_G is the expected yield for G
U_G is the utility ascribed to attaining G
LG is the assessed likelihood of attaining G (boundary range of L: 0–1).

Figure 11.1 illustrates Proposition 1 as a box-and-arrow diagram. Arrows indicate the proposed direction of causation.

Assumption 3 and Proposition 1 are closely related. Assumption 3 posits a cognitive mechanism that performs a certain function. Proposition 1 proposes a cause and effect relationship among constructs that would follow if the assumptions about the

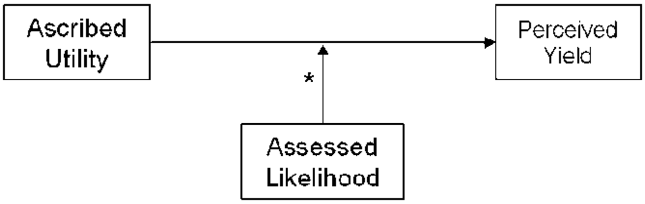

Fig. 11.1 A diagram of Proposition 1. Perceived yield is a multiplicative function of ascribed utility and the moderating construct, assessed likelihood. *Arrows* indicate the direction of causation

underlying mechanisms hold. Without the underlying assumptions, there would be no logic for proposing that likelihood moderates a causal relationship between utility and yield.

11.4.3.2 Contrasting Proposition 1 with Other Moderated Cognitive Relationships

Authors seeking to explain phenomena other than the satisfaction response have also posited or observed cognitive functions based on direct and moderated relationships. For example, expected utility theorists like von Neumann and Morgenstern (1947) demonstrated that actual individual *preferences* among choices with known risks correspond to the *external utility* (as measured in monetary units) of each choice moderated by the *external mathematical probability* of desired outcomes. Kahneman and Tversky (1979) advanced Prospect theory to explain variations in *probability valuation*, the monetary value people assign to choices under conditions of risk. Prospect theory posits that the value people assign to choices is a nonlinear function of the monetary utility of an outcome moderated by its external mathematical probability. They note that people evaluate alternatives differently depending on whether the outcome is framed as a potential gain or a potential loss. Nonexpected utility theorists explain *risky choice decisions* as a function of *monetary utility* moderated by an *internal judgment of probability*, which is similar to the likelihood construct of YST. They observe asymmetry in this relationship with respect to decision making (Starmer 2000).

YST, however, seeks to explain variations in the *satisfaction response* rather than choice behaviors or monetary valuations and posits a primary relationship moderated by *internal likelihood assessments* rather than by external mathematical probabilities.

11.4.3.3 Shifts in Perceived Yield for the Active Goal Set

Cognitive resources are limited (Gilbert and Osborne 1989; Miller 1956). YST assumes that, like conscious working memory, the subconscious mechanisms for the active goal set are also limited in the number of concepts they can process simultaneously. If individuals have many goals, then, at a given moment, they may only be able to assess a subset of those goals. We refer to the subset of goals currently being subconsciously assessed as the *active goal set.* The number of goals in the active goal set could range from zero to some upper limit bounded by the capacity of the mechanism. Thus, once the active goal set is at maximum capacity, a new goal entering the active set would have to displace one or more other goals that had been active until that moment.

At a given moment, the active goal set may contain any newly created, current, or remembered goals. Active goals may or may not also be present in conscious working memory. Goals that reside in conscious working memory are said to be *salient.* When goals move into conscious working memory, YST assumes they also move into the subconscious active goal set. Thus, salient goals constitute a subset of the active goal set.

A change in yield with respect to one or more goals in the active set would constitute a change to the yield for the set as a whole. At a given moment, the yield perception for the active goal set would be the net of the currently perceived yields for the goals in the set.

To explain the satisfaction phenomenon, YST makes two more assumptions.

Assumption 4 *Yield Shift Detection. An automatic, subconscious, cognitive mechanism detects the magnitude and direction of changes in yield for the active goal set.*

Assumption 4 does *not* posit that the individual makes a conscious, point-by-point assessment of the utility and likelihood of each goal in the active set. Rather, it assumes that some subconscious cognitive mechanism detects shifts in yield for the active goal set as a whole.

The notion of subconscious yield shift detection is the most important concept for YST. If the logic of YST holds, then a shift in yield could happen in at least three ways:

The utility ascribed to one or more goals in the active set could change. For example, upon using a new system, a user might discover that the system is faster than originally anticipated.

The likelihood assessment for one or more goals in the active set could change. For example, a system champion who believes that an organization lacks sufficient funds to build a new capability might learn that an important customer may be willing to fund the upgrade.

The mix of goals comprising the active set could change. For example, an accountant who is focused on the moderate-yield goal of pulling a daily report may change focus to a higher-yield goal of cutting the accounts receivable cycle or to a more personal higher-yield goal like job security.

Finally, YST also assumes that:

Assumption 5 *Affective Response to Shifts in Yield. The detection of a shift in yield for the active goal set triggers an affective arousal proportional to the magnitude of the shift in yield***,** *and with a valence in the direction of the shift.*

Thus, if an increase in yield for the active goal set is detected from one moment to the next, an affective arousal with a positive valence will occur. If a decrease in yield is detected from one moment to the next, an affective arousal with a negative valence will occur. The greater the absolute value of the shift detected by the subconscious yield-shift detector, the greater will be the magnitude of the affective arousal.

While the magnitude of shifts in yield may be boundless, human physiological and affective responses are bounded. There may be a ceiling, therefore, on the magnitude of affective arousal an individual can experience. Thus, beyond some level of arousal, incremental increases in magnitude of yield shift would give rise to smaller and smaller increases in affective arousal. The relationship between shifts in yield perception and the magnitude of the satisfaction response would thus have to be curvilinear rather than purely linear. Therefore, YST proposes:

Proposition 2 *Satisfaction Response as a Function of Yield Shift. The magnitude of the satisfaction response is a curvilinear function with a positive but decreasing slope of the absolute value of a yield shift for the active goal set. The valence of the satisfaction response is equivalent to the sign or direction of the yield shift.*

YST deems Proposition 2, the core proposition of the theory, to be both necessary and sufficient to explain variations in the satisfaction response. Proposition 2, the core proposition of YST, may be represented formally as follows:

Formula 2:

$$S = f\left(\sum_{i=1}^{m} Y_i - \sum_{j=1}^{n} Y_j\right)$$

where

S is the satisfaction response
m is the number of goals in the active goal set
n is the number of goals in a prior goal set
Y_i is the yield perceived for goal i of the m goals in the active goal set
Y_j is the yield perceived for goal j of the n goals in the reference goal set

Proposition 2 (Fig. 11.2) posits that the satisfaction response is a function of a shift in the yield of the active goal set. When something changes with respect to the active goal set, an affective response may manifest. For example, in a system design meeting, if a user were to learn that others supported the inclusion of features the user deemed important, that might constitute an upward shift in likelihood assessment with respect to goals relating to the system, which would then give rise to a positive satisfaction response. The magnitude of the satisfaction response would be proportional to the magnitude of the shift. For example, if the user's likelihood assessment for the new features shifted from very low to almost certain, that would constitute a larger shift than if the user's likelihood assessment shifted from almost certain to slightly more certain, and so the former would give rise to a larger satisfaction response than the latter.

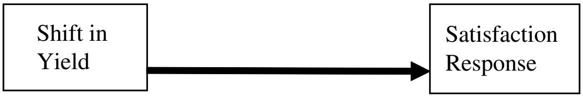

Fig. 11.2 A diagram of Proposition 2. The satisfaction response is a function of shifts in yield for the active goal set. The *arrow* signifies the direction of causation

Table 11.4 Definitions of terms for Yield Shift Theory

Goal	A desired state or outcome
Satisfaction response	A valenced affective arousal with respect to some object that has reference to an individual's goal
Utility	The benefit or value an individual subconsciously ascribes to attaining a goal
Likelihood	The degree to which an individual subconsciously believes a goal to be attainable
Yield	A function of the utility individual ascribes to attaining a goal or a set of goals moderated by the perceived likelihood that the goal will be attained
Active goal set	The subset of goals currently being assessed by the subconscious mind for changes in yield
Perceived shift in yield	A subconscious perception that the overall yield for the active goal set has changed

The magnitude of the shift would be the absolute value of the difference between the subconsciously perceived yield of the active goal set and the yield of the active goal set at a previous moment in time. The sign of this difference would represent the valence of the satisfaction response (i.e., if the difference is positive, satisfaction would manifest, and if the difference is negative, dissatisfaction would manifest).

The propositions offered by YST explain the onset, magnitude, and valence of the affective arousals that constitute the satisfaction response. Table 11.4 lists and defines the key terms and constructs used in YST. Table 11.5 summarizes the assumptions and propositions of YST.

It is important not to confuse the subconscious mechanisms posited by YST with conscious, intentional analyses of potential or obtained outcomes. Conscious analyses may produce cognitive *judgments* about the degree to which needs, wants, or desires have been met, and may even offer rational justifications for satisfaction responses. However, the logic used by YST only holds if we assume these mechanisms to be both automatic and subconscious.

11.5 Evaluating YST

Having advanced a new theory, one should next develop arguments about both its falsifiability and its scientific utility (Popper 1959; Bacharach 1989). This section argues the falsifiability and scientific utility of YST. This section offers arguments with respect to the falsifiability and utility of YST.

Table 11.5 The assumptions and propositions of Yield Shift Theory

Assumption 1: utility assessment	A cognitive mechanism automatically and subconsciously ascribes some level of utility to attaining a given active goal
Assumption 2: likelihood assessment	A cognitive mechanism automatically and subconsciously assesses the likelihood that an active goal may be attained
Assumption 3: yield assessment	A cognitive mechanism automatically and subconsciously generates a perception of yield for an active goal based on the utility ascribed to it, but reduced in inverse proportion to the likelihood assessed for attaining the goal
Proposition 1: perceived yield	At a given moment, the yield an individual perceives for a given goal is a function of the utility ascribed to the goal moderated by the assessed likelihood of attaining it
Assumption 4: yield shift detection	An automatic, subconscious, cognitive mechanism detects the magnitude and direction of changes in yield for the active goal set
Assumption 5: affective response to shifts in yield perceptions	The yield shift detector triggers an affective arousal proportional to the magnitude of the shift in yield, and with a valence in the direction of the shift
Proposition 2: satisfaction response as a function of yield shift	The magnitude of the satisfaction response is a curvilinear function with a positive but decreasing slope of the absolute value of yield shift. The valence of the satisfaction response is determined by the direction of the yield shift

11.5.1 Falsifiability of YST Constructs

For a theory to be regarded as falsifiable, it must be possible to refute its constructs and propositions by experience (Popper 1959). For causal constructs to be regarded as falsifiable, their definitions should be sufficiently explicit that it is possible for a researcher to devise at least two different experimental treatments that instantiate at least two different values of the causal construct. The key causal construct in YST is shift in yield. The theory suggests at least three strategies by which the yield of the active goal set can be manipulated. Table 11.6 lists these strategies and proposes two treatments that instantiate different values of the causal construct based on each strategy. Thus, the causal constructs of YST are demonstrated to be falsifiable.

For a consequent construct (one representing an effect) to be regarded as falsifiable, its definition should, at a minimum, be sufficiently explicit that a researcher can define variables to measure it in an operationally specific manner (Bacharach 1989). Such variables should be able to measure the construct in ways that distinguish it from other closely related constructs. YST defines the satisfaction response as an affective arousal with a valence. This definition distinguishes it from satisfaction-as-judgment and other connotations of the word *satisfaction*, and this distinction can be incorporated into scale items for measuring satisfaction. For example, statements like these elicit explicitly about an affective response, and so are consistent with YST:

> I feel good about today's meeting process (1 = Strongly Disagree, 7 = Strongly Agree) (Briggs et al. 2006, p. 603).

Table 11.6 Theoretical strategies for manipulating shift in yield, and for each strategy, an example of two treatments that instantiate two different values of yield shift in an IS context

Strategy	Treatments
1. Change the utility people ascribe to their active goals	All bank customers are told that their new online banking system will allow them to pay bills online as a free service, eliminating the need to write checks and stamp envelopes. *Object of satisfaction*: Online Bill-Paying Service. *Treatment 1*: users discover that, while the banking service is free, the vendors from whom they buy also offer a 5% discount for online transactions (a positive utility shift). *Treatment 2*: users discover that, while the banking service is free, the vendors from whom they buy charge a 5% fee for online transactions (a negative utility shift)
2. Change the likelihood people assess for active goals	Users are told that there is only a 50–50 chance the budget for a new system will be granted. *Object of satisfaction:* IS/IT budget process. *Treatment 1*: users are subsequently told that the CEO has forwarded a recommendation to the board that the plan should be funded (a positive shift in likelihood). *Treatment 2:* users are subsequently told that the CEO has forwarded a recommendation to the board that the plan should not be funded (a negative shift in likelihood)
3. Change the goals that comprise the current active goal set	HR personnel change to a new ERP system that makes calculations of withholdings more difficult. *Object of satisfaction*: ERP system. *Treatment 1*: a mentor points out to users that people who use the new system have a far greater chance of getting a promotion than people who continue to use the old system (add the goal of job promotion to the active set and position the ERP as something that increases the likelihood of achieving that goal) *Treatment 2:* a mentor points out to users that people who use the system also have a far smaller chance of getting a promotion than people who continue to use the old system (add the goal of job promotion to the active set and position the ERP as something that lowers the likelihood of achieving that goal)

> All things considered, I am (delighted/disappointed) with using the system (Chin and Lee 2000, p. 559).

However, the definition of the satisfaction response used in YST would rule out questions that measure satisfaction-as-judgment such as:

> To what extent does the final solution reflect your inputs? (1 = Not at all, 5 = To a Very Great Extent) (Green and Taber 1980, p. 102).
>
> What is your overall reaction to the system? (Rigid/Flexible) (Chin et al. 1988 p. 217).

The definition would also rule out ambiguous measures like the following that do not distinguish between affect and judgment, and so might produce confounded results:

> How satisfied or dissatisfied are you with the quality of your group's solution? (1 = Very Dissatisfied, 5 = Very Satisfied) (Green and Taber 1980, p. 102).

> Overall I am (extremely dissatisfied – extremely satisfied) with the online offerings of [this provider] (Khalifa and Liu 2003, p. 230).

Appendix A proposes an instrument derived from YST for measuring the satisfaction response of stakeholders with respect to IS/IT artifacts (referred to in the rest of the chapter as the IS/IT Satisfaction Instrument). These examples demonstrate that the definition of the satisfaction response is sufficiently explicit that one can derive variables to measure it, and that one can distinguish it from other closely related phenomena. Thus, both the causal and consequent constructs of YST are demonstrated to be falsifiable.

11.5.2 The Falsifiability of YST Propositions

In order for a theory to be regarded as logically adequate, its propositions must not be tautological, but should be framed such that the causal relationships they propose could be refuted by experience (Bacharach 1989; Popper 1959). YST's Proposition 1 posits that goal yield is a function of ascribed goal utility moderated by assessed likelihood of goal attainment. The relative yield of the active goal set (or at least those in working memory) could be measured by asking participants to list salient goals in rank order according to the value they are likely to derive from pursuing each. A researcher could then manipulate perceptions of likelihood and utility (see Table 11.6 for examples), and participants could be asked to re-rank the goal set. It would be possible for the new goal set rankings to be inconsistent with the moderated relationship posited in Proposition 1. Indeed, it would be possible to produce rankings that were independent of both utility and likelihood. Thus, Proposition 1 could be refuted by experience.

In YST, Proposition 2 posits that shifts in perceived yield for the active goal set cause a satisfaction response. The treatments proposed in Table 11.6 could be combined with the measurement instrument proposed in Appendix A to form hypotheses that test Proposition 2. A test of any of those hypotheses could produce satisfaction data that differ from the predictions of the hypotheses and from the causal relationships of the proposition. Thus, Proposition 2, and so YST, is demonstrated to be falsifiable.

11.5.3 The Scientific Utility of YST

For a theory to be regarded as scientifically useful, it should either offer more explanatory power for the phenomenon of interest than was available in the prior literature, or it should offer a more parsimonious model with similar explanatory power to that which preceded it. In this section, we demonstrate that YST offers an explanation for the ten satisfaction phenomena identified earlier in the paper, that it can predict when each should manifest and when it should not, and that it can reconcile seeming paradoxes within and between existing models of satisfaction.

11.5.3.1 Goal Attainment Effects and YST

Goal attainment effects are said to manifest when one experiences a positive satisfaction response when goals are attained or a negative satisfaction response when goals are thwarted. If the logic of YST holds, a goal attainment event could give rise to a positive satisfaction response under two conditions. First, goal attainment could produce higher utility than that ascribed to a goal. Second, if individuals assess less than full likelihood to attaining a goal, then attainment would constitute a shift from less than full to a certainty. Either condition would produce a positive shift in yield, and so give rise to a positive satisfaction response upon goal attainment. A negative satisfaction response could manifest when goal attainment is thwarted because an individual's likelihood assessment for the goal would move from a value greater than zero to zero, a negative yield shift.

There are also conditions, however, under which YST would predict that goal attainment effects would not manifest. By the logic of YST, goal attainment should be accompanied by a neutral satisfaction response (nonarousal) when goal attainment produces utility similar to that ascribed to the goal, and when the individual assesses full likelihood for achieving the goal. Under these conditions, goal attainment would be accompanied by no yield shift, and so no satisfaction response would manifest. Goal attainment could also produce a negative satisfaction response if goal attainment produced less utility than one had ascribed to the goal.

11.5.3.2 Confirmation Effect and YST

Confirmation effects are said to manifest when one experiences a positive satisfaction response when outcomes meet or exceed expectations, and a negative satisfaction response when outcomes do not meet expectations. In terms of YST, however, the concept "expectations," is ambiguous; it could refer to utility, likelihood, or yield. Regardless of which connotation is intended, however, YST suggests an explanation. When outcomes are consistent with ascribed utility, a positive satisfaction response could manifest if one had assessed less than full likelihood to attaining a goal. Goal attainment would constitute an upward shift to full likelihood. When outcomes exceed expectations, a positive satisfaction response could occur when one had ascribed less than full likelihood to the goal (a likelihood shift) or when outcomes produce more utility than one had ascribed to the goal (a utility shift), or both (a yield shift). When outcomes do not meet expectations, a negative satisfaction response could manifest when outcomes produce a negative likelihood shift or a negative utility shift, or both.

There are also conditions under which YST predicts that no confirmation effect would manifest. If one were to assess full likelihood for goal attainment, and outcomes were to match the utility ascribed to goal attainment, then no yield shift would occur, and so no confirmation effect would manifest.

11.5.3.3 Disconfirmation Effect and YST

Disconfirmation effects are said to manifest when one feels neutral (no arousal) when outcomes match expectations or desires; one feels satisfied when outcomes exceed expectations or desires; and one feels dissatisfied when outcomes are less than expectations or desires. YST predicts there will be a neutral disconfirmation effect when one ascribes full likelihood to goal attainment, and outcomes yield utility equivalent to that ascribed to the goal. YST suggests that positive disconfirmation effect would manifest where outcomes exceed expectations when one assessed less than full likelihood to the outcomes, and/or when outcomes produce more utility than one had ascribed to them. Positive disconfirmation effects should be smaller when individuals ascribe high likelihood to attaining goal attainment than when they ascribe low likelihood. YST suggests that negative disconfirmation effect would manifest when outcomes fall short of expectations where the shortfall represents a downward shift in likelihood or utility.

By the reasoning of YST, however, negative disconfirmation effects would not manifest when an individual ascribes low likelihood and high utility to a goal, and outcomes result in a modest negative utility shift. Under such circumstances, a strongly positive likelihood shift should overwhelm the modest negative utility shift, producing a positive satisfaction response. The neutral responses of the disconfirmation effect should not manifest when individuals ascribe less than full likelihood to goal attainment, and outcomes match utility expectations.

11.5.3.4 Anticipation Effect and YST

Anticipation effects are satisfaction responses that manifest before goals are attained or outcomes are known. The logic of YST suggests that positive anticipation effect could manifest before a goal is attained or before outcomes are known, if something happens to change the likelihood or utility ascribed to the goal either positively or negatively. Such changes would constitute positive or negative yield shifts, causing positive or negative satisfaction responses. By this reasoning, anticipation effects should not manifest when events do not affect the likelihood or utility an individual ascribes to active goals.

11.5.3.5 Nostalgia Effect and YST

Nostalgia effects are satisfaction responses that manifest long after goals have been attained or thwarted. YST suggests that, when one reflects on past success or failure, the goals of that time may temporarily displace more current goals in the active goal set. The yield of those past goals may differ from those of the more current goals they displace, giving rise to a positive or negative yield shift for the active set as a whole, and so to positive or negative satisfaction responses. Nostalgia effects could also be caused if current conditions caused shifts in one's current perceptions of the utility and likelihood ascribed to past goals.

YST suggests that nostalgia effects should not manifest when the yield of past goals is similar to the yield of the goals they displace.

11.5.3.6 Differential Effects and YST

Differential effects are said to manifest when individuals who appear to ascribe similar utility to goals nonetheless manifest differing satisfaction responses upon goal attainment. YST predicts that, upon goal attainment, a differential effect would manifest when different people who ascribe similar utility to attaining the goal nonetheless assess differing likelihoods for its attainment. The person who ascribed the lowest likelihood to attaining the goal would experience the largest upward shift of likelihood when the goal was actually attained, and so would experience the largest yield shift, and so the largest satisfaction response. Likewise, the person who ascribed the highest likelihood to the goal would experience the smallest upward shift when the goal was attained, and so experience the smallest yield shift, and so the smallest satisfaction response.

YST suggests that differential effects would not manifest when individuals ascribe similar utility and similar likelihood to a goal. Differential effects would also not manifest where differences in the utility that individuals ascribe to a goal are offset by differences in countervailing differences in likelihood.

11.5.3.7 Hygiene Effects and YST

Hygiene effects are said to occur where people never evidence a positive satisfaction response toward an object from which they derive value, but manifest dissatisfaction when it delivers less value than usual. YST suggests that when people ascribe full likelihood to a goal, and attain the utility they expect from an object by which they attain the goal, then goal attainment constitutes no shift of likelihood or utility, and so produces no satisfaction response, giving rise to the neutral hygiene effect. If the object fails to deliver value, however, that constitutes both a negative shift in likelihood and a negative shift in utility, which would produce a negative yield shift, and therefore, a negative satisfaction response. This would account for the negative satisfaction responses observed in the hygiene effects.

By this reasoning, the neutral responses of the hygiene effect should not manifest upon goal attainment when individuals ascribe less than full likelihood to such attainment. For example, if the object of satisfaction were an unreliable router, then successful use of the router would constitute a positive shift in likelihood, and so should give rise to a positive satisfaction response. Negative hygiene effects should not manifest when individuals ascribe no likelihood to attaining a goal.

11.5.3.8 Mentor Effects and YST

Mentor effects are satisfaction responses that manifest after conversations with trusted friends or advisers, even when those conversations produce no difference in current conditions. When one speaks with a trusted advisor or friend, that person may cause one to stop focusing on lower-yield goals and to begin focusing on higher-yield goals. Doing so causes the overall yield of the current goal set to increase, resulting in a positive mentor effect. A trusted advisor, perhaps hoping to motivate purposeful action, might also cause one to attend to lower-yield goals, invoking a negative yield shift, and thereby a negative mentor effect. Further, even without invoking a change of goals in the active set, a mentor with experience and credibility may sometimes induce a change in the likelihood or utility ascribed to an individual's active goals, giving rise to a corresponding mentor effect.

11.5.3.9 Mixed Feelings and YST

YST predicts a given satisfaction response for any given yield shift. However, sometimes people report mixed feelings – the near-simultaneous experience of both positive and negative satisfaction responses. Mixed feelings could manifest upon goal attainment under several conditions. First, one could ascribe high utility and low likelihood to attaining a goal, but on attaining the goal, obtain substantially less utility than expected. YST suggests that the positive likelihood shift and the negative utility shift could net out to a single positive, neutral, or negative yield shift, depending on the magnitude and direction of each shift, producing a corresponding satisfaction response. However, individuals may devote their limited attention resources in one moment to only the likelihood shift, and so experience a positive response, and then in the next moment turn their attention to only the utility shift, producing a negative response, causing a sequence of mixed feelings. Mixed feelings could also manifest upon the attainment of a goal when an individual is conscious of having had to sacrifice other high-yield goals in order to achieve the success. The individual might alternate between contemplating the several states represented by the sacrificed goals, each of which might compare differently with the current state, producing a sequence of mixed feelings. By this reasoning, however, mixed feelings should not manifest when all yield shifts invoked by events are in the same direction.

11.5.3.10 Attenuation Effects and YST

Finally, the *attenuation effect* can also be explained by the yield shift mechanism. At the moment a person experiences a shift, the mechanisms posited by YST detect a difference in yield for the active goal set from the moment before, giving rise to a satisfaction response. As time passes, however, current conditions will increasingly be perceived as status quo rather than as a change. Thus, detected yield shifts will diminish, causing the satisfaction response to diminish. By this reasoning, attenuation effects might be temporarily delayed when an individual is in a turbulent, rapidly changing environment where the goals in the active set change quickly and where each change is quickly followed by significant yield shifts for the new active set. Eventually, however, physical and mental exhaustion might limit the individual's ability to focus on new goal sets and new yield shifts, and so attenuation effects would be inevitable.

11.5.4 YST and the Paradoxes of Earlier Perspectives

Goal Attainment and Confirmation Theories of satisfaction predict a positive satisfaction response when outcomes match expectations or desires. Disconfirmation theories predict a neutral response to the same conditions. Yet the literature reports empirical support for all three theories. YST accounts for these outcomes, predicting positive goal attainment and confirmation effects when one ascribes less than full likelihood to goals that are attained or to outcomes that match utility expectations, and YST predicts a neutral disconfirmation effect when one ascribes full likelihood to outcomes that match expected utility. Thus, the seemingly conflicting positions of these models can be unified by YST.

Confirmation and disconfirmation theories both posit satisfaction effects based on a comparison of outcomes to expectations or desires. However, it is possible that one's expectations could be lower or higher than one's desires, and that outcomes could fall somewhere between them. Under these conditions, both confirmation and disconfirmation theories would yield two mutually exclusive predictions of the satisfaction effect, one based on expectations, the other based on desires, creating a paradox. YST removes this paradox by framing the causes of satisfaction in terms of utility and likelihood assessments for goals instead of expectations and desires for outcomes. Any combination of changes to utility and likelihood will result in only a single prediction for a satisfaction response, and so YST resolves the expectation/desire paradox.

11.6 Discussion

With the arguments above, we have demonstrated the falsifiability of YST's constructs and propositions. We have also demonstrated that it provides explanations for each of the ten observed satisfaction effects, and that its logic can be used to predict conditions under which each effect should and should not manifest. YST also explains why researchers could find empirical support for the mutually exclusive predictions of confirmation and disconfirmation models with respect to the case where outcomes match expectations and desires. We have also demonstrated that YST offers a resolution for the paradox of expectations and desires in confirmation and disconfirmation models. Because YST explains more variations of the phenomenon of interest than do its predecessors, its scientific utility is demonstrated.

11.6.1 YST and the Technological Imperative

Early in the chapter, we reported examples of the incidents that motivated the development of YST – an executive who felt dissatisfied after using a new system even though he judged it to be superior to a conventional approach. YST suggests that the satisfactory attributes of the system and of the product created with the system were not instrumental to advancing the executive's active goals. Subsequent discussion with the executive confirmed that conjecture. The executive reported that he had succeeded in his career because he could, by force of his personality, bring political rivals together, penetrate their self-interests, and focus them on achieving common goals. With the new system, the conflicted parties found common ground without his intervention. His distinctive skills were not required, which reduced his influence in the organization. A reduction of desired influence would constitute a negative yield shift, and so give rise to a negative satisfaction response. Thus, a judgment of the system as satisfactory was not a valid predictor of the satisfaction response.

The logic of YST suggests that a technological imperative should not be applied to the satisfaction response. One would not be justified in concluding that the use of some class of IS/IT artifacts necessarily leads to or influences satisfaction. System quality would only correlate with satisfaction responses where system quality induces a yield shift with respect to active goals. There may be a temptation toward the technological imperative because people frequently report higher satisfaction with the better-performing artifacts. Consider, however, a scenario where one group of users sends print jobs to a printer that never fails, while another group sends print jobs to a printer that fails frequently. Suppose users in both groups were asked to print out a large, time-critical proposal that would bring high reward if it could be delivered on time, but no reward if it were delivered late. Suppose further that all printouts were successful, and that users were asked to rate their feelings of satisfaction or dissatisfaction with the printer following the print job. Those who assessed less than full likelihood that the document would print successfully may experience an upward shift in likelihood upon success, while those who assessed full likelihood to the success of the printout may not. Therefore, according to the logic of YST, in this scenario, a counter-intuitive outcome could manifest: users of the unreliable printer may actually rate it higher on the IS/IT satisfaction scale than would users of the reliable printer.

Thus, if the logic of YST holds, then the technological imperative, where systems or their attributes are proposed as causes or influencers of the satisfaction response, cannot hold.

11.6.2 Future Directions

The presentation of this theory raises a number of issues requiring further research. The next step for YST could include experimental testing of its propositions. Such experiments should be conducted with a variety of IS/IT artifacts, policies, procedures, and practices under a variety of circumstances to establish that the effects are not restricted to a specific system or situation. A first step in this process could be to validate an IS/IT satisfaction instrument to further demonstrate the falsifiability of the consequent construct (Straub 1989). This experimental work could begin by examining the ten observed satisfaction effects listed in Table 11.1. We used the logic of YST to derive explanations for all ten observed satisfaction effects and to argue that each effect should occur under some conditions, but not others. It will be necessary to derive formal hypotheses that challenge the derived explanations and that instantiate conditions under which the effects should and should not manifest in the IS/IT domain. If such studies produce results that are consistent with the explanations, and if they demonstrate that each of the ten effects can be generated or prevented by experimental treatments, then the findings would suggest that the causal relationships proposed by the theory are a useful model of the satisfaction response, and that the theory could be useful in applied settings.

It may also be useful to take YST into the field using a design-science approach (Hevner et al. 2004; Nunamaker 1992) to observe if satisfaction responses are consistent with YST's propositions. Such research would serve both applied and theoretical scientific purposes. Because satisfaction is an important construct throughout the IS/IT lifecycle, field observations and theory-based interventions should examine satisfaction during planning and design, development, deployment, operations and maintenance, and phase-out. Field researchers can attempt to use the theory as the basis to derive measurement instruments for practitioners, to amend design and development methodologies, and to create deployment interventions that produce not only sound systems but also systems with which stakeholders feel satisfied. As the applied field work proceeds, researchers can record observations about the degree to which satisfaction phenomena are consistent with, or in conflict with, the propositions of the theory. Thus, their work will either provide additional support for, or will refute, the theory, perhaps pointing the way toward a better theoretical framing of the satisfaction response.

This stream of research began with an observation that satisfaction responses seemed to correlate with the continued use or abandonment of IS. Having derived an explanation for the onset, magnitude, and valence of the satisfaction response, further research will be required to determine the causal link, if any, between the cognitive mechanisms of satisfaction and the cognitive mechanisms of choice, stability, and change.

11.6.3 The Boundaries of YST

YST seeks only to explain the causes for the onset, magnitude, and direction of the affective phenomenon that we label the satisfaction response. It does not attempt to explain other phenomena that bear the satisfaction label, for example, satisfaction-as-judgment. Satisfaction-as-judgment is defined as the evaluation individuals make of the extent to which their needs, wants, or desires have been fulfilled, or that their goals have been attained. This construct may also have bearing on the degree to which individuals perceive that their interests and constraints have been accommodated. Goal attainment or need satisfaction models are useful but insufficient to account for the variety of satisfaction responses that manifest. Nonetheless, it seems important that we come to a deeper understanding of satisfaction-as-judgment – its definition, its causes, and the nature of its relationship to satisfaction-as-affect. We suspect that it is more than a linguistic accident that these two constructs bear the same label, but further research will be required to illuminate this topic.

11.7 Conclusions

The YST of satisfaction uses five constructs arrayed in two propositions derived from five assumptions to build the argument that the satisfaction response can be explained by shifts in perceptions of yield for the active goal set. It argues that the yield for a given goal is a function of the utility an individual ascribes to the attainment of that goal, but reduced in inverse proportion to the likelihood an individual assesses of attaining the goal. The logic of YST suggests three strategies for invoking shifts in yield for the active goal set: (a) change the utility that people ascribe to one or more goals in the active set; (b) change the likelihood people assess of attaining one or more goals in the active set; and (c) change the goals that comprise the active set.

For researchers, YST offers a parsimonious theoretical foundation for understanding the satisfaction response. We have argued both the falsifiability and the scientific utility of the theory. It suggests explanations for ten observed satisfaction effects, and it suggests an explanation for conflicting results in the IS/IT satisfaction literature. It also resolves paradoxes left unaddressed in earlier theoretical perspectives. If the logic of YST holds up to future empirical scrutiny, it may provide a solid foundation for those who research user satisfaction, IS success, technology transition, adoption, diffusion, and other related topics. If YST is sustained by empirical validation, it may be regarded as transformative in that it bridges and integrates previous perspectives, providing conceptual coherence that allows us to re-evaluate earlier perspectives in a new light.

YST has significant implications for IT/IS field. It can provide a basis for making choices about how to approach designing, developing, and deploying IS in ways that are likely to engender positive satisfaction responses among users and other stakeholders. If users feel satisfied, this, in turn, may increase the likelihood that IS and technologies will succeed in creating lasting value in organizations.

11.8 Appendix A

11.8.1 A Satisfaction Instrument for IS/IT Artifacts

The table below presents questionnaire items for measuring a stakeholder's satisfaction response with respect to IS/IT artifacts. The items are offered to argue the falsifiability of the consequent construct of YST, the satisfaction response. YST defines the satisfaction response as an affective arousal with a positive or negative valence. Note that the questions specifically call for reports of affect. They do not call for judgments that needs or constraints have been met. Nor do they leave any ambiguity as to whether they call for reports of affect or judgment. Thus, they demonstrate that the definition of the consequent construct is sufficiently explicit that a researcher can define variables that distinguish it from other closely related constructs, and that it can be measured in an operationally specific manner.

I feel satisfied with <the IS/IT Artifact> (1 = Strongly Disagree; 7 = Strongly Agree)	1 2 3 4 5 6 7
I feel good about <the IS/IT Artifact> (1 = Strongly Disagree; 7 = Strongly Agree)	1 2 3 4 5 6 7
<The IS/IT artifact> gives me a feeling of satisfaction (1 = Strongly Disagree; 7 = Strongly Agree)	1 2 3 4 5 6 7
I feel happy with <the IS/IT artifact> (1 = Strongly Disagree; 7 = Strongly Agree)	1 2 3 4 5 6 7
When I think about the <IS/IT artifact>, I feel positively toward it (1 = Strongly Disagree; 7 = Strongly Agree)	1 2 3 4 5 6 7

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Chapter 12
Intention-Based Models: The Theory of Planned Behavior Within the Context of IS

Enas Al-Lozi and Anastasia Papazafeiropoulou

Abstract The Theory of Planned Behavior (TPB) is a social-psychological model that has been – and still – extensively applied within the domain of Information Systems in predicting, examining, and explaining human behavior. It is a comprehensive model positing that the actual behavior is driven by human intentions that are influenced by personal, social, and situational factors. In this chapter we demonstrate the TPB in a way that best describes the origin of the theory and its relation to other intention-based theories, the purpose behind the theory, and the practical applications of the theory illustrated by an example from the Information Systems field.

Keywords Intention- based models • Theory of Planned Behavior • Theory of Reasoned Action • Online Communities • and Information Systems

Abbreviations

DOI	Diffusion of innovation
EDT	Expectancy disconfirmation theory
IS	Information systems
IT	Information technology
OC	Online communities
PBC	Perceived behavioral control
SET	Self-efficacy theory

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TAM Technology acceptance model
TPB Theory of planned behavior
TRA Theory of reasoned action

12.1 Introduction

Human behavior can be best explained as the result of attempts exhibited by humans to satisfy certain needs and desires. It is driven by a person's own motives and intentions and mostly influenced by personal, social, and situational factors. Studying human behavior allows a better understanding to the motives and intentions behind people's actions, but explaining that in all its complexity has been and is still a difficult task. Human behavior has been approached at many levels, from physiological concerns at one extreme to social concentrations at the other.

Concepts such as personal attitudes and personality traits, social norms and values, and the environmental conditions surrounding a person plays a major and important role in the attempts of predicting and explaining human behavior (see Ajzen 1988; Campbell 1963). But the question remains; why do people act the way they do? Finding the answer to such a question is not easy. In fact, a vast amount of scientific research has tried to answer such a thing but yet, no comprehensive and clear explanation for that.

Generally speaking, you could say people behave the way they do for a reason. However, the reason may not be clear; in fact, it may not be logical or rational either. Therefore, this area of studies has received a great deal of attention for the fact that by observing human behavior, you can gain the knowledge you need to better understand yourself and people surrounding you and influencing your own behavior. It helps in learning why people act and react in certain ways and identifies the various types of behavior and needs of people.

This chapter introduces one of the most widely cited intention-based theories, that has been widely applied and used within the information systems (IS) field to predict and explain human behavior along with its influences; the theory of planned behavior (TPB).

12.2 Intention-Based Models

12.2.1 Origin of Theory of Planned Behavior

The history of TPB is traced back to the theory of reasoned action (TRA), developed by Ajzen and Fishbein (1980). TRA was derived from early research which started out as the theory of attitude, and eventually led to the study of human attitude and behavior. The TRA was "born largely out of frustration with traditional attitude-behavior research, much of which found weak correlations between attitude measures and performance of volitional behaviors" as stated by Hale et al. (2003, p. 259).

By the 1980s, Ajzen and Fishbein (1980) extended the concept into a TRA as a major determinant of any human behavior. Their TRA posits that the antecedent of any behavior is human intention, and that the strength of the person's intentions to perform that certain behavior corresponds with the likelihood of the behavior taking place. The antecedents of intentions were stated as the strength of attitudes towards the certain behavior, and subjective norms that are perceived as the social pressure of whether to perform or not to perform the behavior.

The TRA is a model that finds its origins in the field of social psychology. This model defines the links between behavioral beliefs, personal attitudes, social norms, intentions, and behaviors of individuals. According to this model, a person's behavior is determined by its behavioral intention to perform it. This intention is itself determined by the person's behavioral attitudes, personal traits, and his subjective norms towards the behavior.

The TRA postulates that the attitude of a person towards a behavior is determined by his beliefs on the consequences of this behavior, and by his evaluation of these consequences. Beliefs are defined by the person's subjective probability that performing a particular behavior will get him to a certain outcome and produce specific results. Moreover, behavioral intention is also determined by the subjective norms that are themselves determined by the normative beliefs of an individual and by his motivation to comply to the social norms.

The key application of the TRA is prediction of behavioral intention as reasoned action is explicitly concerned with behavior. This theory recognizes that there are situations (or factors) that might limit the influence of attitude on behavior. Therefore, reasoned action predicts behavioral intention, a compromise between stopping at attitude predictions and actually predicting behavior. Because it separates behavioral intention from behavior, reasoned action also discusses the factors that limit the influence of attitudes (or behavioral intention) on behavior.

TRA also claims that all other factors which influence the behavior only do so in an indirect way by influencing the attitude or subjective norms. Fishbein and Ajzen (1975) refer to these factors as being external variables. These variables can be, for example, the characteristics of the tasks, or of the user, the type of development implementation, the political influences, the organizational structure, etc. (Davis et al. 1989). TRA is an important account of volitional behavior in social psychology. The TRA and its successor, the TPB (Ajzen 1985), were developed to permit prediction behaviors not entirely under volitional control.

12.2.2 Theory of Planned Behavior: Overview

Later refinements of the TRA are Ajzen's TPB – which act as an extension to the TRA that resides around the additional construct of controlled behavior. Ajzen's TPB (1985) proposes and incorporates an additional determinant of human motivational intentions which is the *Perceived Behavioral Control* (PBC) into the reasoned action model. This addition is to acknowledge the discovery that individuals might have incomplete control over their intended behavior, as a result of unstable and uncontrollable external contexts (Ajzen 2002; Bandura 1977, 1982; Triandis 1977).

The TPB is a well-established social-psychological model used to examine and predict human intentions and behavior in situations where individuals might lack control over their own behavior. The major difference between TRA and TPB is the addition of a third determinant of behavioral intention, PBC. The concept of PBC, however, originates from the self-efficacy theory (SET) proposed by Bandura (1977).

PBC indicates that a person's motivation is influenced by how difficult the behaviors are perceived to be, as well as the perception of how successfully the individual can, or cannot, perform the activity. If a person holds strong control beliefs about the existence of factors that will facilitate a behavior, then the individual will have high perceived control over a behavior. Conversely, the person will have a low perception of behavioral control if he/she holds strong control beliefs about that certain behavior.

The TPB is very powerful and superior with respect to other competing models in predicting and explaining human behavior, because it supplies more information to explain behavior (Mathieson 1991; Taylor and Tod 1995a, b). Thus, it provides good prediction while using few predictors and provides a complete understanding of the phenomena as it includes variables with very different conceptual scope.

12.2.2.1 The Conceptual Model

Within the core of the TPB lies the central factor, which is the individuals' intention to perform certain behaviors. Intentions can be defined as the anticipated outcome that guides your planned actions. Individuals' intentions are indications of what would motivate and influence his intent to act in a certain behavior. Thus, intentions would be expected to affect and influence performance to the extent that the person has behavioral control (Ajzen 1991).

Remarkably, the general framework of the TPB (see Fig. 12.1) postulates three conceptually independent determinants of members' intentions; *Attitudes*, *Subjective Norms*, and *Perceived Behavioral Control*. *Attitude* towards the behavior refers to the degree to which a person has a favorable or unfavorable evaluation or appraisal of the behavior to be acted upon (Taylor and Todd 1995a, b; Orbell et al. 1997). Individual attitude is determined by personal beliefs and traits that characterize that individual in particular.

The second determinant strongly relates to social factors and is termed as individuals' subjective norms. *Subjective Norms* refer to the perceived social pressure of the external environment surrounding individuals on whether to perform a behavior or not, and how family and friends would affect his/her perception of whether to behave in a certain way or not. This construct is consistently a weaker predictor of physical activity intentions than attitudes and PBC (Godin and Kok 1996; Hagger et al. 2002).

The third antecedent of individuals' behavioral intentions is the degree of *Perceived Behavioral Control* which refers to one's perceived ease or difficulty of performing the behavior (Orbell et al. 1997). Interestingly, Ajzen (1991) assumes

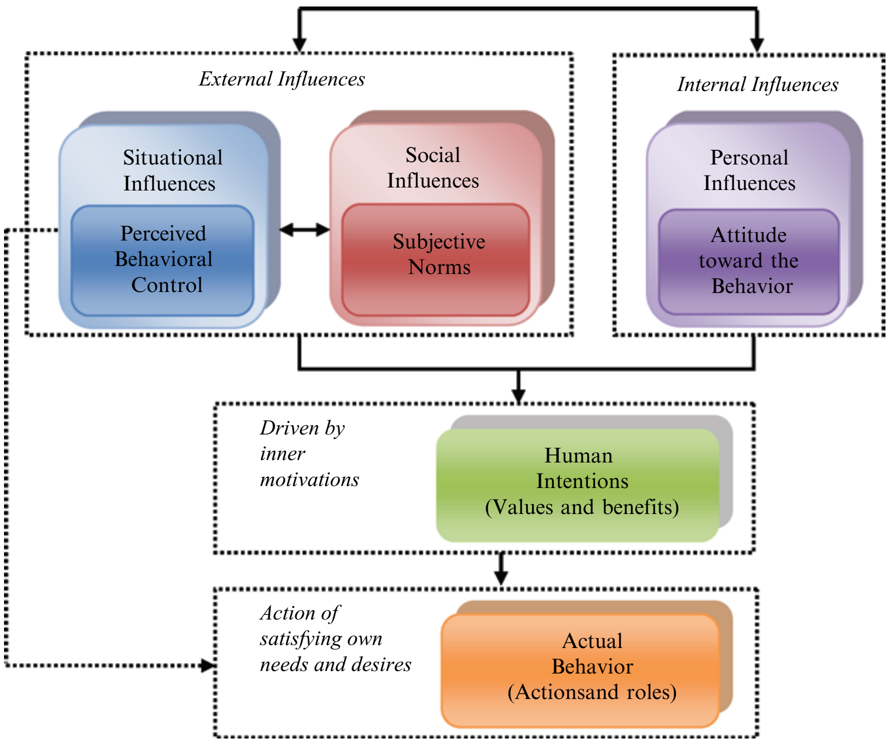

Fig. 12.1 Theory of planned behavior (compiled after Ajzen 1991)

that PBC reflects to some extent past experiences as well as other anticipated hurdles and obstacles (i.e., resources and opportunities available to a person) which might be internal or external.

The antecedent of PBC (ability) contributed by Azjen plays an important part in the TPB. The present view of it is most compatible with Bandura's (1977, 1982) concept of perceived self-efficacy, which is concerned with "judgments of how well one can execute courses of action required to deal with prospective situations" (Bandura 1982, p. 122).

These investigations and findings have strongly indicated that people's behavior is highly influenced by their actual confidence level in their ability to perform it (i.e., by their own PBC). The importance of *actual* behavioral control is self evident (Ajzen 1991); the facilitating resources and opportunities available to a person must to some extent dictate the likelihood of behavioral achievement. Due to the lack of evidence for the interactive effects of PBC on the intention–behavior relationship, Ajzen (1991) argued for a direct relationship between PBC and behavior which more closely fitted the available data. Thus, Ajzen argues that under conditions where behavioral intention alone would account for only small amounts of the variance in behavior (i.e., where there are problems of volitional control), PBC should be independently predictive of behavior.

Consequently, the measurement of PBC has attracted considerable attention in the TPB literature. Several researchers and practitioners (see Armitage and Conner 2001; Trafimow et al. 2002) have argued that PBC is a multidimensional construct comprising two conceptually distinct constructs: *Perceived Control* and *Self-Efficacy*.

Although PBC is about whether individuals' behavior is to be considered under their own voluntary control, self-efficacy refers to the perceived ease or difficulty of performing that behavior (Bandura 1986). However, Ajzen (2002) agreed that PBC consists of perceived control and self-efficacy; but, he rejected the idea that the two variables are independent from each other.

According to the model of the TPB, PBC, together with human intention, can directly predict the actual behavioral achievement that is the performance of behavior. Nonetheless, for accurate predictions, several conditions have to be met, first, the measures of intention and PBC must correspond to (Ajzen and Fishbein 1977), or be compatible with (Ajzen 1988), the behavior that is to be predicted. That is, intentions and perceptions of control must be assessed in relation to the particular behavior of interest, and the specified context must be the same as that in which the behavior is to occur. Therefore, when the situation affords a person complete control over his behavioral performance, intentions alone should be sufficient to predict behavior (Jackson et al. 2003).

12.2.2.2 Dimensions and Measurements of Theory of Planned Behavior

The TPB deals with the antecedents of the three main determinants of behavioral intentions: attitudes, subjective norms, and PBC, which determine intentions and eventually the achievement of direct actions. At the most basic level of explanation, the theory hypothesizes that human behavior is a function of "salient" information, or beliefs relevant to the behavior (Ajzen 1988). People can hold many beliefs about any given behavior, but they can attend to only a relatively small number at any given moment. It is these salient beliefs that form the knowledge to be considered as the prevailing determinants of a person's intentions and actions (see Fig. 12.2). Thus, according to the TPB, human actions are guided by three distinguishable considerations:

1. *Behavioral Beliefs* are the inner beliefs of an individual about the consequences of taking a certain action (Ajzen 1991). Those beliefs differ from an individual to another based on personal backgrounds such as traits, personality, characteristics, and mentality. It is assumed that the behavioral beliefs do influence attitudes towards the actual behavior.
2. *Normative Beliefs* are the individual perceptions about a particular behavior which are mostly influenced by the judgments and beliefs of significant others such as family members and friends. Those beliefs constitute the underlying determinants of subjective norms (Bamberg et al. 2003).

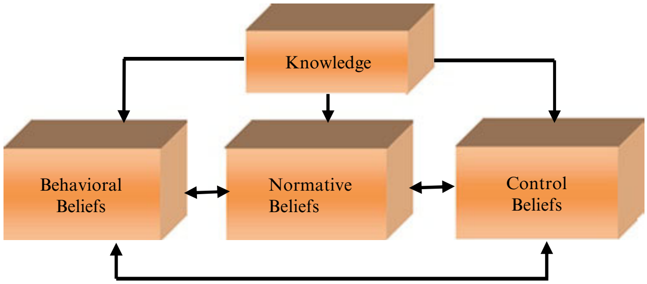

Fig. 12.2 Dimensions and measurements of TPB (Ajzen 1991)

3. *Control Beliefs* are individual's beliefs about the presence and/or absence of certain factors that would facilitate or impede the achievement of the behavior (Ajzen 1991, 2001). Those inner beliefs of being in control of your own actions provide the basis for perceptions of PBC which conceptually related to the self-efficacy concept originated by Bandura (1977).

12.3 Applications of Theory of Planned Behavior

Related-literature has embarked upon the TPB from multidisciplined points of view; ranging from psychology (see Casper 2007), sociology (see Kim and Karpova 2010), management (see Yi et al. 2006), marketing (see Kalafatis et al. 1999), biology (see Patterson 2001), computer science (see Siponen 2000), to IS (see Huang and Chuang 2007) disciplines.

So far, TPB has more than 1,200 research bibliographies in academic databases. In particular, recently, several studies also found that the TPB would better help to predict health-related behavioral intention (Ajzen 1988) given that TPB has improved the predictability of intention in various health-related fields such as leisure (e.g., Ajzen and Driver 1992), exercise (e.g., Nguyen et al. 1997), and diet (e.g., Conner et al. 2003). That is why the health and nutrition fields have been using this model often in their research studies as well.

12.3.1 Applications of Theory of Planned Behavior Within the IS

The TPB is heavily utilized and applied within the discipline of IS. The TPB along with its extensions and modifications with other intention-based theories is used to study, explain, and predict decisions of acceptance, adoption, use, and continuance of use of technology systems and other digital services (see Table 12.1). Applications of the TPB are wide and covering many research areas such as online grocery buying (Hansen et al. 2004); expert decision support system use (Workman 2005); electronic service acceptance (Hsu and Chiu 2004a, b); information technology (IT)

Table 12.1 Applications of TPB in IS

#	Study	Area	Purpose	Modifications to TPB	Main results
1.	Mathieson (1991)	IS usage	Predict user intentions	Comparing TAM with TPB	1. Both TAM and TPB predicted intention to use IS quite well 2. TAM is easier to apply but only supplies general information on users' opinions about a system 3. TPB provides more specific information that can better guide development
2.	Taylor and Todd (1995a, b)	IT usage	Understand IT usage	A comparison of the TRA and the TPB	1. The decomposed TPB provides a fuller understanding of behavioural intentions by focusing on the factors that are likely to influence systems use
3.	Liao et al. (1999)	Virtual banking	Study the adoption intention of virtual banking	TPB and DOI theories	1. Attitude towards virtual banking was dependent on relative advantage, compatibility, ease of use, result demonstrability, and perceived risk 2. Subjective norms about virtual banking were dependent on image, visibility and critical mass 3. PBC about virtual banking was dependent on voluntariness, support and organizational learning 4. Intention to use virtual banking was determined by attitude, subjective norms and PBC
4.	Venkatesh et al. (2000)	Technology adoption	Investigate gender differences in individual technology adoption decision-making processes	TPB	1. Men's decisions of using the technology were more strongly influenced by their attitudes 2. Women were more strongly influenced by subjective norms and PBC 3. Sustained technology usage behaviour was driven by early usage behaviour

5.	Bobbitt and Dabholkar (2001)	Technology based self-service	Understand and predict use of technology-based self-service	Integration of TRA, TPB, Influence of category-based affect, theory of trying, and other external influences	1. Keep marketers aware of what affects consumers' attitudes and behaviours in relation to technology-based self-service 2. Benefiting the marketers by determining the perceived risks associated with a particular technology-based self-service 3. Make marketers consider how the amount and type of information available through a technology-based self-service option can affect consumer intentions 4. Help marketers locate potential situational factors of control that may influence the use of technology-based self-service 5. Marketers need to ensure that consumers do not become frustrated in attempting to use their technology-based self-service
6.	Chau and Hu (2002)	Telemedicine technology	Investigate healthcare professionals' decisions to accept telemedicine technology	Integration of TAM and TPB	1. In healthcare, professionals place more emphasis on usefulness of technology rather than ease of use 2. Professionals in the healthcare seem to be more independent when taking their decisions and seldom influenced by others
7.	Lwin and Williams (2003)	Fabrication of information online	Investigate the antecedents behind online consumers' attempt to disguise their identities through fabrication	Integrating the theory of privacy and the TPB	1. Attitudes, PBC, and perceived moral obligation are significant drivers of fabrication, while subjective norms are not 2. Anonymity likely contributed to the intention to fabricate information

(continued)

Table 12.1 (continued)

#	Study	Area	Purpose	Modifications to TPB	Main results
8.	Lim (2003)	Adoption of negotiation support systems (NSS)	Identify factors affecting the intention to adopt negotiation support systems by managers and executives	Integrating TPB and TAM	1. Subjective norms and PBC emerged as strongest determinants of intention to adopt NSS 2. Probing of subjective norm revealed organizational culture and industrial characteristics to play significant roles
9.	Riemenschneider et al. (2003)	IT adoption decisions in small businesses	Understand IT adoption decisions of small business executives regarding a Web site	A collected model of TAM and TPB with the underlying categories of cognitions	Improved social contact with customers and vendors facilitated by the Internet is the driving force behind Web site adoption
10.	Leonard et al. (2004)	IT ethical behaviour intentions	Investigate what influences IT ethical behaviour intentions	TRA, TPB and other ethical decision making models	1. Perceived importance and age as new variables have a significant impact on the intent to behave ethically/unethically 2. For all taken scenarios, attitudes and personal normative beliefs were significant indicators of intention to behave ethically/unethically

11.	Hsu and Chiu (2004a, b)	WWW	Internet self-efficacy and electronic service acceptance	An extended model of the TPB	1. General internet self-efficacy and Web specific self-efficacy are found to play important roles in shaping individual behaviour 2. General Internet self-efficacy had a significant influence on attitude toward the e-service usage 3. General Internet self-efficacy contributed to the shape of an individual's Web specific self-efficacy 4. Web specific self-efficacy had a significant direct effect on e-service usage 5. Attitude toward the e-service usage was the major determinant of behavioural intention 6. Interpersonal norm and subjective norm did not have a direct effect on behavioural intention
12.	Hansen et al. (2004)	WWW	Predict online grocer buying intention	A comparison between the TRA and the TPB	The TPB with the inclusion of a path from subjective norm to attitude provides the best fit to the data and explains the highest proportion of variation in online grocery buying intention
13.	Celuch et al. (2004)	WWW	Understand insurance sales person Internet information management intentions	A comparison of the TRA and the TPB	1. The TRA fails to account for the important role of self-efficacy in predicting information management intentions in both the customer and company related settings 2. Perceived control was not found to have impact in the customer model and had minor impact in the company model

(continued)

Table 12.1 (continued)

#	Study	Area	Purpose	Modifications to TPB	Main results
14.	George (2004)	WWW	Investigate the relationships among beliefs about Internet privacy and trustworthiness, along with beliefs about perceived behavioural control and the expectations of important others, and online purchasing behaviour	TPB	1. Beliefs about trustworthiness positively affect attitudes toward buying online, which in turn positively affect purchasing behaviour 2. Beliefs about self-efficacy regarding purchasing positively affect perceived behavioural control, which in turn affects online purchasing behaviour
15.	Shih and Fang (2004)	WWW	Study Internet banking in Taiwan	Decomposed TPB (comparing the TRA and pure TPB to a decomposed TPB)	1. Intention to adopt Internet banking can be explained by attitude in both models. However, in the decomposed TPB model, only relative advantage and complexity are related to attitude, while compatibility is not 2. The path from subjective norm to intentions failed to achieve significance. People who are important to users of the do not influence their intention to adopt internet banking. The possible factors of influence could be other network characteristics, such as information quality and security 3. Self-efficacy is a significant determinant of PBC

16.	Workman (2005)	Technology use, disuse, and misuse	Investigate the use, disuse, and misuse of an expert decision support (EDSS) technology	TPB	1. EDSS use was negatively related to errors 2. Misuse of EDSS was positively related to errors. 3. Positive attitudes and social influences led to increased EDSS use while perceptions of control had no effect 4. The interaction of social influences and attitudes had a significant nonlinear relationship with EDSS misuse
17.	Pavlou and Fygenson (2006)	eCommerce	Understand and predict eCommerce adoption	Extension of the TPB	1. Importance of trust and technology adoption variables (perceived usefulness and ease of use) as salient beliefs for predicting ecommerce adoption, justifying the integration of trust and technology adoption variables within the TPB framework 2. In addition, technological characteristics (download delay, Website navigability, and information protection), consumer skills, time and monetary resources, and product characteristics (product diagnosticity and product value)
18.	Truong (2009)	WWW	Predict user acceptance of online video services	TPB	1. TPB model was viable in predicting user acceptance of online video services 2. Perceived behavioural control was the highest contributor to predicting intention to use online video services 3. Attitude toward use and subjective norm were found to have moderate predictive power

ethical behavior (Leonard et al. 2004); IT adoption (Liao et al. 1999; Venkatesh et al. 2000; Riemenschneider et al. 2003; Lim 2003; Brown and Venkatesh 2005); IT acceptance (Chau and Hu 2001, 2002; Venkatesh et al. 2003); fabrication of information online (Lwin and Williams 2003); and IT use (Mathieson 1991; Bobbitt and Dabholkar 2001).

In IS, the TPB has been integrated with other competing models such as technology acceptance model (TAM), expectancy disconfirmation theory (EDT), diffusion of innovation (DOI) theory in a decomposed structure by combining constructs. That proved to help in providing a fuller understanding of IT acceptance, adoption, use, and continuance of use. For example, Chau and Hu (2002) have integrated TAM and TPB into a model that investigates healthcare professionals' decisions to accept telemedicine technology. The integrated model proposes that perceived usefulness and ease of use of the technology have a significant effect on the attitude towards the decision of accepting the technology.

On the other hand, in a study by Liao et al. (1999), the adoption of virtual banking in an international city has been studied through combining the TPB with the DOI theory. They propose that attitude towards the use of virtual banking is dependent upon the beliefs of relative advantage, ease of use, compatibility, results demonstrability and perceived risk. Subjective norms about the use of virtual banking are dependent upon normative beliefs of image, visibility, and critical mass. Perceived behavioral control about the use of virtual banking is dependent upon control beliefs of voluntariness, trialability, support, and learning.

Bosnjak et al. (2005) have extended the TPB in their study to predict and explain the number of participations in a Web-based panel survey. They applied the pure model of the TPB with the addition of a fourth construct (i.e., moral obligation) to the original model. This extension is traced back to the evidence that people are willing to participate in an Internet-based survey to the extent to which they feel morally obliged. Moral obligation has been suggested by researchers to be added to the TRA and the TPB.

As the TPB revolves around explaining human intentions towards a certain behavior, applying its original model without any modifications or decomposition into studying IT acceptance, adoption, use, and continuance of use is not sufficient. Therefore, these general and specific modifications have resulted in a better understanding of the human–IT interaction phenomena. Collected models of these integrative approaches have proved to be powerful and indicated a satisfactory predictive and explanative power (Taylor and Todd 1995a; Lwin and Williams 2003; Bosnjak et al. 2005; Brown and Venkatesh 2005).

12.4 A Proposed Example of TPB Application in IS

Research in IS has noticeably employed intention-based models and theories which use behavioral aspects to identify the influences of human intentions on the adoption and usage (i.e., post-adoption) of various innovations and technologies.

Online Communities (OCs) and their supporting technologies are by no exception one of the largest fields studied nowadays. For example, a wide range of theories has been utilized in this context. Researchers have adopted the TRA (e.g., Hsu and Lin 2008), social capital and social cognitive theories (Chiu et al. 2006; Hsu et al. 2007), a "uses and gratifications" approach (e.g., Nambisan and Baron 2007), as well as an instrumental perspective (e.g., Leimeister et al. 2004) to understand drivers behind participation in these communities and their eventual success. However, despite the significance of the aforementioned theories, no one is considered the most appropriate and sufficient.

In our research (see Al-Lozi and Papazafeiropoulou 2010), we study OCs and more specifically the continuous participation in these communities. Thus, our focus revolves around why users would continue participating in OCs. As such communities have become the lifeblood stream of the Internet nowadays; they are the home space of social networking and interacting, and most importantly, are the values and benefits being created and exchanged as a result of this Web-based interaction. However, these communities cannot succeed and sustain without committed members, where continuous participation takes place. Therefore, studying the behavior of continuous participation is appealing for a healthy operation of such communities. As users join in, they intend to gain certain personal desire and need, and thus play and act upon a specific behavioral role to achieve that.

However, this cannot be done without studying human intentions and what influences would affect their attitudes and overall behaviors over a period of time. Therefore, our research aims at investigating the drivers behind users' continuous participation in OCs. This is significant as many personal, social, and situational determinants would affect their attitudes towards using these communities, change their intentions, and upon that, determine their behavioral role in the community. In our research, we propose a theoretical framework predominantly grounded on the TPB to examine the social-related influences of users' post-adoption actual behaviors.

Notwithstanding the high level of utilization in the literature related to OCs, the TAM (Davis 1989) and DOI (Rogers 1983) theories have been also excluded from our research. This is because these two theories have been developed to measure and delineate the impact of different *technology-related aspects* on the *adoption and acceptance* of innovations and new technologies. This however contradicts the aim of our research in twofolds: (1) we are concerned with social aspects and characteristics, not the technology-related aspects; (2) we are concerned with post-adoption usage (i.e. participation), and not the adoption decision itself of the OCs.

A common theme underlying many of these investigations, however, is to better understand the nature and role of the social and technological influences affecting people and their intentional behavior (Dholakia et al. 2004). TAM, for example, focuses on explaining the attitude behind the intention to accept and adopt – *which is the behavior itself* – a specific technology or service (Shih and Fang 2004). In fact, it is an adaptation of the TRA from psychology specifically tailored to model user acceptance of IT.

TAM has been widely applied in acceptance behavior across a broad range of IT (Lin and Lu 2000; Wu and Wang 2005). However, it places more emphasis on the role of technology in affecting users' intentions towards their behavior. TAM is primarily built on the TRA, expectancy theory (see Vroom 1964; Robey 1979); and efficacy theory (see Bandura 1977). It theorizes that one's behavioral intentions are determined by two specific belief constructs (perceived usefulness, and perceived ease of use of the system). However, as mentioned earlier, the TAM and DOI theories tend to examine factors related to the technology itself, and tend to investigate the behavior of IT adoption and usage as theories derived from the IS field. Therefore, comprehending human behavior without any limitations to a certain field or area of interest, the sociological concentration of the TPB explains it all.

Having recognized that, the TPB is deemed highly appropriate for our research in studying users' participation in OCs as it best fits the purpose of studying the *social aspects* preceding human intentions of whether and how to continue using the system, or not. Therefore, achieving our current research objectives and goals can be best done with the application of the TPB for the advantages it has over the other competing models since (1) it is capable of supplying more useful information to explain behavior in a social-related context (Mathieson 1991); (2) it provides good prediction while using few predictors, and (3) it offers a complete understanding of the phenomena as it includes variables with very different conceptual scope (Taylor and Todd 1995a, b).

Although some researchers pointed out that a weakness of the TPB is its lack of explanatory power of testing different contexts of IS (e.g., Hartwick and Barki 1994; Karahanna et al. 1999), it has been highly claimed that because the original constructs of the TPB model do not fully reflect every context, therefore, it has been preferable to extend it and decompose its key constructs to predict intentions and behavior in various contexts and situations. Speaking of which, there has been massive efforts in decomposing the constructs of the TPB along with the two previously mentioned theories to study different contexts within the field of IS (see e.g., Tan and Teo 2000; Hsu and Chiu 2004a, b; Hong et al. 2008). This decomposed background reflects the social side as well as the technological related aspects influencing human behavior.

12.5 Conclusions

The TPB has proven to be a successful model in a wide range of behavioral disciplines to empirically predict, understand, and explain human behavior in a variety of situations. Although it has some recognized limitations and has been criticized heavily over the years, it is still extensively applied.

While behavior is almost always motivated, it is also almost always biologically, culturally, and situationally determined. Members are driven to act by their own desires, and this desire is limited by each one's attitudes, beliefs, plans, values, goals, and interests, and most importantly individuals will act on how well they perceive their own environment. As a result their motivations lead to the conscious decision of acting and behaving in a certain way.

The TPB is a powerful model in predicting and understanding the motivational influences on behavior that is not under the individual's volitional control. It helps in identifying how and where to target strategies for changing behavior, and most importantly, explaining any human behavior. The TPB strikes the important control variables for each situation independently, and more likely to capture such situation-specific factors surrounding each and every individual. So, the summary proposition of the TPB is that members would intend to perform behavior when they evaluate it positively and perceive it to be under their own control.

From an IS *practical* perspective, it is a unique model that provides insights on the societal, organizational, and individual levels for:

- *Decision and Policy Makers* in building strategic plans for a sustainable technology, and according to that, policies and regulations might need re-engineering for the sake of supporting users of these technologies.
- *Service Providers* in knowing what factors to examine, whom to support, and whom to watch; it eases up their ability of recognizing which parts of the technology provided they need to balance and to focus on for re-enhancement purposes.
- *Users* where they can exactly know how each person's own attitudinal characteristics, normative and social beliefs and influences, and the situational factors accompanied by everyone can influence and affect their decisional intentions to behave in a certain way.
- *Developers*, it inspires them in knowing and meeting the exact needs of users according to their different behavioral beliefs, taking into consideration the personal, societal, and situational differences affecting their intentions and actual behaviors. But as individuals' needs and desires change, developers require re-designing the tools, features, mechanisms, and technologies of the systems. They have to identify carefully human behavior and know what kind of intentional desires are needed, and thus add the right technology components that will better support the technology, in a way a sustainable IS life cycle prescribes.

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Chapter 13
Understanding IS Theory: An Interpretation of Key IS Theoretical Frameworks Using Social Cognitive Theory

Kevin Carillo

Abstract Past research studies have introduced a multitude of theoretical models and constructs when investigating individual behavior. We have now reached a point where the IS discipline requires cohesive guidance to make sense of such a large number of theoretical considerations, as well as to assist in identifying theories that have the potential to shed new light on the complex interaction of technology and behavior. The aim of the present chapter is to use Social Cognitive Theory (SCT) as a meta-level framework to organize the theoretical models and constructs used in the IS literature, so as to provide a clear and integrated depiction of the state of our theoretical knowledge. First, a thorough review of the IS literature which used SCT was performed. Second, the major behavioral theoretical models used in IS research were also reviewed. This literature is mapped into the SCT framework, thus highlighting the main successes but also pitfalls of past research. Future research directions are then identified and discussed.

Keywords Social cognitive theory • Individual behavior • Literature review • IS theoretical models

Abbreviations

DOI	Diffusion of innovations
ERP	Enterprise resource planning
ESS	Executive support system

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IS	Information systems
PCI	Perceived characteristics of innovations
SCT	Social cognitive theory
TAM	Technology acceptance model
TPB	Theory of planned behavior
TRA	Theory of reasoned action
TTF	Task-technology fit
UTAUT	Unified theory of acceptance and use of technology

13.1 Introduction

Since the mid-1970s, the study of the factors leading to the adoption and use of information technology (IT) has been prominent in MIS research. This line of research emerged when both organizations and researchers started realizing that in spite of the immense promises of IT, the level of adoption of IT consistently failed to match the level of users' expectations. Lucas (1975) was among the first IS researchers to investigate the influence of individual behavioral factors on IT adoption. One of the first theories applied to the examination of IT adoption was the Theory of Reasoned Action (TRA) (Fishbein and Ajzen 1975). TRA posits that a person's behavioral intention depends on the person's attitude about the behavior, and on subjective norms. This theory gave birth to one of the most important IS-grounded theories: the Technology Acceptance Model (TAM) (Davis 1989; Davis and Bostrom 1993). The Diffusion of Innovations (DOI) theory (Rogers 1995) also provided successful insights by providing a complementary view of IT adoption and use (Compeau and Meister 1997; Moore and Benbasat 1991).

Drawn from social psychology, Social Cognitive Theory (SCT) (Bandura 1986) has been both promising and insightful in IS research. Focusing on individual learning, SCT relies mainly on the assumption that all individual behavior, cognition, and other personal factors, and environmental influences operate as interacting determinants and influence each other bidirectionally. IS academics started using SCT in the early 1990s when realizing the relevance of the concept of self-efficacy (a central notion in SCT) in understanding the use and adoption of IT. Ever since, SCT has been widely used in IS in the context of computer/software training and use (Agarwal et al. 2000; Compeau and Higgins 1995) but also general Internet use (Hsu et al. 2004; Pearson and Pearson 2008), electronic-commerce-related issues (Hernandez and Mazzon 2007; Klopping and McKinney 2006), and e-learning (Hayashi et al. 2004).

In spite of the promises that were claimed by IS researchers during the introduction of SCT in IS, the interest into the theory seems to have progressively faded within the IS community. The importance and success of the notion of self-efficacy in IS studies have progressively reduced the consideration of the main scope and important concepts leading to the loss of the realization of the full potential of the theory in the IS discipline. I believe that SCT can greatly contribute to IS research at two different levels of analysis. First, SCT emphasizes the role of self-regulation mechanisms by giving a central role to both the beliefs of personal efficacy and the expectations toward certain outcomes. The theory also integrates motivational and emotional factors and both social and situational characteristics in the understanding of individual behavior. The predictive power of the SCT constructs has been widely accepted in various disciplines, providing insights to IS researchers about the use of such constructs when investigating the interaction of individuals with technology. Second, by proposing a high-level understanding of human agency when considering individuals as parts of an inseparable triadic structure, SCT allows viewing human functioning from a more encompassing perspective. In other words, SCT can be seen as a meta-level framework in which other theories (which focus on individual behavior) can be mapped according to the subset of SCT components they concentrate on. Such an approach enables one to highlight unexplored areas of research at the theory level of analysis, encouraging IS researchers to consider new theoretical perspectives to gain a more encompassing view of individual behavior.

The objective of this chapter is to use SCT as a reference theoretical perspective in order to stimulate an introspection within the IS discipline. Since the mid-1970s, a multitude of theoretical frameworks have been used in IS research and provided a vast array of successful results, but there seems to have been a lack of guidance and cohesion in the choice of the theories to be used. It is believed that such guidance can solely be provided through the acceptance of a commonly accepted meta-level framework which will help future research in pointing toward the unexplored areas that remain. To achieve such a high-level goal, the research strategy adopted in this research project relied on a two-level approach.

Since SCT as a theoretical framework has already been successfully used in IS research, a thorough review of the literature was performed in order to gain an overall understanding of the findings provided by SCT in IS research. Such a procedure addresses the first level of analysis stated previously, in proposing various explanatory factors to examine individual behavior. The reviewed articles were then mapped into the SCT framework allowing one to summarize past results but also to investigate whether past studies effectively integrated the over-encompassing assumptions of SCT or else a subset of it. The proposed results drew insights from a previous study of the author (Carillo 2010).

The most used IS theoretical models were then reviewed and mapped into the SCT framework, identifying the areas of research that have been explored but also shedding some new light on areas that deserve further research efforts. The chapter concludes by arguing that SCT has an as-yet-unrevealed but promising potential in IS research.

The remainder of this paper is organized as follows. The first section introduces SCT in social psychology and IS research. The research method is described next and is followed by our analyses. The chapter concludes with the delineation of the state of our knowledge by highlighting key aspects in the identification of future research directions and guidance in IS research. The main findings and issues that are raised are then summarized in a table in which a list of potential research avenues is proposed.

13.2 Social Cognitive Theory: An Overview

Human psycho-social functioning has been interpreted and explained in many theories in both psychology and social psychology. Based on different views of human nature and different perspectives toward the determinants of human action and motivation, most theories have adopted a unidirectional view of human behavior in which individual dispositions or else environmental and social influences shape behavior (Wood and Bandura 1989).

SCT adopts a human agency perspective toward human development, adaptation, and change (Bandura 2006, p. 164). Human agency relies on four core properties that make people "human." First, *intentionality* refers to the aspect that people form intentions toward certain behaviors that include action plans and strategies to achieve them. Second, *forethought* indicates that people set goals and have the capability to project themselves and perceive future outcomes which guide their current motivation and efforts. Third, *self-reactiveness* relates to the capability that people have to self-regulate themselves by continuously constructing and adapting courses of action. Finally, *self-reflectiveness* refers to the fact that people act as self-examiners of their own functioning and actions (Bandura 2006). These four key essential characteristics stand as the foundations of SCT.

Opposing the limited one-sided determinism of other theories, SCT proposes a "triadic reciprocal determinism" view (Bandura 1986; see Fig. 13.1). This shows that individual cognitive and emotional characteristics, social and environmental factors, and behavior mutually influence each other (Bandura 1978, 1982, 1986). The bidirectional determinism between individual and environmental factors can be summarized by acknowledging that individuals choose the environment in which they evolve, but they also shape their surrounding environment. Similarly, cognitive beliefs and behavior mutually influence each other. How people interpret the outcomes of their performance of a given task influences their self-beliefs which in turn affect their future performance (Pajares 1996).

SCT has been widely accepted and empirically validated in various fields of research such as therapeutic research (Bandura 1997; Langlois et al. 1999), mass

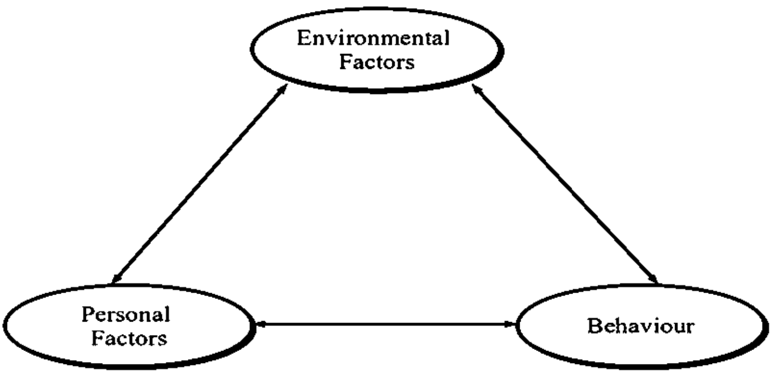


Fig. 13.1 Triadic causal nature of human functioning

media (Bandura 2001; Cantor 1994), public health (Bandura 1998; Holden 1991), and education (Dai et al. 1998; Zimmerman 1989). In SCT, "environment" refers to either the social or physical factors that can affect a person's behavior. Environmental factors are thus seen as the factors that are physically external to the person and that provide opportunities and social support such as social pressure or situational characteristics (Compeau and Higgins 1995).

Personal factors are any cognitive, motivational, emotional, personality, or demographic aspects characterizing an individual. SCT emphasizes the importance of two closely interrelated cognitive factors that play an essential role in self-regulation mechanisms: self-efficacy and outcome expectations. Self-efficacy is defined by Bandura (1986) as "*People's judgment of their capabilities to organize and execute courses of action required to attain designated types of performances. It is concerned not with the skills one has but with judgments of what one can do with whatever skills one possesses.* (p. 391)." Outcome expectations refer to the extent to which an individual will undertake a certain behavior only if he/she perceives that it will lead to some valued outcomes or else favorable consequences (Compeau and Higgins 1995). The interrelation between perceptions of efficacy and outcome expectations stated in SCT highlights the fact that both notions must be analyzed jointly together when studying human behavior due to the synergistic nature of the two concepts (Williams and Bond 2002). The probability for an individual to perform a certain behavior is diminished to a great extent if the outcomes associated with the behavior are not valued or desired even with a high level of self-efficacy. Similarly, people may be strongly convinced and attracted by certain outcomes in relation to a given behavior, but are unlikely to perform the behavior in case they lack the confidence in their own abilities to attain the required performance level (Wise 2002).

SCT considers that self-beliefs are developed through the influence of four main components:

1. *Enactive mastery*: an individual's belief about his/her capability to perform a certain action is influenced by the outcome of past experiences. In other words, past successes condition beliefs about future successes.
2. *Social modeling*: observing people similar to you experiencing successes gives you the belief that you too can be successful.
3. *Social persuasion*: if people surrounding an individual persuade him or her that he/she has the skills and capabilities to master a certain behavior, then the belief about his/her own capability will be influenced positively.
4. *Physical and emotional states* (such as mood, stress, anxiety, fatigue): negative states can be perceived by an individual as indicators of his/her inefficiency to perform a certain behavior.

13.2.1 Social Cognitive Theory in IS Research

The TAM (Davis 1989), Theory of Planned Behavior (TPB) (Fishbein and Ajzen 1975), and DOI (Rogers 1995) have been particularly insightful in IS research. In such theories, behavior is viewed as a set of beliefs about technology, and a set of affective responses (typically measured in terms of attitude toward using) to the behavior (Compeau et al. 1999). Nonetheless, while TAM and DOI focus solely on beliefs about the technology, TPB and SCT integrate the notion of perceived outcomes when forecasting behavior. Indeed, both theories posit that the use of a certain technology is directly influenced by the perception that it will allow the individual to achieve positive outcomes. For instance, a person's motivation might be increased if he/she perceives that learning to use a certain system will lead to a higher level of performance for his/her job. The consideration of individuals' environment as playing an important role is another common concept in both theories. A key aspect differentiates SCT from TAM, DOI, and TPB. The last three theories adopt a unidirectional perspective toward causal relationship, in which environmental factors influence cognitive beliefs, which influence attitudes and behaviors. On the contrary, SCT embodies bidirectional causation in which behavior, cognitive and emotional factors, and environment constantly and mutually influence each other. For instance, an individual's self-efficacy toward using a certain software system is influenced by prior successful experiences and performance with the software. In such a case, self-efficacy is seen as an effect whereas behavior acts as a cause. Such an implication creates a vast and original research avenue in which behavior plays the role of a predictor having an influence on either cognitive and emotional factors or else an individual's environment.

When computers started becoming more common in the workplace, SCT was found to be particularly insightful in understanding individual behavior in computer training (Bolt et al. 2001; Compeau and Higgins 1995; Compeau et al. 1999; Hasan and Ali 2006; Yi and Davis 2003). Two key personal-level factors of SCT have been largely investigated: self-efficacy, and outcome expectations. The latter concept has been widely explored by IS researchers through the concept of perceived usefulness which was defined and measured by Davis (1989). Further comments about the matching of the two concepts will be found in the discussion section.

Compeau and Higgins (1995) and Compeau et al. (1999) were acknowledged to be among the pioneers in IS research to first integrate the SCT framework by using a social psychology perspective in investigating computer training success. Focusing on knowledge workers, they first validated a measure of computer self-efficacy. Second, they found that computer efficacy plays a significant role in influencing individuals' expectations of computer use expectations, individuals' emotional reactions, as well as computer use itself. Both computer self-efficacy and individuals' expectations toward outcome were found to be positively influenced by encouragement of others and others' use confirming the need to integrate social and environmental factors in the understanding of individual behavior. Computer self-efficacy was overall found to significantly influence an individual's decision to use a computer. Later, the authors used a similar model on a sample of 394 end users to predict computer use. The study confirmed that both self-efficacy and outcome expectations impact on an individual's affective and behavioral reactions to IT (Compeau et al. 1999).

With the advent of the Internet, which led to the adoption and use of web-based technologies as well as B2C electronic commerce practices, SCT appeared as an alternative perspective in which the emphasis is on the learning nature of individual behavior. Such learning processes are acquired by an individual in which his/her behavior, cognitive and emotional characteristics, and environment are interrelated, mutually influencing each other (Amin 2007; Chang and Lu 2004).

13.3 Research Method and Data Analysis

A twofold research methodology was adopted for the study. First, to address the construct-level analysis of past SCT papers in IS research, a keyword search was performed using the two most commonly used online databases of academic journals to identify the articles which had used SCT in IS research. Furthermore, it was found during the initial stage that online education journals had provided relevant and quality contributions to IS research by using SCT when investigating the spread of computers in educational institutions and the training it involved. It was decided to include in the review process the articles from top online education journals which were judged to have used an IS research angle in exploring a given IS-related issue through SCT.

Several rules were designed to provide a clear-cut condition to select articles to be integrated into the review. First, articles from IS journals were selected when at least one construct of the SCT framework was integrated in the theoretical model, and when the use of SCT was clearly referred. Second, articles from business academic journals were also selected in which an IS approach was used, focusing on the adoption or use of a certain technology and drawing insights from SCT. Finally, articles from online education peer-reviewed journals were eventually chosen in which researchers use an "IS research approach" and investigated individual behavior toward using a certain technology using SCT. It is important to highlight that only empirical papers were selected, and which adopted an individual level of analysis. The process resulted in a total of 62 empirical papers (see Table 13.1 for the list of the journals in which articles were found and selected, and appendices for more details). The first step in data analysis consisted of identifying the variables taken into account in each study. The variables were then mapped into the SCT framework.

A different approach was followed in order to perform the review of the main theoretical models used in IS research when studying individual behavior. In order to define objective criteria to select the IS theories to be reviewed and mapped into the SCT framework, it was decided to review the IS literature to search for relevant research articles that had scanned through the major IS journals and conferences and identified the most commonly accepted and used theories in IS research. Six such studies were found (Chin and Marcolin 2001; Halawi and McCarthy 2006; Jeyaraj et al. 2006; Liang and Chen 2003; Liu et al. 2008; Williams et al. 2009). From the theories provided by the six sets, were selected only the theories which

Table 13.1 Number of articles selected from peer-reviewed journals

Peer-reviewed journals	No. of articles
Journal of Information Systems Education	6
Journal of Organizational & End User Computing	6
MIS Quarterly	6
The Journal of Computer Information Systems	6
Information Resource Management Journal	4
Decision Sciences	3
European Journal of Information Systems	3
Industrial Management & Data Systems	3
Information Systems Research	3
Journal of End User Computing	3
International Journal of Service Industry Management	2
Internet Research	2
Journal of Global Information Management	2
Journal of Internet Banking & Commerce	2
Academy of Information & Management Sciences Journal	1
British Journal of Educational Technology	1
Information Technology, Learning, & Performance Journal	1
International Journal of Bank Marketing	1
Journal of American Academy of Business	1
Journal of Electronic Commerce Research	1
Journal of Enterprise Information Management	1
Journal of Management Development	1
Management Research News	1
Online Information Review	1
Southern Business Review	1
TOTAL	62

Table 13.2 Theoretical models included in the review

Theoretical model	Authors
Diffusion of innovations theory (DOI)	Rogers (1983, 1995)
Expectation–confirmation theory of IS continuance	Bhattacherjee (2001)
IS success model	DeLone and McLean (1992)
Updated IS success model	DeLone and McLean (2003)
PC utilization model	Thompson et al. (1991)
Perceived characteristics of innovations (PCI)	Moore and Benbasat (1991)
Task-technology fit (TTF)	Goodhue (1995)
Technology acceptance model (TAM)	Davis (1989)
Technology acceptance model II (TAM2)	Venkatesh and Davis (2000)
Theory of planned behavior (TPB)	Ajzen (1991)
Theory of reasoned action (TRA)	Fishbein and Ajzen (1975)
Unified theory of acceptance and use of technology (UTAUT)	Venkatesh et al. (2003)

address individual behavior (in accordance with the focus of SCT). The procedure allowed one to identify 12 theoretical models to be included. The final stage of the research method involved the review of the reference articles which introduced the theories in IS research and the mapping of their theoretical constructs into the SCT framework. The selected theoretical models are summarized in Table 13.2.

13.4 Results

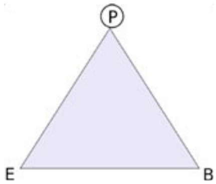
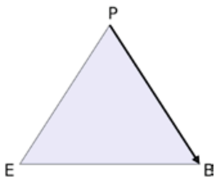
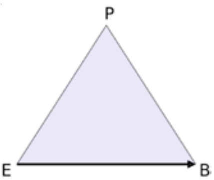
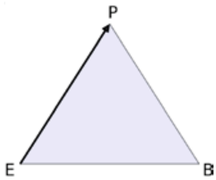
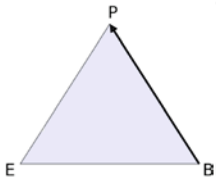
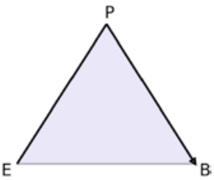
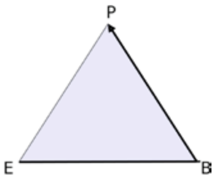
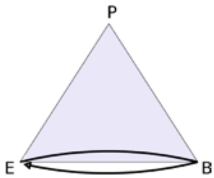
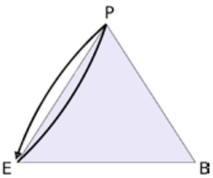
The outcomes of the bi-dimensional analysis of both SCT articles and IS theoretical models highlighted the following results.

13.4.1 Construct-Level Results

The detailed results of the article review can be found in Appendix A. Out of 62 articles, 17 addressed computer use and/or training, 20 were related to software training and/or use (either adopting a general software approach, or else a specific type of application such as ERP, ESS, etc.). Finally, 26 articles used SCT in the context of Internet-based applications or services. Seven types of interaction were found to have been investigated (see Table 13.3). It is important to note that some studies were found to adopt a direct effect approach in which, for instance, personal factors directly influence individual behavior (Gong et al. 2004; Guriting and Ndubisi 2006; Hasan and Ali 2006; for instance). Such studies were classified into the P–B category (personal factors–behavioral factors). Other studies considered mediating effects in which, for instance, environmental factors influence personal factors, which in turn influence behavior. Such studies were classified in the E–P–B category (environment–personal–behavior). Some of the articles were found to address multiple categories, such as P–B and E–P–B, for instance, in which some personal factors were modeled as having a direct effect on behavior whereas others are mediators between environmental factors and behavior.

In terms of dependent variable, it was found that behavior intention was the most represented by far (24 studies) followed by use (11 studies), task performance (ten studies), continuance intention (seven studies), task effectiveness (two studies), and adoption (one study). Out of 62 articles, 51 explored the personal factors–behavior relationship from which 30 did not include any environmental/situational factors which is in direct contradiction with the core assumptions of SCT. Such findings revealed that only 20 articles from the selected 62 (that is to say nearly one-third) considered personal factors, behavior, and environment all together, respecting the triadic nature of learning processes stated by SCT. From the remaining 11 articles which did not focus on the personal factors–behavior interaction, six studies investigated the relationship among various emotional and cognitive individual

Table 13.3 Investigated SCT interactions in reviewed articles and IS models

			
No. of articles	5	51	8
No. of IS models	0	10	10
			
No. of articles	16	1	13
No. of IS models	2	0	4
			
No. of articles	1	0	0
No. of IS models	0	2	2

factors (self-efficacy, outcome expectations, and more), four studied solely the environment–personal factors relationship, (excluding the behavioral dimension of SCT). The remaining study encompassed both the environment–behavior and environment–personal factors links. It was also astounding to find that in spite of the importance of emotional characteristics during learning processes posited in SCT, only 11 studies integrated such individual considerations (nearly 18% of the selected papers), highlighting a clear lack in IS research.

All the reviewed papers included the self-efficacy construct in their research model but 20 of them did not include the concept of outcome expectations, even though SCT strongly posits the synergistic nature of both constructs in their interaction to an individual's environment and behavior (Wood and Bandura 1989) due to their mutual influence during self-regulating mechanisms. Various research projects manifested some overlapping between the constructs of the TAM (Davis 1989): perceived ease of use and perceived usefulness to the SCT constructs of self-efficacy and outcome expectations. The literature review highlighted the fact that some researchers noted the difference between perceived ease of use and self-efficacy. Indeed, from the 27 studies out of the 62 which integrated both TAM and SCT theories, 26 of them had used separate constructs: perceived ease of use and self-efficacy.

It is important to note that such studies did not consider the concept of self-efficacy in direct relation to the investigated system but rather emphasized the concept of general computer self-efficacy as a predictor to perceived ease of use toward a given system. Most studies substituted outcome expectations with perceived usefulness, highlighting the overall techno-centric approach adopted by researchers and omitting the social dimension of performance. This issue will be examined further in the discussion section.

Finally, among the other individual factors that were investigated, it was found that the notion of past experience was used in 19 research papers (past experience was found to be significantly explanatory in most cases). On the one hand, these results are in line with the important role played by enactive mastery in forming self-efficacy beliefs. On the other hand, such findings insist on the temporal dimension of learning processes which should be seen as both evolving and dynamic (Wood and Bandura 1989).

13.4.2 Theory-Level Results

The reviewed theoretical models were found to focus on various aspects of individual behavior concerning adoption, use, and individual performance (see Table 13.4 for the results). Seven theories consider both behavioral intention and behavior together, while one theory, the IS continuance model, primarily focus on continuance intention only. Apart from the Task-Technology Fit model, all theories include individual factors. From these 11 models, only the DeLone and McLean's IS success models (1992; 2003) do not include cognitive factors. Five models consider emotional factors that are satisfaction, affect, and attitude. Other individual factors are also used: experience (UTAUT and TAM2), age, gender (UTAUT). Environmental factors were found to be considered in most models except TAM and the IS continuance models. Social considerations covered various aspects such as subjective norms, facilitating conditions or normative beliefs (seven models). Situational factors are included in seven models covering notions such as triability, observability, voluntariness, information/system/service quality. It is important to note that three models focus only on situational factors, three other models on social factors only, whereas four models encompass both situational and social considerations. On several occasions, the final mapping of some of the constructs into the SCT framework have appeared to be debatable; it was decided to provide readers the definition of the constructs of all the reviewed theoretical models in the appendix section so that they could form their own opinion.

The most represented SCT interactions (see Table 13.3) were found to be the personal–behavior interaction factors (all the models except Task-Technology Fit) and environmental–behavior factors (ten models). Four models consider the E–P–B interaction (UTAUT, TAM2, and DeLone and McLean's models). The B–P path was found to be investigated in the PC utilization model and the IS continuance models. Finally, only the DeLone and McLean's models suggested adopting an

Table 13.4 Mapping of the IS models into the SCT framework

Theoretical Models	Individual					Environmental		Behavior		SCT Paths
	Cognitive									
	SE	OE	Others	Emotional	Others	Social	Situational	Behav. intention	Behavior	
DOI	Complexity	Relative advantage	Compatibility	–	–	–	Triability, observability	–	Innovation adoption	P-B E-B
PCI	Ease of use	Relative advantage, result demonstra-bility, image	Compatibility	–	–	–	Triability, visibility, voluntariness	–	Innovation adoption	P-B E-B
TAM	Perceived ease of use	Perceived usefulness	–	–	–	–	–	Behavioral intention to use a system	Actual system use	P-B
UTAUT	–	Performance expectancy	–	Attitude toward using technology	Gender, age, experience	Social influence, facilitating conditions	Voluntariness	Behavioral intention to use a system	Use behavior	P-B E-B E-P-B
TAM2	Perceived ease of use	Perceived usefulness, image, result demonstra-bility	Job relevance, output quality	–	Experience	Subjective norms	Voluntariness	Behavioral intention to use a system	Actual system use	P-B E-B E-P-B
TPB	Control beliefs, perceived behavioral control	Behavioral belief, attitude toward behavior	–	–	–	Normative belief, subjective norm	–	Behavioral intention to use a system	Use behavior	P-B E-B
TRA	–	Behavioral belief, attitude toward behavior	–	–	–	Normative belief, subjective norm	–	Behavioral intention to use a system	Use behavior	P-B E-B

TTF	–	–	–	–	–	–	Task characteristics, technology characteristics	–	Performance impacts, utilization	E-B
IS Success |Model	–	–	–	User satisfaction	–	Organizational impact	Information quality, system quality	–	Use, individual impact	E-P-B E-P-E E-B-E
Updated IS Success Model	–	–	–	User satisfaction	–	Net benefits	Information quality, system quality, service quality	Intention to use	Use	E-P-B E-P-E E-B-E
PC utilization model	–	Perceived consequences (perceived complexity, perceived job fit, perceived long-term consequences)	–	Affect	Habits	Social factors, facilitating conditions	–	Behavioral intention to use PCs	Utilization of PCs	P-B E-B B-P
Expectation-confirmation theory of IS continuance	–	Perceived usefulness	Confirmation of expectations	Satisfaction with IS use	–	–	–	IS continuance intention	–	P-B B-P

environment-level dependent variable by focusing on, either organizational impact or net benefits (environmental component of the SCT framework), investigating interactions such as E–P–E, E–B–E.

13.5 Discussion and Future Research

The results issued from the literature review highlighted various research issues and avenues.

13.5.1 Self-Efficacy Theory Versus Social Cognitive Theory

It has been commonly acknowledged that the concept of self-efficacy plays a central role in SCT in which the belief that a person is capable of using a certain system influences significantly his/her performance. However, it is very restrictive to summarize SCT as being solely the concept of individual self-efficacy leading to the definition of a "self-efficacy theory."

Such a claim arose from the review of the articles that used SCT from which an overwhelming majority did not include other key concepts of the theory such as the notion of outcome expectations. The power of SCT does not reside in discovering the importance of self-efficacy but rather in making explicit the complexity of learning processes in which self-efficacy is intimately intertwined with other cognitive factors such as outcome expectations, emotional factors (e.g., affect or else anxiety) but also individual behavior and environmental factors. At a higher consideration level, having realized that researchers often affirmed using SCT in solely importing one construct from SCT, such findings raise an important issue in IS research: is it relevant to claim the use of a certain theory in a research project by simply integrating one or few concepts from a theory in an overall theoretical framework?

Furthermore, SCT clearly states that self-efficacy beliefs are determined by four components, which are enactive mastery, social modeling, social persuasion, and physical and emotional states. The results of this research project have proven that enactive mastery through the use of the concept of past experience had well been considered. Social persuasion and social modeling mechanisms have provided some insights through the use of constructs such as normative beliefs, social norms, encouragements of others or else others' use, for instance. Nonetheless, the influence of both social persuasion and social modeling deserves further research efforts especially as predictors of self-beliefs. Similarly, emotional factors have rarely been studied as predictors of cognitive self-beliefs. SCT thus provides a categorization of the factors that influence an individual's beliefs of his or her capability to perform a certain task as well as behavior itself, providing guidance to future research projects.

Recent refinements of SCT provided a more encompassing view of human behavior by extending human agency to the notion of collective agency (Bandura 1997, 2001). Such a view was mainly motivated by the reflection about the ever-increasing influence of computer-based communications and interactions in human lives. One essential aspect of collective agency is the consideration of people's shared belief in their combined efforts to achieve certain results. The notion of perceived collective self-efficacy was then introduced and was empirically found to "raise people's motivation of what they wish to achieve, enhance motivational commitment to their missions, strengthen resilience to adversity, and enhance performance accomplishments" (Bandura 2002). It is important to note that collective self-efficacy is more complex than the simple aggregation of all the individual beliefs of self-efficacy. The concept encompasses coordination and interaction aspects that arise during the synergistic efforts of individuals in performing a task (Bandura 2000). This concept was never found in the reviewed articles but deserves further research efforts. Its investigation may shed some new light in studying IS phenomena related to virtual team or community practices as well as software development for instance.

13.5.2 Inter-influence Between Self-Beliefs and Expected Outcomes

The assertion of the interrelation between perceptions of self-efficacy and outcome expectations stated in SCT seems to have been an overall accepted view in various theoretical perspectives. Such findings are in line with an overall acceptance of the important role played by self-regulation mechanisms in which individuals assess their own capability of performing a certain task and infer potential achievable outcomes. The TAM relies on the central role of two closely related beliefs. Perceived ease of use tends to echo the notion of an individual's perception of his/her ability to perform a certain task. Perceived usefulness can be seen as a component of outcome expectations in relation to the perception that an individual has toward the anticipated direct outcome from the use of a certain technology. Similar claims can be done by linking self-efficacy to the notions of complexity (from DOI) or else control beliefs (from the TPB). Concepts such as relative advantage (DOI), result demonstrability, and image (PCI and TAM2), for instance, can be seen as parts of outcome expectations. Obviously, one must be extremely cautious when comparing or identifying constructs from different theories. The point here is rather to suggest that theories seem to converge toward analogous aspects in which self-beliefs and projected outcomes act as essential self-regulating forces in determining individual behavior. SCT argues that both notions must be seen as multidimensional concepts encompassing both individual and environmental considerations. For example, the TAM is a pure techno-centric model and the concept of perceived usefulness is purely task-related. In SCT, the notion of performance is much broader, and outcome expectations address both task-related performance but also personal-based expectations such as change of status, change of image, but also rewards within the environment (Compeau et al. 1999). This broader view of outcome expectancy should trigger research efforts.

13.5.3 Potential of Self-Regulation Mechanisms

In spite of the previous statement that acknowledges the consideration of self-regulation when studying human behavior, the potential of self-regulation in terms of explanatory power toward human behavior may not have been entirely revealed. Self-regulation relates to controlling one's own behavior and can be defined as "systematic efforts to direct thoughts, feelings, and actions, toward the attainment of one's goals" (Zimmerman 2000). The study of self-regulation processes necessitates the consideration of a temporal perspective since it involves repetitive and consecutive efforts to assess one's performance and revisions to expected results when performing a single task. Zimmerman (2000) has been acknowledged as one of the most influential researchers in investigating the concept of self-regulation and proposes characteristics of self-regulation that may provide valuable insights for IS research. Such characteristics are: self-observation (monitoring one's activities), self-judgment (self-evaluation of one's performance), and self-reactions (reactions to performance outcomes). This view of self-regulation mechanisms may provide an initial understanding and may trigger further research efforts in refining the concept of self-regulation in IS research when studying human behavior. Other than self-efficacy and outcome expectations, various constructs were found to address certain aspects of self-regulation such as control beliefs and perceived behavioral control in the TPB (Ajzen 1991) or else in the reviewed articles (Bock et al. 2006; George 2004; Piccoli et al. 2001). A more encompassing view of self-regulation mechanisms may provide a deeper and complementary understanding of the inter-influence among cognitive, motivational, and emotional factors in IS research.

13.5.4 Observational Learning and Social Modeling

SCT emphasizes the importance of observational learning (or vicarious learning) and is opposed to the classical view of human behavior which posits that learning occurs essentially through direct experience: "If knowledge and skills could be acquired only by direct experience, the process of cognitive and social development would be greatly retarded, not to mention exceedingly tedious and hazardous" (Bandura 1989). The notion of vicarious experience, and the social modeling processes it entails, provides an interesting perspective in understanding the factors influencing an individual's behavior. Several reviewed articles gave some credit to the concept of modeling when studying human behavior (Compeau and Higgins 1995; Johnson and Marakas 2000; Ratten and Ratten 2007; Yi and Davis 2003), but SCT tends to suggest that this notion deserves more thorough consideration. SCT states that observational learning is mainly governed by four component processes. First, attentional processes determine what information people extract and retain from their observations. Second, representational processes regard the transformation and restructuration of the information into concepts and rules. Third, behavioral production processes traduce symbolic conceptions into courses of action. Finally, motivational processes emphasize the difference between acquisition and performance since people do not perform every skill they learn. Such a framework may provide IS researchers insights about the conceptualization of observational learning.

It is important to note that observational learning does not refer only to the experience that is gained through direct physical interactions. SCT states that observational learning also occurs through symbolic communication (Bandura 1986). The advent of the Internet has created a vast symbolic environment in which people perceive and extract images of the reality. Symbolic modeling that occurs through the use of certain computer systems within an organization or else through Internet-related practices is an area that deserves research efforts.

13.5.5 Lack of Emotional Considerations

SCT identifies enactive mastery, social modeling, social persuasion, and emotional states as the main determinants of a person's self-beliefs. It was noted previously that IS research had integrated to some extent the notions of enactive mastery, social modeling, and social persuasion, but it seems that there is an overall lack of emotional considerations even though SCT emphasizes the importance of the role played by emotional states. Indeed, it is said that people's self-beliefs of efficacy affect how much stress and depression they experience in threatening situations, as well as their level of motivation (Wood and Bandura 1989). Few theoretical models were found to integrate emotional considerations and among the reviewed articles that used the SCT framework, few included emotional issues. Such findings seem to call for more research efforts to investigate the role played by emotional considerations on cognitive and behavioral factors. Prior results suggested that anxiety and stress reactions are low when people cope with tasks in their perceived self-efficacy range (Wood and Bandura 1989), whereas self-doubts in coping efficacy produce substantial increases in subjective distress and physiological arousal. Such insights deserve further investigation in IS, investigations, which will likely require consideration of theories from various fields of research in which emotions play a core role.

13.5.6 Behavior as a Temporal Process

IS research has started acknowledging the importance of past experience in learning processes, echoing the importance of enactive mastery in the construction of self-beliefs in SCT. A significant number of reviewed articles included this notion while the TAM2 and UTAUT model have made past experience an important factor. Indeed, the bidirectional nature of causality stated in SCT indicates that performance has effects on both cognitive and emotional factors, which in turn will affect future performance. Such a statement reminds us that any learning process must be seen as a temporal and evolving phenomenon in which past outcomes become future inputs.

Too few studies have considered such temporal aspects when investigating the ability of an individual to learn to perform a certain task. For instance, an individual's belief that he/she is capable of conducting a certain online transaction (self-efficacy) constantly varies based on past transactions and environmental influences (such as having a peer who encountered a certain fraud when conducting an online purchase). The PC utilization model addresses another aspect of the temporal nature of the use of computers by mentioning the notion of habits (this model drew insights from Triandis' model (1980) in which the concept of habits was already present). Such a claim insists on the relevance of studies that encompass temporal considerations and the importance of longitudinal studies in IS research when studying learning-related individual behavior.

13.5.7 Human Agency and Triadic Reciprocality

Considering a human agency perspective may broaden our understanding of human functioning. Keeping in mind the four properties that characterize a human agent, which are intentionality (the capacity to form intentions and courses of action toward a behavior), forethought (the capability to project oneself and set goals), self-reactiveness (or self-regulation capability), and reflectiveness (the aptitude to act as a self-examiner for our own functioning), can help IS researchers in conceptualizing cognitive factors and processes.

Bandura postulates that "the person, the behavior, and the environment were all inseparably entwined to create learning in an individual" (Bandura 1986, p. 18). In the social cognitive view, people are neither driven by inner forces nor automatically shaped and controlled by external stimuli. Rather, human functioning is explained in terms of a model of triadic reciprocality in which behavior, cognitive and other personal factors, and environmental events all operate as interacting determinants of each other. Consequently, using SCT in an IS study consists of acknowledging the concept of triadic reciprocality, which means integrating both individual and environment-based variables to predict an individual's behavior. In other words, SCT encourages researchers to encompass both types of factors to effectively understand human behavior. These considerations raise issues when considering studies and theories that focus solely on either technological or individual factors when striving to understand and predict the use or adoption of a certain system. IS research seems to have been mainly driven by a techno-centric approach when studying individual behavior, leading to the use of theories that omit the social nature of human behavioral functioning. Based on the triadic structure of human agency claimed by SCT and its inseparable nature, SCT raises the debate whether researchers should focus on individuals when studying human behavior or else on a higher-level entity which consists of individual, his/her environment, and behavior. Further research efforts should strive to measure the role of both environmental and social factors on behavior.

13.5.8 Dependent Variables and Unexplored Interactions

SCT indicates that behavioral, cognitive, emotional, and environmental factors constantly influence each other. An overwhelming majority of IS theories uses individual behavior as a dependent variable by providing factors that explain use, adoption, or performance. Based on the principle of the triadic reciprocality, several interactions in the SCT triangle have not been explored and deserve future research efforts. For instance, SCT indicates that an individual's behavior shapes his/her environment. The DeLone and McLean's model links individual behavior and environment by emphasizing the influence of individual performance on organizational performance. Similarly, the impact of personal cognitive and emotional factors on an individual's environment has also never been explored even though it was suggested in DeLone and McLean's model when linking user satisfaction (an emotional belief) to net benefits (which encompass both individual and organizational performance). Another unexplored interaction regards the behavior–personal factors path of the SCT framework which echoes the temporal notion of individual learning and behavior. Indeed, past behavior influences current individual beliefs, which in turn affect future performance. The PC utilization model proposes a challenging view by identifying the relationship between behavior, habits, and affect. It thus ascertains the role that individual behavior plays in shaping individual beliefs and perceptions, especially emotional ones. Indeed, gaining a deep understanding of human behavior in relation to technology certainly involves identifying the significant predictors (either individual or environmental) that can best be used when studying behavior, but it also implies that researchers should strive to understand how behavior impacts individuals in their future beliefs and perceptions as well as how it impacts individuals' environments.

Another aspect of SCT may help in highlighting potential dependent variables. Indeed, the theory posits that beliefs of self-efficacy regulate human functioning through cognitive, motivational, affective, and decisional processes (Bandura 1997). Individuals exert some influence on their environment through decisional processes in which the belief of self-efficacy affects the choice to pursue or avoid certain activities and situations. This process has been empirically studied in psychology research in the context of career path choice (Wood and Bandura 1989). Such consideration may provide some guidance for IS researches to identify potential dependent variables when investigating the personal factors–environment interaction. Moreover, people's self-beliefs of efficacy determine their level of motivation (Wood and Bandura 1989) which is reflected in the amount of effort and perseverance toward performing a certain task. Perseverance may be a notion that is worth investigating since it will directly impact an individual's overall performance.

The main findings as well as the raised issues are summarized in Table 13.5. Along with each of them, a list of indicative research avenues is proposed in order to encourage further research efforts. Table 13.6 integrates the various paths and relationships to be studied in line with an SCT perspective and pinpoints unexplored areas of research.

Table 13.5 Construct definitions in the reviewed IS theoretical models

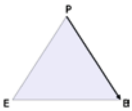
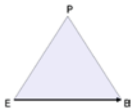
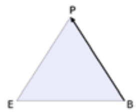
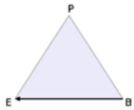
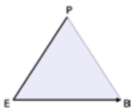
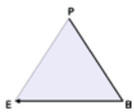
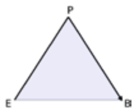
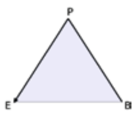
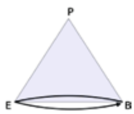
Findings/issues	Recommendations and sample research opportunities
Potential of SCT to study IT adoption/use	Adopt an individual learning perspective to review and revisit the concept of IT adoption/use in IS research. Review IS studies about IT adoption/use which have included the social dimension of the phenomenon.
Use both personal and environmental factors when studying individual behavior	Study the importance of external and environmental factors in predicting IT adoption and use. Study the interaction of personal and environmental factors to predict individual behavior.
Inseparability and synergistic nature of self-efficacy without outcome expectations	Investigate the relationship between self-efficacy and outcome expectations and their interaction in predicting individual behavior.
Lack of consideration of emotional factors	Review all IS studies that used emotional factors to predict IT adoption/use, propose a framework to guide future research. Investigate the notions of anxiety and stress in predicting IT adoption and use. Investigate the impact of emotional factors on both self-efficacy and outcome expectations as well as the direct impact on individual behavior.
Enactive mastery, social modeling, social persuasion, and emotional states as the determinants of a person's self-beliefs	Explore the various personal factors that characterize enactive mastery, social modeling, social persuasion, and emotional states. Investigate their influence on personal self-beliefs such as self-efficacy or outcome expectations.
Concept of collective self-efficacy	Investigate the relationship between personal self-efficacy and collective self-efficacy among a group or community of people. Compare the influence of personal self-efficacy and collective self-efficacy on IT use/adoption for individuals among certain groups or communities.
Clarification between TAM constructs and SCT & social dimension of the constructs (multidimensional)	Comparison of perceived usefulness/outcome expectations and perceived ease of use/self-efficacy. Exploration of the multidimensional nature of the concepts, including behavioral and environmental dimensions. Extension of the TAM model by considering the multi-dimensional and temporal nature of the constructs. Review the various instances of personal beliefs and individual outcome expectations constructs in IS research and map them into the SCT framework.
Multidimensional nature of use and performance	Exploration of the multidimensional nature of use and performance (personal, behavioral, and environmental) Design a performance measure that addresses the three dimensions.

(continued)

Table 13.5 (continued)

Findings/issues	Recommendations and sample research opportunities
Importance of self-regulation mechanisms and lack of research	Investigate the notion of self-regulation and its mechanisms.
	Explore the sub-concepts of self-observation (monitoring one's activities), self-judgment (self-evaluation of one's performance), and self-reactions (reactions to performance outcomes).
	Design a longitudinal study that considers self-regulation mechanisms in relation to self-efficacy, outcome expectations, and individual performance.
Lack of understanding of the concept of observational learning	Study the relevance of observational learning in IS.
	Explore observational learning and consider attentional processes, representational processes, behavioral production processes, and motivational processes.
	Consider and investigate the notion of symbolic observational learning to explain IT use/adoption.
Lack of research that studies social modeling	Extend the understanding of social modeling in IS research.
	Consider and investigate the notion of symbolic modeling in IS.
	Study the impact of social modeling on IT use/adoption.
Enactive mastery & past experience: investigation and future research	Investigate the importance of enactive mastery to predict IT use and adoption.
	Review all IS studies that used experience as a predictor of IT adoption/use and relate to the concept of enactive mastery.
Learning processes a temporal and evolving phenomena in which past outcomes become future inputs	Investigate IT adoption/use as a learning process and draw insights from individual learning research.
	Consider IT adoption/use as a temporal learning process and use SCT insights to describe such process.
	Need for longitudinal studies to study IT adoption/use.
	Investigate the relevance of time-related factors such as previous use or habits to study IT adoption and use.
Regulation of human functioning through self-efficacy	Investigate the influence of cognitive, motivational, affective, and decisional processes on self-efficacy.
	Explore the IT adoption/use issue by considering the combination of cognitive, motivational, affective, and decisional processes mediated by self-efficacy.
Study individual behavior in a broader view in line with human agency and triadic reciprocality	Extend this research project by reviewing all the IS studies that have investigated individual behavior and map all the reviewed constructs into the SCT framework.
	Study one or several of the unexplored areas highlighted in Table 13.6.

Table 13.6 SCT paths and unexplored relationships

Direct effects					
					
	+			+	+
Mediating effects					
					
+		+	+	+	+
					
+	+	+	+	+	+

+ indicates an unexplored path

13.6 Conclusion

Any classification can certainly be seen as arbitrary and arguable (Delone and McLean 1992). A theory always has limitations and will not entirely explain and predict the complex issue of individual behavior. However, this chapter defends the viewpoint that the use of the SCT framework can shed some new light on the individual behavior issue in IS research. The full potential of SCT still has not been unveiled due to a lack of consideration of SCT from a meta-level of analysis that encompasses both theoretical models and constructs. This chapter has reviewed past IS studies which integrated SCT, together with the most common IS theories, and has examined those theories using SCT as a math theory. Numerous unexplored areas were identified in order to help and guide researchers for future studies. We hope this chapter will trigger such new research efforts.

13.7 Appendix A: Results of the Article Review

Reference	Context	Sample	Social/env. variables	Individual variables			Behav./dep. variables
				SE	OE	Others	
Agarwal et al. (2000)	Software	186 students	–	General computer self-efficacy, software self-efficacy	–	Prior experience, personal IT innovativeness, software ease of use	–
Amin (2007)	Internet banking	250 students		Computer self-efficacy	Perceived usefulness	Perceived ease of use, perceived credibility	Behavioral intention
Ball and Levy (2008)	Emerging educational technology	56 instructors	–	Computer self-efficacy	–	Computer anxiety, experience with use of technology	Intention to use emerging educational technology
Bhattacherjee et al. (2008)	Document management system	81 employees	Facilitating conditions	IT self-efficacy	Post-usage usefulness, disconfirmation	Satisfaction	Continuance intention, continuance behavior
Bock et al. (2006)	Electronic knowledge repository system	134 graduate students	Collaborative norms, Resource-facilitating conditions	Self-efficacy, perceived ease of use	Perceived usefulness	Seeker knowledge growth, perceived behavioral control, future obligation	Use
Bolt et al. (2001)	Computer training	249 students	Training method, task complexity,	Self-efficacy	Outcome expectation	Prior performance	Performance

(continued)

Appendix A (continued)

Reference	Context	Sample	Social/env. variables	Individual variables			Behav./dep. variables
				SE	OE	Others	
Chang and Lu (2004)	Internet banking	499 students	Subjective norms, image, perceived risks, results demonstrability	Computer self-efficacy, perceived ease of use	Perceived usefulness	–	Intention to adopt, intention to continue use
Chau (2001)	Office software	360 students	–	Computer self-efficacy, perceived ease of use	Perceived usefulness	Computer attitude	Behavioral intention
Chung et al. (2002)	Computer	350 senior-level students	Encouragements of others, others' computer use	Computer self-efficacy	Outcome expectations	Positive/negative attitude, unfamiliar software, computer experience, knowledge of computers, university major	–
Compeau and Higgins (1995)	Computer usage	1,020 students	Encouragements by others, others' use, support	Computer self-efficacy	Outcome expectations	Affect, anxiety	Usage
Compeau et al. (1999)	IS usage	394 end-users	–	Computer self-efficacy	Personal outcome expectations, performance outcome expectations	Affect, anxiety	Usage

Downey et al. (2008)	Computer use	310 Navy students	–	General computer self-efficacy, application-specific self-efficacy	–	Anxiety, affect, declarative knowledge	Overall computer competence, domain-specific competence (performance measure)
Fagan et al. (2004)	Computer	978 students	Organizational support	Computer self-efficacy	–	Computer anxiety, computer experience	Computer use
George (2004)	Online shopping	193 students	Normative structure, subjective norms	Efficacy	–	Internet trustworthiness beliefs, unauthorized use beliefs, perceived behavioral control, attitude toward online purchasing	Internet purchasing
Gong et al. (2004)	Web-based learning system	280 teachers and students	–	Computer self-efficacy, perceived ease of use	Perceived usefulness	Attitude	Intention to use
Guriting and Ndubisi (2006)	Online banking	133 individuals	–	Computer self-efficacy, perceived ease of use	Perceived usefulness	Prior computing experience	Behavioral intention

(continued)

Appendix A (continued)

Reference	Context	Sample	Social/env. variables	Individual variables			Behav./dep. variables
				SE	OE	Others	
Hasan and Ali (2004)	Computer learning	151 students	–	Computer self-efficacy	–	Computer attitudes, computer experience	Learning performance
Hasan and Ali (2006)	Computer training	78 undergraduate students	–	General computer self-efficacy, system-specific computer self-efficacy, perceived ease of use	Perceived usefulness	–	Training effectiveness
Hasan (2006)	Computer training	78 undergraduate students	–	General computer self-efficacy, software-specific computer self-efficacy, perceived ease of use	–	Computer anxiety	Training effectiveness
Hasan (2007)	Editing application training	96 undergraduate students	–	Computer self-efficacy, ease of use	Usefulness	Attitude, perceived complexity	Intention
Havelka |(2003)	Software use	324 students	–	Software self-efficacy	–	Computer anxiety, computer experience, gender, ACT score	–
Hayashi et al. (2004)	E-learning system	110 undergraduate students	–	Computer self-efficacy, perceived ease of use	Perceived usefulness	Satisfaction, confirmation	Continuance intention

Henry and Stone (1999)	Computer	411 business executives	–	Computer self-efficacy	Work-related outcome expectancy, personal outcome expectancy	Gender, education	System use, perfor-mance
Hernandez and Mazzon (2007)	Online banking	600 internet banking users/ potential users	Subjective norm, technological support, government support, result demonstrability, image	Self-efficacy, ease of use	Relative advantage	Has PC at home, gender, income, age, education, compatibility, observability, complexity, triability	Intention to use, intention to continue to use, actual adoption
Hsu et al. (2004)	WWW use	235 students	–	Internet self-efficacy	Outcome expectations	Satisfaction with prior use, prior perceived confirmation	WWW continuance intention
Hung and Liang (2001)	Executive support system	16 participants (experiment)	–	Computer self-efficacy	Perceived usefulness	Gender, education, organizational tenure, computer experience, cognitive style, user information satisfaction	Performance
Jawahar and Elango (2001)	Software	431 undergraduate students	–	Computer self-efficacy	–	Attitude toward working with computers, goal setting	Performance
Johnson and Marakas (2000)	Software	146 students	Behavioral modeling	Computer self-efficacy	Outcome expectancy	Prior experience, anxiety	Performance

(continued)

Appendix A (continued)

Reference	Context	Sample	Social/env. variables	Individual variables			Behav./dep. variables
				SE	OE	Others	
Kamhawi (2008)	Decision support tools in ERP	75 ERP users – employees	–	Computer self-efficacy	Perceived shared benefits, perceived usefulness	Gender, age, education, knowledge of system, perceived usefulness	Behavior intention
Kankanhalli et al. (2005)	Electronic knowledge repository system	150 users	Organizational reward, pro-sharing norms, identification, reciprocity	Knowledge self-efficacy	Image, loss of knowledge power, reciprocity	Enjoyment to help others, codification effort, generalized trust	Electronic knowledge repository system usage
Karsten and Schmidt (2006)	Computer use	119 + 114 students	–	Computer self-efficacy	–	Computer experience, gender	Use
Kim et al. (2009)	Online shopping	210 undergraduate students	–	General self-efficacy, online transaction self-efficacy	–	Perceived risks, disposition to trust, trust	Purchase intention
Klein (2007)	Healthcare web application	294 patients/users	Healthcare need, primary care practice	Computer self-efficacy	Perceived usefulness	Perceived ease of use, personal innovativeness	Behavioral intention
Klopping and McKinney (2006)	Online shopping	546 students	Task-technology fit	Self-efficacy, perceived ease of use	Perceived usefulness	Playfulness, playfulness, actual e-commerce experience,	Intention to use

Langford and Reeves (1998)	Computer	127 students	–	Computer self-efficacy	Grade expectations	GPA average, prior computer experience, locus of control, self-esteem, need for recognition, problem-solving preferences	–
Lee (2006)	E-learning system	1,085 students	Subjective norms, perceived network externality, course attributes	Computer self-efficacy, perceived ease of use	Perceived usefulness	Competing behavioral intentions, perceived content quality,	Behavioral intention, behavior
Lee (2007)	E-learning	259 Taiwanese undergraduate students	–	Self-efficacy, perceived ease of use	Perceived usefulness	Internet experience	Intention to use
Lewis et al. (2003)	IT use	161 faculty members	Top management commitment, local management commitment, social norms	Computer self-efficacy, ease of use	Perceived usefulness	Personal innovativeness	–
Looney et al. (2006)	Online investing	414 students	–	Computer self-efficacy, investment self-efficacy, online investing self-efficacy	Performance outcome expectancy, personal outcome expectancy	–	–

(continued)

Appendix A (continued)

Reference	Context	Sample	Social/env. variables	Individual variables			Behav./dep. variables
				SE	OE	Others	
Lu and Hsaio (2007)	Web blog update	549 web blog users	Subjective norms, feedback	Knowledge self-efficacy, perceived information-creation ability	Outcome expectations	Knowledge-sharing experience,	Intention of continuing to update web blog
Ma and Liu (2005)	Web-based medical record system	86 health-care participants	–	Internet self-efficacy	Perceived usefulness	Perceived ease of use	Behavioral intention
Noguera and Watson (2004)	ERP system	284 students	Instructional method	Self-efficacy	–	Learning style, user satisfaction	Performance
Oyedele and Simpson (2007)	Self-service technology in shopping, library, hotel	187 college students	Chance, powerful others (locus of control)	General self efficacy	–	Technology anxiety, internal control, autonomy, time orientation	Usage intention
Park and Chen (2007)	Smartphome use	135 doctors and nurses	Surrounding organization, industry environment	Smart-phone self-efficacy, perceived ease of use	Perceived usefulness	Attitude toward use, user compatibility, user triability, user observability, user everyday task, individual features	Behavioral intention to use
Pearson and Pearson (2008)	Website usability	301 students	–	Computer self-efficacy	–	Gender, ease of use, computer anxiety, individual innovativeness,	–

Piccoli et al. (2001)	Virtual learning	146 undergraduate students	Learning model, technology, learner control, content, interaction, instructors technology control/technology attitude/teaching style/availability, instructor self-efficacy	self-efficacy	–	Maturity, motivation, technology comfort, technology attitude, previous experience, computer anxiety, epistemic beliefs, satisfaction	Performance
Ranganathan and Jha (2007)	Online shopping	214 online customers	–	Computer self-efficacy	–	Past experience, customer concerns in online shopping, IT attitude, IT skills, privacy concerns, security concerns	Online shopping intention
Ratten and Ratten (2007)	Online banking	203 young people	Media, modeling	Self-efficacy	Outcome values, outcome expectancy	–	Behavioral intention
Reid (2008)	Banking information systems	374 bank customers	–	Computer self-efficacy, perceived ease of use	Perceived usefulness	Trust, gender, attitude toward using	Intention to use
Schen and Eder (2009a)	Virtual worlds	90 students	–	Computer self-efficacy, perceived ease of use	Perceived usefulness	Computer anxiety, computer playfulness	Behavioral intention to use

(continued)

Appendix A (continued)

Reference	Context	Sample	Social/env. variables	Individual variables			Behav./dep. variables
				SE	OE	Others	
Schen and Eder (2009b)	Virtual worlds	90 students	–	Computer self-efficacy, perceived ease of use	Perceived usefulness	Computer anxiety, computer playfulness, perceived enjoyment	Behavioral intention to use
Sheng et al. (2003)	EPR and BPR	352 individuals	Organizational culture	Computer self-efficacy	–	–	–
Shivers-Blackwell and Charles (2006)	ERP technology	238 students	–	Computer self-efficacy	Perceived usefulness	Perceived ease of use, gender, perceived benefits of ERP, readiness toward change, attitude toward usage	Intention to use
Srite et al. (2008)	Computer usage	350 students	–	Computer self-efficacy	Usefulness of IT	Culture (Hofstede's constructs), computer anxiety, personal innovativeness	Computer use
Stone and Henry (2003)	Medical information system	383 end-users	Computer-staff support	Computer self-efficacy	Outcome expectancy	Past computer experience, ease of system use, organizational commitment	System use
Thatcher and Perrewé (2002)	Software	235 students	–	Computer self-efficacy	–	Negative affect, trait anxiety, computer anxiety, personal IT innovativeness, individual traits and differences	–

Thompson et al. (2006)	Software training	193 students	Social factors	Computer self-efficacy, ease of use	Perceived usefulness	Innovativeness with IT, affect, perceived behavioral control	Future intention
Venkatesh, and Davis (1996)	Computer, software	108 students	Objective usability	Computer self-efficacy, perceived ease of use	Perceived usefulness	Direct experience	–
Wang and Wang (2008)	Online games	281 respondents	System characteristics: challenge, feedback, speed	Computer self-efficacy	–	Perceived playfulness, gender, computer anxiety	Behavioral intention
Wang et al. (2003)	Online banking	123 users	–	Computer self-efficacy	Perceived usefulness	Perceived ease of use, perceived credibility	Behavioral intention
Yi and Davis (2003)	Software training	95 students	Modeling-based training interventions	Software self-efficacy (pre/post training)	–	Pre-training individual differences, motivation to learn, observational learning processes	Task performance
Yi and Im (2004)	Computer training	41 MBA students	–	Computer self-efficacy	–	Personal goal, age, prior experience	Computer task performance

13.8 Appendix B: Definition of the Constructs in the Reviewed IS Theoretical Models

It is important to note that the definitions were extracted from the original research articles in which the theoretical models were introduced by their authors. In several cases, some authors did not provide a conceptual definition of some constructs of their proposed model.

Diffusion of Innovation Theory – DOI (Rogers 1983, 1995)

- **Relative advantage**: the degree to which an innovation is perceived as better than the idea it supersedes
- **Compatibility**: the degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs of potential adopters
- **Complexity**: the degree to which an innovation is perceived as difficult to understand and use
- **Triability**: the degree to which an innovation may be experimented with on a limited basis
- **Observability**: the degree to which the results of an innovation are visible and communicable to others

Expectation–confirmation theory of IS continuance (Bhattacherjee 2001)

- **Initial satisfaction**: user's affect with prior use
- **Confirmation**: users' perceptions of the congruence between expectation of use and actual performance
- **Perceived usefulness**: users' perceptions of the expected benefits of use

IS Success Model (Delone and McLean 1992) & Updated IS Success Model (Delone and McLean 2003)

- **System quality**: technical success of a system
- **Information quality**: semantic success of a system

PC utilization model (Thompson et al. 1991)

- **Social factors**: the individual's internalization of the reference groups' subjective culture, and specific interpersonal agreements that the individual has made with others, in specific social situations
- **Affect**: the feelings of joy, elation, or pleasure, or depression, disgust, displeasure, or hate associated by an individual within a particular act
- **Perceived complexity**: the degree to which an innovation is perceived as relatively difficult to understand and use
- **Perceived job fit**: the capabilities of a PC to enhance an individual's job performance
- **Long-term consequences of use**: Long-term outcomes that have a payoff in the future, such as increasing the flexibility to change jobs or increasing the opportunities for more meaningful work
- **Facilitating conditions**: "objective factors," "out there" in the environment, that several judges or observers can agree make an act easy to do
- **Habits**: situation–behavior sequences that occur without self-instruction

Perceived Characteristics of Innovations – PCI (Moore and Benbasat 1991)

- **Result demonstrability**: the degree one can see results of using the innovation
- **Image**: the degree to which use of an innovation is perceived to enhance one's image or status in one's social system
- **Visibility**: the degree to which the results of an innovation are visible

(continued)

Appendix B (continued)

Diffusion of Innovation Theory – DOI (Rogers 1983, 1995)

- **Voluntariness**: the degree to which use of the innovation is perceived as being voluntary, or of free will
- Other constructs: see DOI and TAM

Task-Technology Fit – TTF (Goodhue 1995)

- **Task-Technology Fit**: the degree to which a technology assists an individual in performing their task

Technology Acceptance Model – TAM (Davis 1989)

- **Perceived usefulness**: The degree to which an individual believes that using a particular system would enhance his or her job performance
- **Perceived ease of use**: the degree to which a person believes that using a particular system would be free of effort
- Other constructs: see TRA

Technology Acceptance Model II – TAM2 (Venkatesh and Davis 2000)

- **Job relevance**: an individual's perception regarding the degree to which the target system is applicable to his/her job
- **Output quality**: an individual's perception regarding the degree to which a system will perform a certain task
- Other constructs: see TAM and TRA

Theory of Planned Behavior – TPB (Ajzen 1991)

- **Perceived behavioral control**: an individual's perceived ease or difficulty of performing the particular behavior
- **Control beliefs**: an individual's beliefs about the presence of factors that may facilitate or impede performance of the behavior
- Other constructs: see TRA

Theory of Reasoned Action – TRA (Fishbein and Ajzen 1975)

- **Behavioral beliefs**: an individual's belief about consequences of particular behavior
- **Attitude toward behavior**: an individual's positive or negative evaluation of self-performance of the particular behavior
- **Normative beliefs**: an individual's perception about the particular behavior, which is influenced by the judgment of significant others
- **Subjective norms**: an individual's perception of social normative pressures, or relevant others' beliefs that he or she should or should not perform such behavior
- **Behavioral intention**: an indication of an individual's readiness to perform a given behavior
- **Behavior**: an individual's observable response in a given situation with respect to a given target

Unified Theory of Acceptance and Use of Technology – UTAUT (Venkatesh et al. 2003)

- **Performance expectancy**: the degree to which an individual believes that using the system will help him or her to attain gains in job performance
- **Effort expectancy**: the degree of ease associated with the use of the system
- **Facilitating conditions**: the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system
- **Attitude toward using technology**: an individual's overall affective reaction to using a system

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Chapter 14
The Potential of Critical Realism in IS Research

Sven A. Carlsson

Abstract Although, the information systems (IS) field is dominated by positivistic research there exist plausible alternatives. The dominating alternatives include constructivism, grounded theory for theory development, and structuration theory as an underpinning theory for developing theories for technology-enabled organizational change. The alternatives overcome some problems with positivism, but they are themselves not without problems. This chapter presents and discusses how critical realism (CR) can be an alternative philosophical underpinning for IS research. The chapter presents briefly CR and how CR can be used in IS research. Contemporary examples of how CR can be used and is used in research aiming at generating new IS theory, IS evaluation research, and IS design science research are presented.

Keywords Critical realism • Behavioral science research • Design science research • Theory generation • Evaluation research

Abbreviations

ANT	Actor network theory
APMS	Automated performance measurement systems
CIMO	Context-IS initiative-mechanism-outcome
CR	Critical realism
DSR	Design science research

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ERP	Enterprise resource planning
GT	Grounded theory
ICT	Information and communication technology
IS	Information system(s)
PIMCO	Problem situation (P)-IS initiative (I)-mechanism (M)-context (C)-outcome (O)
SISP	Strategic information systems planning
SOX	Sarbanes-Oxley act
TIS	Technology of information systems

14.1 Introduction

The information systems (IS) field is dominated by positivistic research approaches and theories (Arnott and Pervan 2005; Chen and Hirschheim 2004; Schultze and Leidner 2003). Weaknesses in these approaches and theories have been pointed out and different alternative theories and research approaches have been developed and are used. The approaches and theories include constructivism, grounded theory (GT), and theories like Giddens' (1984) structuration theory. For simplicity, these different approaches and theories are referred as "post-approaches" and "post-theories" when distinction is not required. Although these approaches and theories overcome some of the problems noted with positivistic approaches and theories, they have some major weaknesses and limitations. Some of these weaknesses and limitations are discussed in the next section.

An alternative to traditional positivistic models of social science as well as an alternative to post-approaches and post-theories is critical realism (CR). Critical realism argues that social reality is not simply composed of agents' meanings, but that there exist structural factors influencing agents' lived experiences. CR starts from an ontology that identifies structures and mechanisms, through which events and discourses are generated, as being fundamental to the constitution of our natural and social reality.

This chapter presents and discusses how CR can be used in IS research. It will be shown how CR can be used in behavioral IS research as well as how it can be used in IS design science research (DSR). The next section presents why CR can be useful in IS research by briefly discussing how CR overcomes some of the problems associated with post-approaches and post-theories as well as positivism. It is followed by a presentation of CR. Section 14.4 presents and discusses different types of CR-based IS research, including: (1) the development of a CR-based theory for technology-enabled organizational changes, (2) the development of a theory for explaining the outcome of strategic information systems planning (SISP), (3) two CR-based evaluation studies of the impact of computer-based IS, and (4) how to develop design knowledge underpinned by CR. Section 14.5 presents conclusions and discusses the use of CR in IS research.

14.2 Why Critical Realism?

Elaborate critique of post-approaches and post-theories can be found in Archer et al. (1998) and Lòpez and Potter (2001). Here, from an IS perspective, we will point out limitations and weaknesses in post-approaches and post-theories used in the IS field. This includes the limitations and weaknesses in one research approach for generating IS theories (grounded theory), and one "theory" (description) of human action and social organization in an IS context (structuration theory). The section also discusses the role of CR in IS design science research.

Several IS scholars have suggested the use of grounded theory (Gasson 2004) and a number of IS studies using grounded theory have been published – for a good example, see Urquhart (2001). Generally, Grounded Theory (GT) is an approach to the analysis of qualitative data aiming at generating theory out of research data by achieving a close fit between the two (Glaser and Strauss 1967). Said Strauss and Corbin, "theory that was derived from data, systematically gathered and analyzed through the research process. In this method, data collection, analysis, and eventual theory stand in close relationship to one another." (Strauss and Corbin 1998). One of the weaknesses in grounded theory is its concentration on micro-phenomena: "The very fixity of this concentration is a factor which prevents grounded theory from attending to historical matters of macro-structure as a means of enriching contemporary or, as I [Layder] shall call them, present-centered forms of research on micro-phenomena. It should be possible to augment the processual and dynamic analyses of interactional phenomena by a parallel focus on the historically antecedent forms that provide their institutional backdrop." (Layder 1993). Macro-phenomena have no validity to IS researchers using grounded theory unless these macro-phenomena emerge directly from the field data. IS research suggests that macro-phenomena, like national culture, influence IS designers (Hunter and Beck 1996) and how IS are used and evaluated (Tan et al. 1995; Leidner et al. 1999; Leidner and Carlsson 1998). Macro-phenomena (structural/systemic factors) can hardly emerge in IS research focusing on agents' perceptions, meanings, and actions. Other problems with GT pointed out by Layder and other researchers include its flat treatment of power and its rejection of the use of prior theory. GT focuses on situated and interpersonal aspects. This means that a researcher using GT will most likely miss the importance of power "behind the scenes" of situated activities, that is, an IS researcher using GT will most likely miss the structural (systemic) aspects of power. GT points out that prior theory, in the form of constructs and theoretical frameworks, should play no formal role in empirical studies and analysis. Not using prior theory means overlooking and ignoring constructs and frameworks that have, in the past, proven themselves to be fruitful.

A theory having gained popularity in the IS field is Giddens' (1984) structuration theory – for a good review of the use of structuration theory in IS studies, see Jones and Karsten (2008). Most notable is Orlikowski's work on applying structuration theory to the development and use of IS in organizations (Orlikowski 1992, 2000).

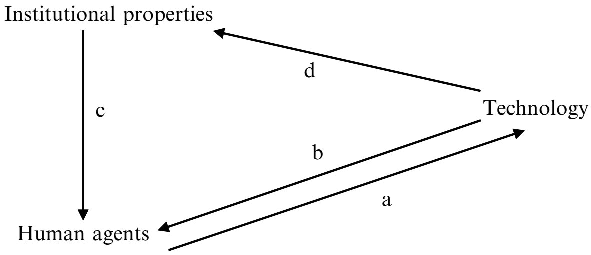

Fig. 14.1 Structurational model of technology

Figure 14.1 depicts Orlikowski's structurational model of technology and shows the relationship between technology, human agents, and institutional properties.

According to Orlikowski (1992), technology is identified as the "product of human action" (arrow a), coming into existence and being sustained through human action, and being constituted through use. Only through the appropriation of technology by humans does it exert influence. However, technology is also "the medium of human action" (arrow b). Technology constrains and enables social practices. Institutional properties influence human agents (arrow c) – "institutional conditions of interaction with technology." Arrow d reflects the influence of technology in reinforcing or transforming organizations' institutional properties – "institutional consequences of interaction with technology."

Structuration theory overcomes some of the problems associated with structuralism, but Giddens' view on agency and structure is problematic when studying artifacts like ICT-based IS. Giddens' conception of agency and structure means that structure cannot be separated from agency. It is an attempt to treat human action and social structure as a duality rather than a dualism; action and structure are seen as two aspects of the same whole (a duality). Said Reed, it is "a single-level social ontology that conflates 'agency' and 'structure' in such a way that they are analytically rendered down to localized social practices bereft of any institutional underpinnings or contextualization." (Reed 1997). Jones after reviewing IS research based on Giddens' structuration theory concludes: "it is evident that the specific attempts to adapt structuration to incorporate material aspects of IS have encountered a number of serious problems which remain as yet unresolved." (Jones 1999); and Jones and Karsten add: "A number of aspects of the duality of technology would seem similarly at odds with Giddens's account of structuration." (Jones and Karsten 2008). Section 14.4.1.1 presents Volkoff et al.'s (2007) CR-based theory-generating study that overcomes the problems noted with structuration theory.

From an IS research perspective, at least three major problems with the use of different strands of post-approaches and post-theories can be identified. First, the post-approaches and post-theories fascination with the voices of those studied (a focus on agents) has led to an increase in IS research as mere reportages and local narratives. Second, their focus on agency leads to that they ignore the structural (systemic) dimension. Third, their rejection of objectivist elements leads to problem when researching artifacts like ICT-based IS. The criticized post-approaches and post-theories can in some cases be useful in IS research, but they have a number of limitations and weaknesses. They are certainly not panaceas.

IS research has serious utilization and relevance problems. To increase IS research utilization and relevance, scholars argue that the dominating behavioral IS research paradigm should be complemented with IS design science research (DSR). A problem with IS DSR is that there is no, or little, discussion about underlying philosophical assumptions in the IS DSR literature. As noted by Indulska and Recker (2008) there is a lack of DSR approaches having clear ontological and epistemological views. Purao notes: "the scientific foundations underlying this critical area of the IS field – design research – have remained largely undeveloped. … philosophical underpinnings of this form of research have been largely unexplored. Without adequate scientific foundations, research in the technology of information systems (TIS) continues to be a lost child still searching for its scientific home." (Purao 2002). The underlying ontological view an IS DSR framework or approach is built on will ultimately affect how to do IS design science research and what types of outcomes that can be produced. Although, current frameworks and approaches to a large extent lack in clearness on underpinning philosophies and ontological views, they seem to be based on positivism, traditional realism, or pragmatism. Given, the critique of these philosophies and ontological views, it can be fruitful to develop and explore IS DSR frameworks and approaches based on CR. The CR-based approach presented in Sect. 14.4.3 can be seen as part of the changing view on IS DSR noted by Kuechler and Vaishnavi (2008). They say that the "view of IS design science research as a 'hard' engineering practice is being mitigated in the USA by the increasing influence of European concepts of IS and design in IS; these have traditionally incorporated a greater emphasis on the business environment." (Kuechler and Vaishnavi 2008).

14.3 Critical Realism

Different philosophies of science have different ontological views. Idealists have the view that reality is not mind-independent. Idealism comes in different forms reflecting different views on what is man-created and how it is created. Realists have the view that reality exists independently of our beliefs, thoughts, perceptions, discourses, etc. As for idealism, realism comes in different forms. Today most philosophies of science are based on realism. Bhaskar says that it is not a question of being a realist or not, but what type of realist (Bhaskar 1991).

CR was developed as an alternative to traditional positivist models of social science and as an alternative to post-approaches and post-theories. The most influential writer on critical realism is Roy Bhaskar. Good summaries of CR are available in Archer et al. (1998), Sayer (2000), Dean et al. (2005), and Chapter 1 in Bhaskar (2002); key concepts and main developments are presented in Hartwig (2007). In Archer et al. (1998) and Lòpez and Potter (2001), chapters focus on different aspects of critical realism, ranging from fundamental philosophical discussions to how statistical analysis can be used in CR-based research.

CR was primarily developed as an answer to the positivist crisis. In 1975 Roy Bhaskar's work *A Realist Theory of Science*, with "transcendental realism," was published. In *Possibility of Naturalism* (1979/1998), Bhaskar focused on the social sciences and developed his "critical naturalism." These two major works present a thorough philosophy of science project and later "critical realism" and "critical naturalism" were merged to "critical realism." A concept also used by Bhaskar. Through the 1980s, Bhaskar primarily developed his position through sharpening arguments, etc. The late 1970s and early 1980s also saw a number of other CR scholars publishing influential works, for example, Margaret Archer's *Social Origins of Educational Systems* (1979) and Andrew Sayer's *Method in Social Science* (1984). Most of CR's early critique was targeting positivism, but later critique is targeting alternatives to positivism, for example, postmodernism and structuration theory. CR is a consistent and all-embracing alternative to positivism and different postmodernistic strands.

CR can be seen as a specific form of realism: "To be a realist is to assert the existence of some disputed kind of entities such as gravitons, equilibria, utility, class relations and so on. To be a scientific realist is to assert that these entities exist independently of our investigation of them." (Fleetwood 2002). CR's manifesto is to recognize the reality of the natural order and the events and discourses of the social world. It holds that "we will only be able to understand – and so change – the social world if we identify the structures at work that generate those events or discourses …. These structures are not spontaneously apparent in the observable pattern of events; they can only be identified through the practical and theoretical work of the social sciences" (Bhaskar 1989). Bhaskar (1978) outlines what he calls three domains: the real, the actual, and the empirical. The real domain consists of underlying structures and mechanisms, and relations; events and behavior; and experiences. The generative mechanisms residing in the real domain exist independently of, but capable of producing, patterns of events. Relations generate behaviors in the social world. The domain of the actual consists of these events and behaviors. Hence, the actual domain is the domain in which observed events or observed patterns of events occur. The domain of the empirical consists of what we experience; hence, it is the domain of experienced events.

Bhaskar argues that "real structures exist independently of and are often out of phase with the actual patterns of events. Indeed it is only because of the latter we need to perform experiments and only because of the former that we can make sense of our performances of them. Similarly it can be shown to be a condition of the intelligibility of perception that events occur independently of experiences. And experiences are often (epistemically speaking) 'out of phase' with events – e.g., when they are misidentified. It is partly because of this possibility that the scientist needs a scientific education or training. Thus I [Bhaskar] will argue that what I call the domains of the real, the actual and the empirical are distinct." (Bhaskar 1978). CR also argues that the real world is ontologically stratified and differentiated. The real world consists of a plurality of structures and generative mechanisms that generate the events that occur and do not occur. From an epistemological stance, concerning the nature of knowledge claim, the realist approach is non-positivistic which means that values and facts are intertwined and hard to disentangle.

CR is a well-developed philosophy of science, but on the methodological level, it is less well-developed. The writings of Kazi (2003), Layder (1993, 1998), Pawson (2006), Pawson and Tilley (1997), and Robson (2002) as well as some of the chapters in Ackroyd and Fleetwood (2000) and Fleetwood and Ackroyd (2004) can serve as guidelines for doing critical realism research.

CR has influenced a number of disciplines and fields, for example, economics, management, and organization studies, but it is not very prominent in the IS field. CR's potential for IS research has been argued by, for example, Carlsson (2003, 2004), Dobson (2001), Mingers (2004), and Mutch (2002). CR-based empirical research can be found in, for example, Morton (2006, 2010), Volkoff et al. (2007), Dobson et al. (2007), and De Vaujany (2008). CR has also critical and emancipatory components (Bhaskar 2002). Wilson and Greenhill (2004) and Smith (2005) address how CR in IS research can work critically and emancipatory. CR's potential for IS design science research has been argued by Carlsson (2006, 2010) and Lyytinen (2008). CR-based IS design science can be found in Carlsson et al. (2008, 2010) and Hrastinski et al. (2007, 2010). Having briefly presented CR, the next section presents and discusses how CR can be used and how it is used in IS research.

14.4 Using Critical Realism in IS Research

As noted above, CR has primarily been occupied with philosophical issues and fairly abstract discussions. In recent years attention has been paid to how to actually carry out research with CR as a philosophical underpinning. This section presents how CR can be used and is used in IS research. Gregor (2006) argues that five interrelated types of IS theories can be distinguished: (1) theory for analyzing, (2) theory for explaining, (3) theory for predicting, (4) theory for explaining and predicting, and (5) theory for design and action. The five types can be clustered into two main types: "traditional" natural/social research (first four types) and design science (fifth type). Examples of how CR can be used in both main types of research are presented. This includes the presentation of: (1) two theory-generating studies (Sect. 14.4.1), (2) a CR-based IS evaluation approach and two CR-based IS evaluation studies (Sect. 14.4.2), and (3) a CR-based design science research approach and CR-based IS design science research (Sect. 14.4.3).

14.4.1 CR-Based Development of IS Theories

Section 14.4.1 presents two theory-generating studies. The first is the development of a CR-based theory of ICT-enabled organizational change. The generated theory can be seen as an alternative theory to Giddens' and Orlikowski's structuration theories. The second theory-generating study develops an explanation of what are the causes of the outcomes of attempts to develop and implement strategic IS plans in organizations. The generated theory can be seen as an alternative to the two dominating Strategic Information Systems Planning (SISP) theories.

14.4.1.1 A CR-Based Theory of Technology-Enabled Organizational Change

A classical concern in the IS field is the development and test of explanatory theories for ICT- and IS-mediated organizational change. Various theories on how technology leads to or enables organizational change have been proposed. The research and the theories can be categorized as having a deterministic view or an emergent view. They can also be classified as having an agency view or a structural view (including a technology view). As discussed above, CR focuses both structure and agency and has an emergent view. It separates structure and agency, whereas other "perspectives" either ignore agency (institutional theory), ignore structure (behavioral approaches), or conflate the two (structuration theory and ANT) (Archer 1995).

Volkoff et al. (2007) addressed the classical concern "how does ICT-based IS mediate organizational change" by developing a new theory underpinned by CR. Volkoff et al. longitudinally studied the implementation and use of an Enterprise Resource Planning (ERP) system. Their specific view on technology-mediated organizational change is based on Archer's (1995) morphogenetic approach which is conceptualized as a cycle consisting of three phases: (1) structural conditioning, (2) social interaction, and (3) structural elaboration. The "concept morphogenesis indicates that society has no preferred form … but is shaped and re-shaped by the interplay between STRUCTURE and AGENCY." (Archer 2007). The middle phase of social interaction is the one which may appear to be where human agency has its greatest role, but this is not the case, as human agency is implicated in, and embedded within, all phases of the cycle. The structural conditioning phase incorporates the critical realist assumption that structure pre-dates action(s) which transforms it. Structural elaboration post-dates those actions (Fig. 14.2). The structural elaboration phase of the model, which flows out of the social interactions in phase two can have one of the two characteristics: structural elaboration/morphogenesis, where people and structures are transformed, and structural reproduction/morphostasis, where people and structures are largely reproduced. Said Archer: "Although, all three lines are in fact continuous, the analytical element consists in breaking up the flows into intervals determined by the problem in hand." (Archer 2007).

Based on CR, Volkoff et al. view ERP as "a source of structural conditioning that is relatively independent and enduring, existing materially in the real domain, rather than primarily as a malleable structure, existing only in the empirical domain at the moment of instantiation." Hence, Volkoff et al. "can discuss the interplay between structures and human agents, and examine the generative mechanisms or mediators

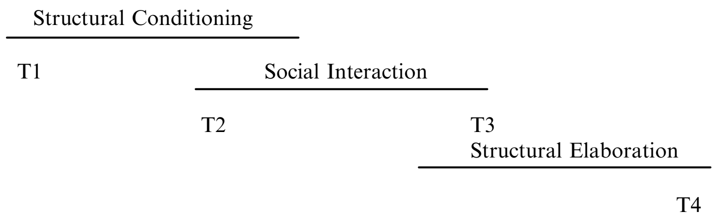

Fig. 14.2 Archer's morphogenetic approach

through which agents affect structure and, of greater importance for this study, how structures shape agency" (Volkoff et al. 2007).

Since CR is not a theory per se, Volkoff et al. used other mid-range theories in their work. For example, they based their study on Feldman and Pentland's work on organizational routines (Feldman and Pentland 2003; Pentland and Feldman 2005). Volkoff et al. used their distinction between ostensive (structural) aspects of routines and the performative (agentic) aspects of routines. Volkoff et al. found that "in addition to ostensive and performative aspects, routines also have a material aspect that is embedded in the technology" and "material aspect of routines plays a critical and direct role in the change process." Their study resulted in a CR-based theory of technology-mediated organizational change. The theory does not conflate the agency structure dimension, which structuration-based theories do.

14.4.1.2 Explaining SISP Outcomes Using a CR

Strategic Information Systems Planning (SISP) is a strategic management activity focused on the role of information systems in organizations. As the criticality and dependency of IS in organizations increase, the importance of SISP increases. In his Ph.D. thesis Paul Morton (2010) reviews the SISP literature and concludes that both private and public sector organizations having used SISP have had problematic experiences. This motivates research on causes of SISP outcomes. Scholars have argued that CR can be useful for developing causal explanations of phenomenon in open systems, such as in organizational settings where complex interactions occur between people and ICT-based IS and where outcomes are not predictable. Underpinned by CR, Morton (2010) addresses the research question: What are the causes of the outcomes of attempts to develop and implement strategic IS plans in organizations?

Morton's research design follows Robson's (2002) four-part structure for CR-based research comprising: (1) purpose, (2) methods, (3) theory, and (4) sampling strategy. In line with CR the purpose of the research is to describe and explain rather than predict. The aim is to generate theory, by a process of retroducing the form and constitution of causal mechanisms that could have produced and hence explain the empirical effects in the case studies. Four case studies were used as the

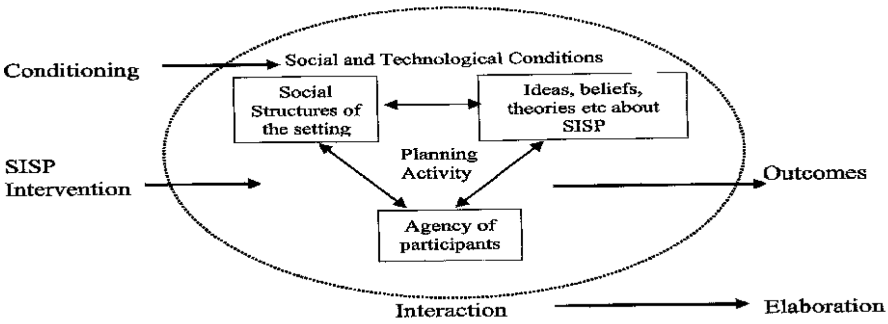

Fig. 14.3 A realist conceptualization of SISP (Morton 2010)

primary source of empirical data. The organizations were government organizations either developing or implementing a strategic IS plan. An advantage of doing a multiple case study is that it allows for the corroboration of findings across case studies. Morton used Bergene's (2007) approach in the comparative analysis. Four methods of data collection were used: (1) participant observation (case one), (2) non-participant observation (case two), (3) interviewing (all cases), and (4) document review (all cases).

Morton reviewed the SISP literature on both private and public sector organizations and an immanent critique was undertaken to establish a conceptualization of SISP consistent with the open systems view of social reality set out by CR. An immanent critique is an examination of existing theory about the phenomenon of interest using CR as a meta-theory to critique the theory's ontological presuppositions (Hesketh and Fleetwood 2006). On the basis of the immanent critique a new reconceptualization of the phenomenon was developed (see Fig. 14.3). Morton used the reconceptualization as a framework to analyze each of the four case studies to identify a set of causal mechanisms responsible for the outcomes of SISP projects contingent on organizational conditions.

In the literature review, two models of SISP were identified: (1) the comprehensive, formal, and systematic model, (2) and the incremental, informal, and opportunistic model.

The immanent critique finds significant theory–practice inconsistencies in relation to both the comprehensive and informal models of SISP. The comprehensive model adopts, contra CR, a closed systems ontology. The informal models contra CR, either the privileging of agential knowledge or the elision of agency and structure through the use of structuration and discourse theory. Based on the critique and using CR a reconceptualization of SISP as an intervention into the open systems social reality of the organization with unpredictable outcomes was developed (Fig. 14.3). In the new model SISP is a collection of causal mechanisms that activate other causal mechanisms in the setting, which originate in the agency of participants, the prevailing social structures and the use by agents of a range of elements from the cultural system.

The comparative analysis revealed a set of 13 causal mechanisms that had a significant impact on the outcomes in each case and 9 contingent factors that affected their activation and interaction. The mechanisms are: Advocacy, Resistance, Fragmentation, Engagement, Secretary Intervention, Government Intervention, IS Demand Management, Integration, Project Control, Approval, ICT Support Demand, Collaboration, and Central Agency Intervention. Nine of the mechanisms were identified in at least three of the case studies providing strong corroboration for their existence. Several of the mechanisms were also corroborated by reference to supporting literature. The mechanisms complete the CR reconceptualization of SISP and explain the varied outcomes of the SISP projects, undertaken by the case study organizations, by showing how they result from the contingent interaction of these mechanisms. It should be noted that the effects of causal mechanism are always subject to contingent conditions.

14.4.2 CR-Based Information Systems Evaluation Research

The development and expansion of evaluation theory and practice is at the core of several different disciplines. It is important to scrutinize theories, approaches, and models used in evaluation (research) as well as evaluation research approaches' philosophical underpinnings. IS evaluation and IS evaluation research have been stressed as critical means in advancing the IS field. Generally, IS evaluation is concerned with the evaluation of different aspects of real-life interventions, where IS are critical means in achieving the interventions' anticipated goals. IS evaluation research can be considered a special case of evaluation research.

Driving CR-based IS evaluation research, called realistic IS evaluation, is the aim to produce ever more detailed answers to the question of why an IS initiative – IS, types of IS, or IS implementation – works for whom and in what circumstances (Carlsson 2003). This means that evaluation researchers attend to how and why an IS initiative has the potential to cause (desired) changes. Realistic IS evaluation research is applied research, but theory is essential in every aspects of IS evaluation research design and analysis. The goal is not to develop theory per se, but to develop theories that can be used by practitioners, stakeholders, and participants.

A realistic evaluation researcher works as an experimental scientist, but not according to the logics of the traditional experimental research. Said Bhaskar: "The experimental scientist must perform two essential functions in an experiment. First, he must trigger the mechanism under study to ensure that it is active; and secondly, he must prevent any interference with the operation of the mechanism. These activities could be designated as 'experimental production' and 'experimental control'." (Bhaskar 1998). Figure 14.4 depicts the realistic experiment adapted to the context of IS initiative/intervention.

Realistic IS evaluation researchers do not conceive that IS initiatives "work." It is the action of different stakeholders that makes them work (or not work). The causal potential of an IS initiative takes the form of providing reasons and resources

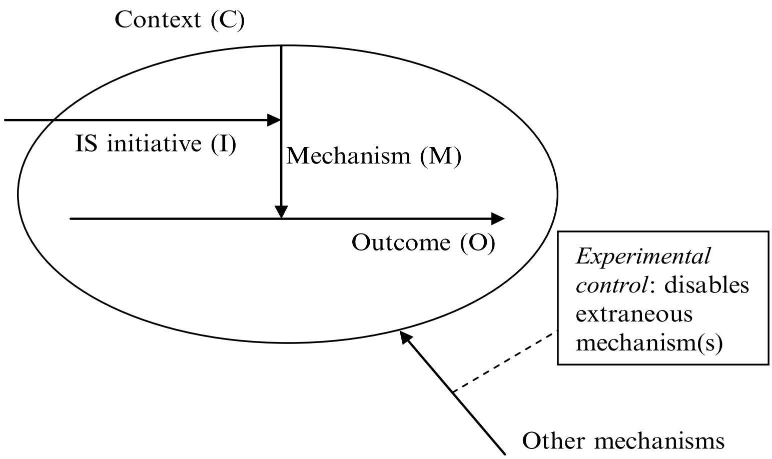

Fig. 14.4 The IS initiative/intervention "experiment"

to enable different stakeholders and participants to "make" changes. This means that a realistic evaluation researchers seek to understand why an IS initiative (IS implementation) works through an understanding of the action mechanisms. It also means that a realistic evaluation researcher seeks to understand for whom and in what circumstances (contexts) an IS initiative works through the study of contextual conditioning.

Realistic IS evaluation researchers orient their thinking to context-IS initiative-mechanism-outcome pattern configurations – called CIMO configurations. This leads to the development of transferable and cumulative lessons from IS evaluation research. A CIMO configuration is a proposition stating what it is about an IS initiative (IS implementation) which works for whom in what circumstances. A refined CIMO configuration is the finding of IS evaluation research – the output of a realistic IS evaluation study.

Realistic evaluation researchers examine outcome patterns in a theory-testing role. This means that a realistic evaluation researcher tries to understand what are the outcomes of an IS initiative (IS implementation) and how are the outcomes produced. Hence, a realistic evaluation researcher is not just inspecting outcomes in order to see if an IS initiative (IS implementation) works, but are analyzing the outcomes to discover if the conjectured mechanism/context theories are confirmed.

In terms of generalization, a realistic evaluation researcher through a process of CIMO configuration abstraction creates "middle range" theories. These theories provide analytical frameworks to interpret differences and similarities between types of IS initiatives (IS implementations).

Realistic IS evaluation based on the above may implemented through a four step realistic evaluation cycle. The starting point is theory. Theory includes proposition on how the IS intervention into a pre-existing context and other mechanisms can generate outcomes. This entails theoretical analysis of mechanisms, contexts, and expected outcomes. This can be done using a logic of analogy and metaphor. The second step consists of generating "hypotheses." Typically the following questions would be addressed in the hypotheses: (1) what changes or outcomes will be brought about by an IS intervention, (2) what contexts impinge on this, and (3) what mechanisms (social, cultural and others) would enable these changes, and which one may disable the intervention. The third step includes the selection of appropriate data collection methods. Realists are committed methodological pluralists, which will be illustrated below. In this step, through empirical studies, it might be possible to provide evidence of the IS intervention's ability to change reality. Based on the result from the third step, one may return to the program (the IS intervention) to make it more specific as an intervention of practice. Next, but not finally, one returns to theory. The theory may be developed, the hypotheses refined, the data collection methods enhanced, etc.

Two studies will be used to illustrate realistic IS evaluation. The first is an evaluation study of enterprise systems implementations. The second is a study of the impact of a computer-based IS on clinical practice.

14.4.2.1 Enterprise Systems Implementation Evaluation

In this study CR was used as the underlying philosophy for the research. The specific type of system addressed is automated performance measurement systems (APMS). APMS are a fairly recent evolution within the context of enterprise systems. They deliver information to senior managers through automatically collecting operational data from integrated IS to generate values for key performance indicators. APMS are a consequence of the Sarbanes–Oxley (SOX) Act and similar legislation. The study investigated a number of APMS implemenations with varying degree of success and failure. In line with CR, Dobson et al. found that contextual issues were key in explaining the success and failure of the APMS implementations. Said Dobson et al., the "critical realist focus on retroductive prepositional-type questioning led to a contextual basis for the study seeking to answer 'Under what conditions might APMS implementation prove successful?' rather than 'What are the (predictive) critical success factors for an APMS implementation?' A simplistic critical success factors approach tends to deny the heavy contextuality and complexity of large-scale systems implementation." (Dobson et al. 2007).

Dobson et al.'s study has six major phases. The first phase was a literature review including the use of DeLone and McLean's IS success models (DeLone and McLean 1992, 2003) and Wixon and Watson's data warehousing success model (Wixom and Watson 2001). The purpose of the review was to develop an APMS success model. The literature review followed Pawson's (2006) suggestions on how to conduct systematic reviews to make sense of a heterogeneous body of literature. The review was driven by a focus on context – IS initiative-mechanism-outcome and how outcome can be "produced." Using Pawson's approach means that it is possible to move away from the many one-off studies and instead learn from fields such as medicine and policy studies on how to develop evidence-based IS knowledge.

In the second phase, the developed success model was used as the basis for generating questions for semi-structured, qualitative interviews. In the third phase, the generated questions were used in a focus group interview. The focus group was composed of IS industry experts, active in the performance measurement system area. The generated data and the first developed model were analyzed and a revised model (Model 1) was developed. In the fourth phase, this model was tested against a case study with further refinements to the model resulting in Model 2. In the fifth phase, a number of reviews and case interviews were done. These lead to the refinements of the model (Model 3 and 4). A final model was synthesized (Myles 2008).

Dobson et al.'s study illustrates the realistic IS evaluation research well. The study has a focus on unpacking the mechanisms of how complex IS implementations work in particular settings and contexts. The focus is on what is it about a specific IS implementation that works for whom in what circumstances.

14.4.2.2 A Realistic Evaluation of the Impact of a Computer-Based IS on Clinical Practice

Above, a case-based and primarily qualitative evaluation study was presented. As noted, critical realists are committed methodological pluralists, which means that realistic IS evaluation research can also be quantitative. Oroviogoicoechea's (2007) PhD thesis is an example of a primarily quantitative CR-based evaluation study – see also, Oroviogoicoechea and Watson (2009).

ICT-based IS are increasingly being implemented and used in clinical practice. Evidence of IS implemented and used effectively and efficient in healthcare organizations appear to be critical. Oroviogoicoechea's evaluation study was done in this context. She explicitly explored nurses' (users') perceptions of the impact (effect) on clinical practice of the use of an ICT-based hospital IS. Her IS evaluation study had a socio-technical view, and not moved a technical view. This means that she incorporated user perspectives and context in the evaluation.

Oroviogoicoechea used a realistic IS evaluation design based on Pawson and Tilley's (1997) and Carlsson's (2003) work. The approach was used across all the phases of the study. As the approach is theory driven approach and focuses "what works, for whom and in what circumstances." As presented above, the relationships were constructed as context-IS initiative-mechanisms-outcomes configurations (CIMO).

Oroviogoicoechea used a self-developed questionnaire containing both closed and open-ended questions. The developed questionnaire was tested (pilot study) and distributed to all nurses working in in-patient units of a University Hospital in Spain ($n=227$); 179 nurses participated (returned the questionnaire) in the study (78.8% response rate). Descriptive statistics were used to get an overall overview of the nurses' perceptions. Additional, inferential analysis, including both bivariate and multivariate methods (path analysis), were used for cross-tabulation of variables to identify CIMO relationships. Content analysis of the answers to the open-ended questions was used to identify major themes in nurses' responses.

Oroviogoicoechea's results show that overall the nurses are satisfied or very satisfied with the new IS. Only 7.5% of the nurses wanted to go back to the paper-based system. The mechanisms and outcomes were highly correlated. A comparisons with context variables show how users' characteristics, except attitude towards the introduction of the ICT-based IS, did not have a significant influence on perceptions while the nursing unit context had greater influence. The path analysis showed that the influence of unit context variables is on outcomes and not on mechanisms. In the content analysis of the answers to the open-ended questions, six main themes emerged: information, communication, patient care, documentation processes, work dynamics, and running of the program. Some differences in relation to the unit context were observed.

14.4.3 CR-Based Information Systems Design Science

Above, how CR can be used in behavioral IS research being was presented. Below, Gregor's fifth type of theory is addressed: theory for design and action. Research generating this type of theories is solution driven and called IS design science research. In order to increase the relevance and bridge the gap between scholarly IS research and IS practice scholars argue for IS design science research. Two major IS design science research schools have emerged (El Sawy, August 2006, Personal communication): (1) information systems design theory (Walls et al. 1992; 2004), and (2) design science research (Hevner et al. 2004). The schools share a focus on the IT artifact. Some scholars argue for a third "school." These researchers argue that IS is a socio-technical discipline and that: "design science and the research that builds that body of knowledge must acknowledge that IS is fundamentally about human activity systems which are usually technologically enabled, implying that the context of design and use is critical, and that research paradigms, practices and activities must embrace such a worldview." (McKay and Marshall 2005) – see also, Carlsson (2010).

The primary constituent community for the output of IS design science research is the professionals in the IS field. This means primarily professionals who plan, manage and govern, design, build, implement, operate, maintain and evaluate different types of IS initiative and IS.

Using van Aken's (2004) classification three different types of designs an IS professional makes when designing and implementing an IS initiative can be distinguished: (1) an object-design, which is the design of the IS intervention (initiative), (2) a realization design, which is the plan for the implementation of the IS intervention (initiative), and (3) a process-design, which is the professional's own plan for the problem solving cycle and includes the methods and techniques to be used to design the solution (the IS intervention) to the problem. IS design science research should produce knowledge that can be used by the professionals in the three types of designs.

The outcomes of IS design science can take the form of, for example, algorithmic or heuristic design propositions, design exemplars, or stories and narratives. The outcomes should be useful and applicable for IS practitioners. We have in the last years in a number of projects developed IS design knowledge for what we call "IS use and management" in the form of, for example, design propositions. Carlsson et al. (2008) and Carlsson (2010) have argued for that such research can be developed based on an

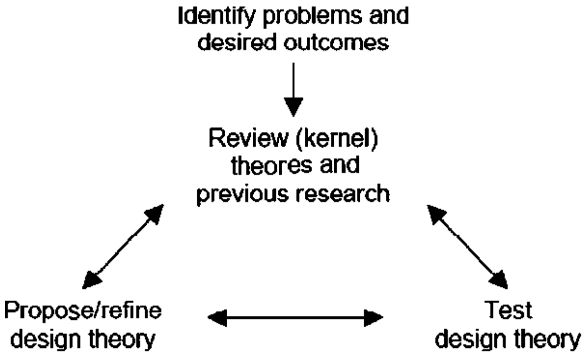

Fig. 14.5 IS design knowledge development (Hrastinski et al. 2007)

approach having four major research activities (Fig. 14.5): (1) identify problem situations and desired outcomes, (2) review (kernel) theories and previous research, (3) propose/refine design theory, and (4) test design theory. The figure reveals that IS design science research is not only about doing or designing. An important part of this research approach is to continuously test design theories. This includes testing of theories' applicability, understandability, and actability in practice. Another key characteristic of this IS design science research approach is that one should build on what is already known, i.e. kernel theories and previous research.

14.4.3.1 Research Activity: Identify Problem Situations and Desired Outcomes

Design theories and design knowledge aim to support solving practical problems in such a way that desired outcomes are reached. Hence, such theories and knowledge are goal and outcome-oriented, which means that they should when used increase the likelihood of reaching desired outcomes. Below, one example of design theories and knowledge and the practical problems that motivated the need for the theory are presented. The design theories and knowledge were developed to guide IS practitioners in how to achieve desired outcomes.

14.4.3.2 Research Activity: Review (Kernel) Theories and Previous Research

Design theories and design knowledge should be enhanced through grounding in previous research. A design theory should be enhanced by continuously "interacting" with what is currently known, that is, grounding in kernel theories and previous research. Gregor (2006) argues that theories can and should "inform" design theory and that design theory and explanatory and predictive theories are strongly interrelated.

Design theories and design knowledge can be enhanced through systematic reviews of previous research. Several scholars (e.g., Pfeffer and Sutton 2006) have argued for the development of evidence-based or evidence-informed management knowledge, including evidence-based design knowledge. In the IS design science research case presented below, the reviews of previous research was inspired by Pawson's (2006) suggestions on how to conduct systematic reviews to make sense of a heterogeneous body of literature. Such reviews should be driven by PIMCO configurations and should have a specific focus on outcome(s) and how outcome(s) can be produced or enhanced (in the next activity PIMCO configurations are explained). Using this method for review of relevant literature means that it is possible to move away from the many one-off studies and instead learn from fields such as medicine and policy studies on how to develop evidence-informed IS design knowledge.

14.4.3.3 Research Activity: Propose/Refine Design Theory

When proposing a design theory, for example, in the form of design propositions, it is important to provide "thick descriptions" to aid the reader in understanding the theory, which may support practitioners in translating a theory to specific contexts and situations (van Aken 2005).

A design proposition follows the logic of a technological rule. In the field of IS it may be more appropriate to use the term design proposition instead of technological rule since the latter term may suggest a technical, rather mechanistic approach (Hrastinski et al. 2007; Carlsson et al. 2010; Carlsson 2010). A design proposition can be expressed as: in problem situation (P) and context (C), to achieve outcome (O), then design and implement IS initiative (I). As presented above, the "design and implement IS initiative I" includes three different types of designs: (1) object-design, (2) realization design, and (3) a process-design. Since a design proposition should be used by practitioners, it should be understandable, applicable and actionable.

A field-tested and grounded design proposition has been tested empirically and is grounded in science. Field-tested and grounded design propositions will in most cases be in the form of heuristics. This is consistent with CR's open systems view and its view on causality (Bhaskar 1978, 1998; Groff 2004). It means, for example, that the indeterminate nature of a heuristic design proposition makes it impossible to prove its effects conclusively, but it can be tested in context, which in turn can lead to sufficient supporting evidence (Hedström and Swedberg 1998; Groff 2004).

14.4.3.4 Research Activity: Test Design Theory

After having formulated an initial design theory, the next step is empirical tests, which include the selection of appropriate data collection methods (Carlsson 2006).

In testing the design theory, it can be examined whether the design theory may be used as support when trying to "change" reality. Based on the results, the outcome may be reflected on and the design theory may be refined. Through multiple studies one can accumulate supporting evidence iteratively and continuously move towards "evidence saturation." We can say that the tests of a design theory go through alpha, beta, and gamma testing. Alpha testing concerns further development by the originator(s) of the design theory. Beta testing concerns further development by other researchers. Gamma testing concerns testing the design theory in practice, and includes testing whether practitioners can use it and if the use of the theory leads to the desired outcome(s). To strengthen the validity of design theories, test triangulation may be beneficial, i.e. to combine two or more complementing ways of conducting gamma testing, such as focus groups and field experiments.

14.4.3.5 An Example of How to Develop IS Design Theories and Design Knowledge

This section describes how we have developed a design theory for successful use of e-learning by using the approach presented above. For more elaborate presentation of the approach and how it has been applied, see Carlsson (2010), Carlsson et al. (2010), and Hrastinski et al. (2007, 2010).

Identify problems and desired outcomes. In order to succeed with e-learning initiatives, organizations and educational institutions must understand benefits and limitations of different e-learning techniques and methods. An important task for research is to support practitioners by studying the impact of different factors on e-learning effectiveness. Commonly, two basic types of e-learning are compared, i.e., asynchronous and synchronous e-learning. E-learning initiatives mainly rely on asynchronous means for teaching and learning (Hrastinski and Keller 2007). More recent improvements in technology and increasing bandwidth have led to an increasing popularity of synchronous e-learning. Many practitioners are interested in using e-learning but simply do not know what the benefits and limitations of different approaches are (Hrastinski 2007) and which effects these approaches have on learning outcomes (Cole 2000). However, e-learning use also has organizational implications. Acceptance, i.e., the willingness of teachers and students to use e-learning environments is a prerequisite for participation (Keller 2007). Thus, this design theory is intended to contribute towards a deeper understanding on a topic where guidance is urgently needed.

Review (kernel) theories and previous research. The review was driven by a focus on outcome, in our case participation, and how outcome can be "produced" (in our case when synchronous and asynchronous communication can be used to enhance participation and learning outcomes in e-learning settings). Underlying kernel theories included technology acceptance models (Venkatesh et al. 2003) and social learning theories that view participation as critical to the learning process (e.g., Vygotsky 1978; Wenger 1998). The cognitive model of media choice (Robert and Dennis 2005) served as an aid in explaining when synchronous or asynchronous communication may be preferred. Furthermore, to focus on the quality of learning outcomes in online education, learning theories describing the prerequisites of deep learning, as opposed to surface learning (e.g., Bloom 1956; Marton et al. 1977), were included among the kernel theories.

Propose/refine design theory. In our previous research, the research question of which factors contributes to successful use of e-learning was explored. As a foundation of our design theory, we proposed that acceptance of e-learning environments is a prerequisite for participation in e-learning settings. Participation is, in its turn, a prerequisite of high-quality learning outcomes. The research question was addressed by developing eight design propositions, intended to guide practitioners on the use of e-learning. The "propose/refine design theory" activity was revisited many times. The design theory was continuously improved, as lessons were learnt by testing the theory and by analyzing previous research. Examples of developed design propositions:

- Design Proposition #5: If you want to enhance "cognitive" participation to provide deep learning, then support asynchronous communication.
- Design Proposition #7: If you want to enhance weak class-wide relations among students, then support "formal" communication.

Test design theory. One important aspect of design theory development is the empirical test. When having proposed an initial design theory, an empirical gamma test, i.e., a test with practitioner involvement, was conducted. Krueger (1994) argues that focus groups are an appropriate method for evaluating the effect of interventions in social contexts and, thus, seem appropriate for evaluating design propositions by obtaining feedback from experienced practitioners. A brief version of the design propositions was published in a Swedish e-learning magazine. In the article, teachers, managers, administrators, and developers with experience of asynchronous and synchronous e-learning were invited to participate in focus groups to evaluate the design propositions of the theory. Drawing on the results, the design theory was refined.

14.5 Conclusions and Discussion

Although, CR has influenced a number of disciplines and fields it is not very prominent in the IS field. CR's potential for IS research has been argued by, for example, Carlsson (2003, 2004), Dobson (2001), Mingers (2004), and Mutch (2002). This chapter has shown that CR can be useful as an underpinning philosophy for behavioral IS research as well for IS design science research. Generally, for behavioral science studies, CR offers an opportunity to do research in order to get a deep understanding of contexts, mechanisms, IS interventions, and outcomes. The CR-based IS studies presented in this chapter as well as the work of Koponen (2008) and Smith (2007) represent major studies of complex IS phenomenon. Tentatively, this suggests where and how CR is useful in IS research. Based on the described studies in this chapter as well as other CR-based studies a number of conclusions can be drawn regarding the potential of CR in IS research.

CR has an ontological basis that can function for different conceptions of social reality (open systems). These conceptions will differ from that based on traditional philosophies of natural and social science. As presented above, CR can be used in studies aiming at developing theory (Sect. 14.4.1). CR's open systems view and its view on causality mean that theory testing is not the aim, but it should be noted that it is possible through multiple studies to accumulate supporting evidence iteratively and continuously move towards "evidence saturation."

CR-based IS studies can inform practitioner. A theory-generating study can show how outcomes can be anticipated. As a result of the contingent interaction of causal mechanisms originating in the organizational setting, outcomes cannot be predicted. For practitioners this means that results from CR-based IS studies can indicate likely causal factors of relevance. This is quite different from the popular, but quite simplistic, critical success factors studies.

Section 14.4.3 presented CR-based IS design science research. It should be stressed that the suggested approach, with its socio-technical perspective, is primarily useful for developing design theories and design knowledge for IS management and governance. Closed-system problems are not very likely to be researched by the suggested approach, for example, it will not be useful in the development of a new search algorithm.

Although, critical realists are committed methodological pluralists, it should be noted that the majority of CR-based IS studies are primarily qualitative case studies.

Scholars have argued that theories can and should "inform" IS design theory and that design theory and explanatory and predictive theories are strongly interrelated (Gregor 2006). van Aken (2005, 2006) maintains that design knowledge in the form of design propositions can be developed through cross-case analyses of previous case studies. This means that design knowledge is abstracted from cases. Van Aken (2004) refers to this as "extracting case studies" and shows how it has led to a number of useful and actionable design propositions, for example, Kanban systems and Just-In-Time (van Aken's work is underpinned by CR). In order to guide practitioners, critical realists can analyze previous research based on the assumption that one can draw more powerful conclusions from the collective wisdom of previous research. Working like this is not very common in the IS field, but have proved to be quite useful in other fields, like medicine and policy studies. The enterprise system evaluation study (Sect. 14.4.2.1) and the IS design science research in Sect. 14.4.3.1 used this approach.

It seems that CR-based research overcomes some of the problems with IS research. It should be noted that doing CR-based IS research is not without "problems." For example, due to its open system view and as it recognizes social systems' complexity, CR-based IS research will generate theories that are provisional, fallible, incomplete, and extendable. In other words, CR-based IS research will not produce simple theories and "quick fix" results.

The examples presented in this chapter can function as exemplar of how to different types of IS research.

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Chapter 15
Grounded Theory and Information Systems: Are We Missing the Point?

Hans Lehmann

Abstract Theories indigenous to the Information Systems (IS) discipline are scarce. The Grounded Theory Method (GTM) specifically aims to create theory in domains where none are. But although its use in information systems (IS) research increased over the last two decades, the number of grounded IS theories created did not. This could be because either GTM is not 'right' for the information systems discipline or that it is not 'done right'. The chapter investigates both options and concludes firstly that the method is 'right': it is a general method, capable of accepting any kind of data and works well with information systems, which are defined as actor networks of technology and people. Furthermore, GTM's paradigmatic position (or, more accurately, its lack of one) is very conducive to mixed-actant research. There is, however, reason to suspect that GTM is not 'done right' and that GTM's core tenets are often misunderstood. Two core tenets are defined: (a) the specific rigour of its data collection and analysis; and (b) the maxim of only using concepts as the unit of analysis for developing grounded theory. To elaborate on this a brief history of concepts is given. In conclusion, the GTM analysis regime is re-stated.

Keywords Theory building • Grounded Theory Method • Joint data collection and Analysis • Constant Comparison • Units of Enquiry • Concepts as Units of Analysis

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Abbreviations

AN	Actor network (an element of actor network theory)
GTM	Grounded theory methodology
IS	Information systems
ISR	Information systems research
IT	Information technology
MISQ	MIS quarterly

15.1 Introduction

Theories, together with the methods and skills to build them, still seem scarce in the Information Systems (IS) discipline.

A decade ago Bob Zmud (1998), then editor-in-chief of MISQ, issued a call for more 'pure-theory' contributions to the journal to counterbalance the predominantly empirical, theory-testing character of the submissions received. He pointed to the Academy of Management Review (who already in 1989 had devoted a special issue to this topic) for examples of such articles. Three years later Izak Benbasat at Information Systems Research (ISR) commissioned a commentary on the place of the technology component in IS research – an area *desperately* in need of attention (Orlikowski and Iacono 2001). Soon afterwards, Ron Weber (2003) had to repeat his predecessor's call because in MISQ there has still 'much more… been written about theory testing than theory building'. He pointed out that too many theories in IS research are 'borrowed and adapted from other disciplines – perhaps a manifestation of our need to build theories in domains where no prior theories exist', a sign that 'as members of a discipline, we [information systems researchers] still need to improve our theory building skills'. (Weber 2003)

Whilst there are many ways to build theory, in *domains where no prior theories exist*, qualitative, and initially inductive, theory creation methods seem intuitively a natural fit. One of them, the Grounded Theory Method (GTM), is specifically geared to 'discover' social theory from empirical data sourced in a wide range of contexts and activities. For this reason, its use had spread from its origins in medical sociology at the University of California medical school in San Francisco to wider social research. In business research it is used especially in the management, organisational studies and marketing disciplines – and, over the last decade and half,[1] also in the IS discipline.

However, the resulting increase in new, IS discipline-specific, theoretical constructs has seemingly not yet eventuated to the full extent of GTM's potential.[2] Why?

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[1] Orlikowski's 1993 research into the adoption of a systems engineering approach seems a good starting point. It is arguably the first full theory developed for the IS field using all aspects of GTM.

[2] And not only in the IS domain – Suddaby (2006) laments the same point in an invited editorial for the Academy of Management Journal. His – excellent – compendium of common errors, misconceptions and omissions with regard to Grounded Theory research is quite familiar to reviewers and supervisors of Grounded Theory research and should be a recommended reading for every GTM researcher.

There could be two possible explanations for this:

- GTM is not 'right' for IS, with its mix of technological and social phenomena; and/or
- GTM is not done 'right'. Already in the mid-1990s misuse of GTM was commented on (e.g. Bryman and Burgess 1994; Locke 1996). A recent analysis (Lehmann et al. 2004) of IS research papers that profess to have used GTM[3] over the last decade showed that it had only been used comprehensively in just 20% of the studies. However, in order to generate good theory, the essentials of the GTM process need to be first understood and then followed. If they are not, then the outcomes will be conceptually weak, theoretically inconclusive or, in extremis, just plainly meaningless.

This chapter investigates these possibilities, then sets out to clarify some key points about GTM and subsequently defines some of the hallmarks of good grounded theory research. As a foundation for future sections firstly some background to GTM is provided. Then the question: Is GTM 'right' for IS? is answered with a qualified, but firm, 'yes'. The main section then explains how GTM is done 'right'. It does so by clarifying what is specific to, and unique in, GTM and which of its processes are generic and thus common to most, if not all qualitative social research. To satisfy the need for detailed paradigmatic classification of GTM's cornerstones, the method's epistemological and ontological position (or, more accurately, the lack thereof) is discussed. Finally, a set of criteria to asses the quality of GTM studies is proposed together with some suggestions on how Grounded Theory studies may best be published.

15.2 A Brief Overview of GTM

As with many complex issues, understanding GTM is easier with some historical notes.

Social science has only been recognised as a separate area of philosophical enquiry as late as the closing decades of the nineteenth century. The notion that they also require their own, specific set of research methods had not found full acceptance before the late 1930s. From then on qualitative methods began to develop, but for the next three decades quantitative, positivist, methods still dominated headline social research. However, by the 1960s two distinct schools of social research had established themselves: a traditionally quantitative, positivist/realist, school around Paul Lazarsfeld and Robert Merton in New York and a qualitative/interpretivist school in Chicago around Herbert Blumer. The Grounded Theory method described in the 'Discovery of Grounded Theory' (Glaser and Strauss 1967) was the first synthesis of the two opposing worldviews: Glaser, who came from Columbia with a heritage of 'scientific' thinking in sociology, complemented Strauss's Chicago-style emphasis on understanding and explaining of social phenomena. The outcome was an 'inductive technique, grounded in the data to an extent that would convince 'hard-nosed' quantitative researchers of the soundness of the approach' (Gibbs 2002, p. 165).

[3] A sample drawn by a ProQuest search of papers in learned journals with 'grounded theory' and 'information systems' in abstracts and citations, published between 1990 and 2002.

As more researchers started to use GTM, it soon became evident that many found the required high degree of creative conceptualising difficult. 'Theoretical Sensitivity' (Glaser 1978) was intended to ameliorate this difficulty – but did not entirely succeed. About a decade on, Strauss, with one of his students, published a detailed, procedural 'how-to guide' to GTM (Strauss and Corbin 1990). Glaser (1992), however, virulently opposed the heavily procedurised method propagated by Strauss and Corbin as restrictive to the point where it actually inhibits the emergence of a 'theory'.

With now two versions of GTM (further on labelled 'Glaser' and 'Strauss'), its use spread fast and wide. By the mid-1990s influential opinion considered it to be 'probably the most widely employed interpretive strategy in the social sciences today' (Denzin and Lincoln 2000, p. 382).

There are various definitions of the grounded theory method, but the simplest and cleanest comes from the creators themselves:

> [GTM is] the discovery of theory from data – systematically obtained and analysed in social research (Glaser and Strauss 1967, p. 1).

This qualification of GTM as a 'social research' method, however, raises the next question: How suitable is GTM for researching information systems, when the identity of IS as a social discipline (among other issues) is still being debated?

15.3 'Right' for Information Systems Research?

That an information system is a 'package' of technology and other socio-economic activity was recognised as early as 1973 (Ivan Illich, cited by Kling and Dutton 1982). A decade later this notion was refined as a 'web model of computing', comprising of equipment, techniques, applications and people (Kling and Scacchi 1982) and further characterised as a 'dynamically emergent causal chain' between technology and organisations (Markus and Robey 1988). It finally developed into the metaphor of an 'information ecology' (Davenport and Prusak 1997).

Figure 15.1 introduces a five-component actor network (AN) model that depicts the interdependency between the technical and organisational elements of the 'package'. This follows a model first introduced in 1991 and updated in 2008 (Kroenke 2008, p. 6). In terms of Actor Network Theory, it forms the general framework for the specific actor network that is the individual information system under investigation.

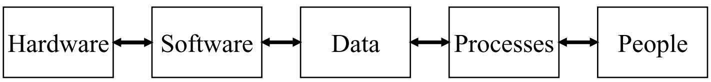

Fig. 15.1 Information technology as an interrelated system of technical and organisational elements (Kroenke 2007)

15.3.1 GTM for Organisational Cases?

Accepting the hybrid view of IS as mixed-actant ANs is one thing. Using GTM in IS, however, requires an extension of the method. Both 'Glaser' and 'Strauss' methods were explicitly grounded in research about the interactions between *individual* human actors in predominantly non-business sociological settings. Researching the IS 'Ensemble', however, needs a wider focus on interactions between groups of people and technology, all embedded in organisations and typically investigated with case study methodology. One way of achieving this starts with conceptualising all the individual slices of data (technical and organisational) within one organisation and then amalgamating the results into one contiguous narrative (the 'case history'). This 'then forms a second-order 'text' from where further conceptualisations now progress. Theoretical sampling thus first ranges *within-case* to maximise the theoretical depth and density of the case story. The resulting theorems of what 'happens in the case' are then applied to theoretical sampling *between-cases* to move the overall theory – of what 'happens in the substantive area' – forward (Lehmann and Gallupe 2005, pp. 166–167; in more detail in Lehmann 2010, p. 59 ff).

One further point that has caused much discussion is GTM's position with respect to the different philosophical paradigms in social research: Does GTM have a paradigmatic bias?

15.3.2 What is GTM's Paradigmatic Position?

GTM lets abstracted concepts emerge from data by ways of a stringent method, as set out above. Its sole axiological predicate is that the propositional, theoretical knowledge that helps understanding, explaining and predicting 'the world' is intrinsically valuable. Because GTM use is not contingent on any specific view of 'the world' it is fully compatible with (post-) positivist and interpretivist stances, be they objectivist, constructivist or critical (when such knowledge is deemed instrumental for social emancipation and justice) or participatory (which adds a practical dimension to the critical stance). GTM's core tenets simply prescribe a way of developing a theory that has the closest possible relationship to the data it 'emerged' from. The method is entirely independent of the nature of the data or the nature of the abstractions incumbent researchers assign to them. GTM neither prescribes a specific ontology or epistemology nor does it limit the researcher's freedom to choose whether they consider data to be naively or critically, real or a subjective, transactional and/or a relativistic construction.

The original ignition point for the discussions about GTM's paradigmatical classification was the role of induction versus deduction in the method. In the first instance GTM is an *inductive* method and has been named that by its founders from the very beginning. Because induction is often (and myopically) equated with interpretivist paradigms, GTM has been labelled that, too. On the other hand, it has been argued that GTM's distinction between empirical base and derived abstractions may be dualist, which eo ipso characterises GTM as (post-)positivist (Annells 1996). As a positivist method, however, GTM would be strongly (and equally myopically) associated with the *deductive* development and verification of hypotheses – which is *toto orbe* from GTM, and vehemently so (Glaser and Strauss 1967, p. 2).

The resolution of the argument is that GTM does both. The cycle alternates between inductive and deductive logic as the research proceeds. The initial abstracting of concepts from the data is *inductive*, but *deductive* work is used to derive from induced codes the clues and directions for where to go next in the theoretical sampling stage. In the Peirce's 'pragmatism', the key paradigm that informed 'Discovery', this fusion of approaches is termed *abduction*. It is 'the process of forming an explanatory hypothesis. It is the only logical operation which introduces any new idea…. Deduction proves something that must be, Induction shows that something actually is operative, Abduction merely suggests that something may be' (Peirce 1903, p. 216). The fact that GTM's logic of theory development uses this *inference to the best explanation* (Josephson and Tanner 1994) as a matter of course renders irrelevant the inaccurate conjecture that the use of inductive or deductive logic predicates specific underlying paradigms.

A recent work also helps put this fruitless discussion to rest. Kathy Charmaz, an original student of both Glaser and Strauss, eventually reconciled the long-running objectivist/constructionist schism among grounded theorists with her guide on how to discover grounded theory for either paradigm family (Charmaz 2006).

In summary, GTM is a neutral research procedure and inherently multi-paradigmatic. Whatever a grounded theorist's epistemological stance and ontological position might be, their resultant theory can be a useful contribution to their discipline – as long as it is demonstrably grounded in the data it emerged from. In the next section a set of simple criteria is proposed to assess this.

Concluding then that GTM is an appropriate method for information systems research, this then only leaves the question whether GTM has been applied 'correctly', i.e. have the core tenets of the Grounded Theory method been followed.

But what is the essence of that method?

15.4 The 'Right' GTM?

When it was developed GTM's initially most conspicuous difference to other qualitative methods was its rigour – the key to assure that emerging theories are as close a *fit* to the data as possible and that they *work* to understand, explain and predict the phenomena under investigation. So what makes up this specific rigour? Begin with what does not.

15.4.1 What is Not Specific to GTM

Firstly, GTM follows the traditional three-step research sequence of any social science method, as succinctly described by Stoller: 'I "gathered data" and once the data was arranged in "neat piles," I "wrote them up."' (Stoller and Olkes 1987, p. 227). And whilst a current 'triple crisis of representation, legitimation and praxis confronts qualitative researchers in the human disciplines' (Denzin and Lincoln 2000, p. 19), this only – if often severely – questions the 'how' of these three steps. The basic sequence seems to be an immutable axiom for most conclusion-oriented investigative activities.

Secondly, the 'coding' of the data – which, as in most other areas of social research, can be any 'text', be it narratives, observations or documents in whatever form – is often seen as the most distinctive GTM process. This is not at all the case. On the contrary, coding happens at the exact same three levels of depth as in all other social research. Miles and Huberman (1994, p. 57; emphasis added) label them as follows:

- Initially, commonalities in the data are captured in 'descriptive' codes to clearly *capture the essential attributes* of the phenomenon.
- Next, as more data and codes are available, 'interpretive' codes are abstracted from the idiographic confines of the concrete incidents to help *understand* what is going on 'behind' the data.
- Lastly, inferential 'pattern' codes, now abstract of space and time and etic to the substantive range of the research, are conceptualised; they are *explanatory* and often *predictive.*

What is different in GTM is merely its anarchic nomenclature: Glaser and Strauss (1967) talk of 'categories' and their 'properties' instead of 'codes', but also recognise their development in 'open' coding first, then in 'theoretical' coding, followed by 'selective' coding to reduce the number of concepts that make up the final theory.[4] Most of the further developments of the method, such as by Strauss and Corbin (1990) and Charmaz (2006), have defined their own labels, as well as some interim steps, but all are only immaterially different from the three universal coding levels. Table 15.1 shows a comparison.

This use of generic social research methods within GTM is clearly not what sets it apart from other qualitative social research.

So what does?

[4]This process, 'delimiting the grounded theory' in Glaser and Strauss terms (1967, p. 109 ff), is again not at all specific to GTM; closely related to 'Occam's razor', this process is possibly one of the oldest tenets of theorising and very akin to Zetterberg's (1965, p. 94 ff) 'definitional reduction' or 'axiomatisation', all designed to increase a theory's parsimony; together with clarity and logical coherence this is one of the three classical 'canons of a good theory' (Mayhew 1981; Pfeffer 1982).

Table 15.1 Relation of different GTM coding classifications schools to levels of abstraction in generic coding levels of qualitative data analysis (After Miles and Huberman 1994)

Generic 'coding' levels	Glaser and Strauss (1967)	Strauss and Corbin (1990)	Charmaz (2006)
Descriptive	Open coding	Open coding	Open coding Focused coding[a] Axial coding[a]
Interpretive	Theoretical coding	Axial coding[b]	Theoretical coding [c]
Pattern	Selective coding	Selective coding[d]	

[a] 'Focused' coding concentrates on a subject/object group; axial coding looks for related types of data; this is, however, more a function of theoretical sampling than of coding

[b] Strauss and Corbin (1990) restrict relations between categories to their 'interactionist coding paradigm' (which Glaser (1992) refutes because it 'forces' concepts rather than letting them emerge)

[c] This includes all conceptualising needed to formulate a theory

[d] Strauss and Corbin (1990) include two more procedural steps here, 'Process Contingencies' and the 'Conditional Matrix' – to make it easier to recognise the 'core category' and embed it into the 'story line' of the nascent theoretical construct (which Glaser (1992) also refutes, for the same reason)

15.4.2 Specifics of GTM

Two aspects differentiate GTM. One is the level of rigour in its analysis regime. More important, though, is the distinction by the units of analysis that are the raw material of theory building in GTM. Consider each in turn.

15.4.2.1 The Rigour of GTM

The essentials of GTM's way of analysing data had already been developed some time before 'Discovery' appeared in 1967. Named the 'constant comparative method of joint data collection and analysis' (Glaser and Strauss 1965a), it contained but two stringent rules:

1. First, *data gathering* and *data analysis* are undertaken *together*. This is in contrast to many qualitative research approaches, where most, if not all, data has been collected before analysis begins. The grounded theorist repeats these two steps continuously: every slice of data is analysed as it is collected – in order to determine where to collect the next one(s).
2. Second, this analysis is a *constant comparison* of every new slice of data with every other one and all the results so far. This is done by constantly asking any or all of three questions:

   (a) What is this slice of data an example of?
   (b) What does this slice of data represent?
   (c) What category or property of a category does this slice of data indicate/point to?

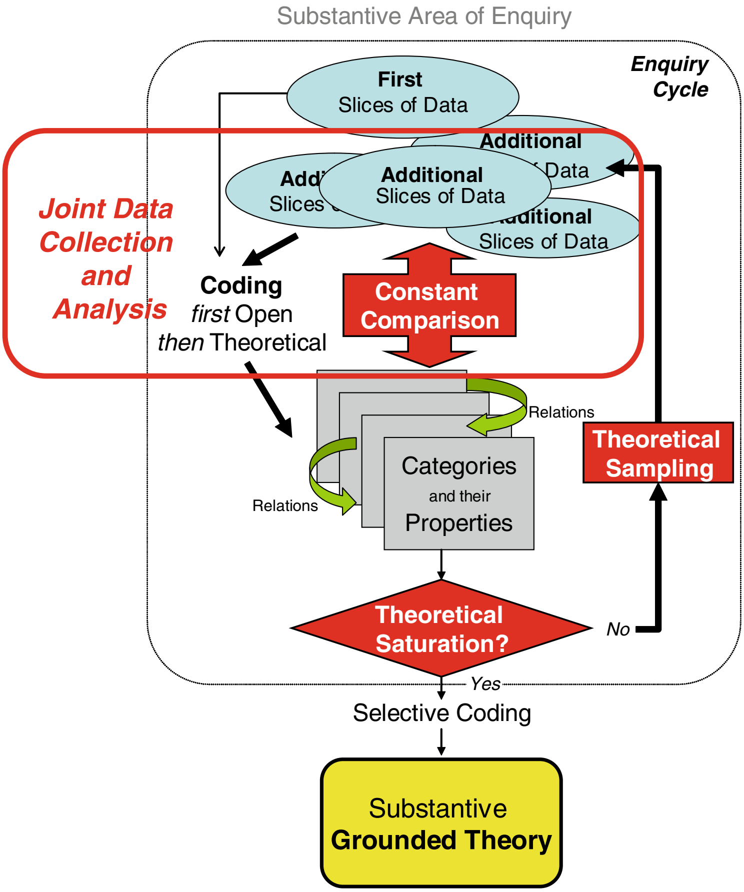

Fig. 15.2 GTM's analysis regime

The classic Grounded Theory method (the 'Glaser' approach) was then completed in the 'Discovery' by stipulating how to collect the next slice of data – and when to stop collecting:

3. After each round of analysis the 'next slices of data' are selected using *theoretical sampling* to determine what data (and from where) is needed next to clarify, enhance, extend, complete or densify the theorems (i.e. the building blocks of the nascent theory) so far; and lastly, but most importantly.
4. The cyclical iterations only end when new slices of data can no more add to, or refine further, the theorems, which are then *theoretically saturated.*

A cycle diagram (Fig. 15.2) illustrates the sequence of activities in the GTM cycle and highlights the parts that are specific and unique to the method.

Again, however, taken on its own, neither of these procedure elements per se is unique to GTM

- Conjoint data collection and analysis is also used in case study and ethnography
- Constant comparison in one form or another seems to happen in all interpretive and most other qualitative work as a companion of conjoint data collection and analysis; as does
- Theoretical sampling, certainly recommended by Yin (1989) for case selection, and
- Theoretical saturation,[5] which is often the terminating criteria for several types of interpretive work

But whilst the cycle of data acquisition and analysis in GTM, again, uses the same procedure elements and follows the same basic logic as most other qualitative research, the iterations between collection and analysis of the data are firstly much tighter in GTM: theoretical sampling is often carried out after each individual slice of data and there is no pre-set sample size – data gathering only stops when nothing more can be learned about the nascent theory. Secondly, the rule to compare instantly each individual unit of data as it is acquired with all the other material assembled so far is unbending and is to be followed religiously with every incident. The requirement of slavish adherence to this intellectual 'drill' is the first essential characteristic of GTM. It is what first precipitates the emergence of theory and then binds it in the closest possible way to the underlying data. Alas, this differentiation by degree only is rather a weak distinction between GTM and other qualitative research approaches.

15.4.2.2 Perception Versus Conception: GTM's Unit of Analysis

What distinguishes GTM more clearly from other qualitative research is the question of 'what' it is that needs to be so stringently compared and analysed, i.e. GTM's basic 'unit of analysis'.[6] Glaser, in his attempt to define, describes and to some extent procedurises 'theoretical sensitivity' and first hints that this is different in GTM:

> Most sociology is focused on a rendition of a social structural unit. That is, no matter what the substantive issues …, we read about properties of a unit; persons, groups, organisations, aggregates, statuses, nations and so forth. In contrast, … we have emphasised … social process as the focus of analysis. We generate properties of process. … A unit is a place where a process goes on … . Analysis uses properties of unit, not unit itself. (Glaser 1978, p. 109)

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[5]This endpoint in the cycle is defined as 'a combination of the empirical limits of the data, the integration and density of the theory and the analyst's theoretical sensitivity' (Glaser and Strauss 1967, p. 62).

[6]The author is indebted to Lynne Marcus, who showed that making concepts the sole unit of analysis is indeed the major, if not only, key distinction of the grounded theory method. Lynne had developed this essential point before, but had never taken it to publication.

Strauss and Corbin, as they procedurise GTM much further, say this in different words:

> Concepts Are the Basic Units of Analysis. A theorist works with conceptualisations of data, not the actual data per se. Theories cannot be built with actual incidents or activities as observed or reported; that is, from 'raw data'. The incidents, events and happenings are taken as, or analyzed as, potential indicators of phenomena, which are thereby given conceptual labels. … As the researcher encounters other incidents, and when after comparison to the first, they appear to resemble the same phenomena, then these, too, can be labeled [in the same way]. Only by comparing incidents and naming like phenomena with the same term can a theorist accumulate the basic units for theory. (Strauss and Corbin 1990, p. 7)

The reason why both citations appear somewhat obscure is that they use loose nomenclature: 'unit of analysis' in general usage is defined as what the research focuses on – generally without much differentiation between data and the concepts derived from them. Moreover, it usually has a bias towards 'data' – 'concepts' are more often regarded as the result elements of research, not as full process participants from its outset. Separating out data from concepts in the definition of research focus, however, helps understanding. Units of 'enquiry' and units of 'analysis', often used synonymously, may be useful for making this distinction. If 'units of enquiry' are defined as the objects the research deals with, i.e. people, artefacts, incidents and all other raw data around them, and if 'units of analysis' are then restricted to the abstractions the researcher builds about them, then the position of *concepts* in GTM becomes more unequivocal. This clear cognitive distance between empirical and abstract units and their opposite role in the GTM cycle now becomes something entirely specific to GTM. And, whilst GTM is 'general' as to the units of enquiry – any data is acceptable – it is very specific as to the units of analysis employed: Only abstractions (albeit at different levels), which are here summatively labelled 'concepts', are used for no other purpose than for building a theory.

How the units of enquiry and the units of analysis interact is shown in Fig. 15.3.

Distinguishing between units of enquiry – the descriptive, summative 'codes' – and the units of analysis, i.e. the conceptual structures that make up a grounded theory, is one of the main difficulties Grounded Theory researchers face. The next section provides explanatory notes and examples of the qualities conceptual constructs need to have in order to produce a good theory.

15.5 The Nature of Concepts: A Brief History

The definition of 'concept' is fairly wide and, not only in the case of GTM, this can lead to confusion. The Oxford English Dictionary[7] defines a 'concept' simply as *an idea of a class of objects*, *a general notion or idea*; *the product of the faculty of*

[7] Second Edition, Oxford University Press, 1989; online at http://dictionary.oed.com.helicon.vuw.ac.nz/.

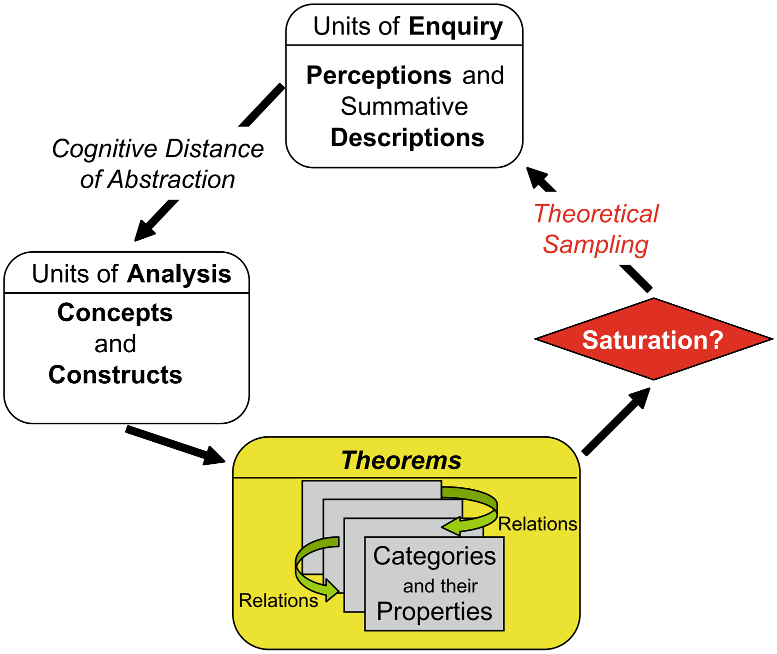

Fig. 15.3 Iteration between empirical units of enquiry and the concepts that make up the unit of analysis in GTM

conception. In GTM, however, where the classification of such objects, notions and ideas moves through stages of abstraction, a sharper distinction between the different types of 'class' is necessary.

The first stage in the GTM research process is the collection and description of the 'slices of data', which are analysed into descriptive codes. These are summations, grouping and clustering like-attributes among the data. Examples from IS research would be that the data in question is concerned with:

- (Aspects of) 'user management'
- (Specific) 'project issues'
- (Incidents of) 'resistance to change'
- (Characteristics of the) 'system environment'; and such like

Together they are an important first step because they map the substantive area, making it possible to stake out the definitive focus of the investigation. They are, however, still firmly rooted in the idiographic context of the units of enquiry that provided the data and therefore cannot enable the wider understanding and explanation that is the essence of theorising. Theory building requires abstraction to 'classes' that cut across different empirical environments and transcend to nomothetic constructs that are independent of the actual units of enquiry.

Looking at concrete examples helps to make the nature of abstracted concepts clearer.

The move to distill – and superpose – qualities that relate divergent phenomena has, of course, always been a fundamental aim of science. The oldest example of a conceptual construct used in this endeavour is the ‘homunculus’. From origins in primal mythology, ancient medicine and philosophy, through alchemy, mediaeval art and literature, this notion of an abstracted prototype or model of (part of) the human system found its way into what eventually became the social sciences. Mill’s (1836) ‘homo oeconomicus’, the abstraction of a human …solely as a being who desires to possess wealth, and who is capable of judging the comparative efficacy of means for obtaining that end is possibly the earliest ideation of man as a social being. Half a century later, founding the new science of sociology, Max Weber postulated his ‘ideal types’, overarching concepts used as models of behaviours in different contexts. He defines them as formed by …the synthesis of a great many diffuse, discrete, more or less present and occasionally absent concrete individual phenomena… into a unified analytical construct.[8]

Jung’s (1934–1954) ‘archetypes’ are entities of much the same construction in the even newer field of psychology. Building on these precedents the phenomenologist Alfred Schütz (1932) created a specifically ‘sociological homunculus’ as the framework for behavioural insights.[9] The ‘Formal Sociologists’ Georg Simmel, Robert Park and, to some extent, Robert Merton, developed this thread further when they re-defined theory building in the social sciences as the distilling of ‘generic social processes’ that underlie, explain and predict the actual instantiations of observed behaviour.

This intellectual background shaped Glaser’s and Strauss’ work. They developed the grounded theory method through their first research together: the study of dying hospital patients and their social environment. They found two ‘core’ categories, i.e. the key conceptual constructs that explain the majority of behaviour in the substantive setting. One had to do with the ‘awareness of dying’ in the people involved and the other one with ‘timing’ of death. Awareness, i.e. to what degree the actors involved were aware of dying, was the main dimension that determined contextual behaviour dynamics (Glaser and Strauss 1965). Timing, i.e. whether death was imminent or as a longer terminal illness, also made a significant difference to the way in which all actors in the situation behaved (Glaser and Strauss 1968). Both concepts could explain the social interaction in the investigated phenomena because they were at a sufficient cognitive distance from the simple, situation-bound, summative codes that can only describe, but neither explain nor predict – which is what a good theory must do.

Outside the medico-sociological area it was the management discipline in the organisational sciences that first used GTM. Sutton (1987) studied the death of organisations and found a similar ‘awareness’ concept as a main driver of behaviour in dying organisations: once closure was announced, motivation of employees increased.

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[8]Cited in Habermas, Jürgen (1985, p. 127).

[9]Glaser uses this special ‘homunculus’ to explain and illustrate what basic social processes and core (theoretical) categories are all about (Glaser 1978, p. 106).

Building on this core conceptual insight he constructed an explanatory model of the factors that shape the end of enterprises – again far removed from the actual situation of the eight firms he studied.

Another classic grounded theory study in the business field is about the perceptions of change by the managers involved in it. Isabella (1990) found that the way in which a wide sample of managers dealt with organisational change could be conceptualised into a four stage process: Managers construe different realities as they first anticipate change, then have it confirmed, as they go through with it and, lastly, in its aftermath. Each step has specific 'tasks' and clear triggers for progression to the next stage. This shows how conceptualisation has to move away from the units (of enquiry) to an overarching, ideational entity that defines the process that underlies the observed phenomena. Glaser explains this clearly when he juxtaposes unit versus process focus in the analysis: 'a unit is a place where a process goes on…[process] analysis uses properties of a unit, not unit itself. Focus is on process as it explains or processes a problem or a behaviour pattern'. (Glaser 1978, p. 109)

Qualitative research and analysis started rather late in the Information Systems discipline. Les Gasser's work (albeit not GTM) on the embedding of computer systems in business procedures was one of the first to conceptualise behaviour patterns that were free of the idiographic confines of mere description. His concepts of dealing with the contingencies individuals face in their daily work with computer applications are clear examples of not just summarising, but lifting to a higher logical level the commonalities in individual behavioural patterns, such as *fitting* or *augmenting* work to compensate for computer dysfunction.

Another good IS example of conceptualisation (again, not explicitly using GTM) demonstrates the adaptation of a framework from a neighbouring discipline for explaining acceptance and integration of the information technology artefact. DeSanctis and Poole (1994) use *appropriation*, a central concept of Adaptive Structuration Theory (Ollman 1971), to *provide a dynamic picture of the process by which people incorporate advanced technologies into their work practices.* They add their own specifically inducted 'appropriation moves' to the existing body of knowledge within Adaptive Structuration Theory. Such borrowing from other disciplines is an often exceedingly useful technique. When inductively developed concepts from one study can be embedded in other relevant research, then a posteriori extending of the reach and range of pre-existing conceptual structures is not only legitimate, but explicitly recommended by Glaser and Strauss (1967) – not least as a stepping stone towards more 'formal' theories.

The first prominent use of GTM in the IS arena was Orlikowski's prize-winning 1993 study of the adoption of CASE methodology in two enterprises. Her model shows that the key drivers for CASE implementation are the not just the specifics of institutional and people contexts, but the way in which they are melded and amplified by an understanding that installing CASE is an organisational change process, not merely an exercise in software updates. Similar to Glaser's and Strauss' core categories, the degree to which this overarching concept was integrated into the implementation project explained and determined its outcome.

More recently, in a study of the dynamics of information systems implementation in multinational enterprises, Lehmann and Gallupe (2005) found that common systems are often interpreted as instruments of head-office control over – otherwise – autonomous subsidiaries. This can result in 'territorial' conflicts full of destructive political infighting if no basis for a rational resolution can be found. Analysing the conflicts and abstracting cause–effect relations across diverse cases yielded the concept of 'synchronicity' to avoid or make redundant territorial arguments. Synchronicity is the condition where common systems are only applied for business processes that have a need to share systems functions (i.e. not just data) across geographical boundaries in real time. This makes the 'subjugation' of subsidiaries to a centrally controlled system an operational, and usually beneficial, necessity – which is acceptable and thus eliminates destructive conflict.

In conclusion, it is of paramount importance that the concepts that form the unit of analysis in GTM are abstracted further than the summative descriptions that arise as a first sifting through the evidence. Covering this cognitive distance is the move from 'perception' to 'conception'. As Watts (1724) so elegantly put it: 'Perception is the consciousness of an object when present; conception is the forming an idea of the object whether present or absent'.

Concepts, in turn, are what theories are made of.

15.6 Re-stating the GTM Analysis Regime

Re-fitting this notion to the analysis regime employed in GTM combines both aspects of what makes GTM different: Constant comparison (in the conjoint data collection and analysis) is thus the juxtaposition of the unit of enquiry (the slices of data) and the unit of analysis (the conceptual constructs already there or yet to be discovered). The (many-to-many) linkages between the two are the indicators, aspects of the unit of enquiry that associate them with a unit of analysis. Each instantiation of the unit of enquiry (the slice of data) is inspected for indicators, to either confirm existing concepts (the units of analysis), or add to them, or suggest new ones – in other words analysis is towards the grounded theory concept and not to a social unit. This one-way linkage (the inductive phase of GTM) then guarantees the 'grounding' of the concepts in the characteristics of the units of enquiry.

Next, theoretical sampling (the deductive phase) defines what new units of enquiry (or new instantiations of old ones) can be expected to yield indicators that further the enquiry, i.e. further develop the units of analysis. For this the existing units of analysis, i.e. the concepts (categories, their properties, nascent theorems, etc.), alone define the direction and targets of the research process. This cycle is then continued until no more new indicators and thus no more new concepts are found within the confines of the substantive area of enquiry and the conceptual network so far is at the point of theoretical saturation. The theorems can then be densified and formulated as a coherent theory for the substantive area as defined by the accumulated units of enquiry.

In conclusion: the 'uniqueness' of GTM has two facets and can be re-stated as follows:

1. The distinction into units of enquiry and units of analysis and their juxtaposition as equally weighted process actors in the method
2. The rigour of its process, i.e. how to use otherwise common research processes in a very specific way, which consists of:

   (a) The fiat that *every* new slice of data is instantly compared to *every* existing concept; and
   (b) The *shortness* of the collection-analysis cycle: theoretical sampling occurs after every instantiation, incident/event – where the definition and granularity of the next 'slice of data' is continuously directed towards maximum concept/theory emergence

Any study that uses GTM needs to fulfil these two core tenets in order to produce a grounded theory that, in addition to the classical canons of a good theory (clarity, parsimony and logical coherence), also 'fits' the situations investigated, be 'relevant' and 'works' to explain them.[10]

15.7 Conclusion

This chapter has meandered over some ground and it seems useful to finish with a summary of what was said in each place.

History was brought in to underline the fact that GTM's major initial contribution is the rigour with which it anchors conceptual conjecture in data to give it legitimacy as a theory. GTM's proven applicability to divergent disciplines rests on its generality – data can come from any source. This makes it the right choice for fundamental research in IS, which is an actor network of technology and people actants. Right choice is one thing – doing GTM the right way is another: its uniquely specific aspect, as it has been shown, is it to make conceptual structures the method's sole unit of analysis. Theory emerges through the constant juxtaposition of empirical data (the unit of 'enquiry') with the theorems so far. This has helped to correct the common misconception that coding in a specific way constitutes GTM – it does not, whatever fancy name the different coding levels may have been given. Another quality that makes GTM useful for IS is its paradigmatic neutrality – researchers of

[10]Glaser and Strauss (1967), cited in Lehmann (2010, p. 45 ff), define these three criteria of the goodness of a theory as follows:

[a]Fit, with 'the situations being researched … i.e. categories must be readily, and not forcibly applicable to and indicated by the data under study' (Glaser and Strauss (1967, p. 3).

[b]Have relevance; i.e. be 'meaningfully relevant to … the behaviour under study' (Glaser and Strauss (1967, p. 3).

[c]Ability to work; i.e. the theory 'should be able to explain what happened, predict what will happen and interpret what is happening in an area of substantive or formal inquiry' (Glaser and Strauss (1967, p. 4).

the technology part of the IS can apply a realist, positivist approach and investigations where people, processes and organisations are in the foreground may use an interpretivist, constructivist lens. But, both would use the same basic processes of grounding their concepts in the data. The discussion of GTM's paradigmatic neutrality concluded that abduction logic best describes the way in which GTM distills meaning from phenomena and also straddles most of the paradigmatic stances represented in social science. Finally, a short list of indicia to be provided for showing that GTM has been used was given and a structure for publishing grounded theories in learned journals was suggested.

Concluding: GTM is a useful method to create theory in the information systems domain where few exist. It is, however, not formulaic – it requires creativity. It is not easy – it requires knowledge of the field and method skills. It takes you where no one has been before – this makes it risky.

But high risk can bring high rewards, too.

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Chapter 16
Developing Theories in Information Systems Research: The Grounded Theory Method Applied

Benjamin Müller and Sebastian Olbrich

Abstract Scientific work depends on a foundation of strong and robust theories to guide the process of scientific discovery. Theories are paramount for the understanding, description, and prediction of phenomena studies in the field. In information systems research (ISR), however, only few domain-specific theories have emerged from that last decades of scientific work. To help researchers answer the call for more IS-specific theoretical work, this chapter introduces the Grounded Theory Method (GTM) as one approach to conceptual, theory generating work that extends our understanding beyond the use of grand theories from adjacent disciplines. Based on a brief historical overview, the chapter shows some particularities of ISR and how GTM can be used to address them. It introduces the general process of GTM-based studies and shows how theories emerge ground observations grounded in the field. Afterwards, the chapter shows some of the often rather small and substantive theories in IS can mature toward grand theories using the GTM approach. The ability to frame our research results in a theoretical way is important to build a cumulative research tradition in IS. This will not only help to gradually extend our understanding of relevant phenomena, but will also allow for advances in the discipline search for domain identity and in our race for credibility with the adjacent disciplines.

Keywords Grounded Theory • Grounded Theory Method • Information Systems Research • Theory Building

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Abbreviations

AIS	Association of information systems
CASE	Computer-aided software engineering
EJIS	*European Journal of Information Systems*
GT	Grounded theory
GTM	Grounded theory method
ICIS	International Conference on Information Systems
IS	Information systems
ISJ	*Information Systems Journal*
ISR	Information systems research
JAIS	*Journal of the Association for Information Systems*
JIT	*Journal of Information Technology*
JMIS	*Journal of Management Information Systems*
JSIS	*Journal of Strategic Information Systems*
MISQ	*Management Information Systems Quarterly*

16.1 Introduction

Developing theoretical work in information systems research (ISR) is one of the central missions of our discipline and the topic of an ongoing discussion. As early as during the first International Conference on Information Systems (ICIS), Keen (1980) identified the building of a cumulative research tradition as one of the key challenges of the IS discipline. Such a cumulative tradition helps a discipline to advance its understanding of the subjects under investigation and to make that knowledge applicable in practice (Lewin 1945; van de Ven 1989). Sources like the Wiki on theories used in IS research (Schneberger and Wade 2007) help to establish such a cumulative tradition via the use of established theories and the knowledge documented in them. However, IS research has only produced a few theories specific to the IS discipline (Burton-Jones et al. 2004). Quite contrary, IS researchers have earned harsh critique as some have described the investigation of information systems as a "mishmash of fuzzy thinking and incomprehensible jargon" (Dearden 1972, p. 90).

The role of theory in scientific discovery in general is paramount. Theories are generally found to provide a concise account of the "what, how, and why" (Whetten 1989) of phenomena. In describing concepts and their relations (Sutton and Staw 1995), theories provide us with the ability to better describe and explain these phenomena and, moreover, also offer the basis for their prediction. Examples for this centrality of theories can be found in the natural sciences (e.g., physics) and the social sciences (e.g., sociology and psychology) (Atmanspacher 2007). Beyond the documentation and accumulation of knowledge, theory is also a vehicle that can inform and guide the discovery and creation of new knowledge.

Frequently, new and innovative technologies and a persistently changing attitude of heterogeneous user groups toward the application of technology make generating theory particularly challenging in the IS field (Heinrich 2005; Hirschheim and Klein 2003). Moreover, being a discipline at the intersection of social, technological, and design sciences, theorizing in the IS discipline does require a unique understanding of theory in light of these three scientific paradigms (Gregor 2009). So far, many of the phenomena observed in IS research are explained using theories from neighboring disciplines such as sociology or psychology on the behavioral side and computer science or engineering on the technical side (Baskerville and Myers 2002; Gregor 2006; Schneberger and Wade 2007). While this can be interpreted as a sign for the relevance of IS research at the intersection of its adjacent disciplines, many scholars – IS and non-IS – have complained about the lack of an IS-specific cumulative tradition of theory and emphasize the importance of generating IS-specific theories (e.g., Lee 2001b; Weber 2003; Zmud 1998). The need for domain identity (Benbasat 2001; Benbasat and Zmud 2003), the legitimacy of the IS field in comparison to its neighboring disciplines (Frank 2006; Lyytinen and King 2004), and the "race for credibility" in the scientific discourse (Weber 1997, p. 2) have been described as reasons for the importance of such powerful, general IS theories.

Building on the current discussion on a theoretical body of IS research (e.g., Gregor 2006; Lee 2001a; Weber 2003), this chapter aims at briefly introducing the Grounded Theory Method (GTM) as a tool to generate such theories in IS. Reading this chapter will allow IS researchers – who are interested in theoretical work – to develop their own theoretical contributions and consequently strengthen our discipline's theoretical foundations. Thus, we intend to respond to the call for IS-specific theories by suggesting the GTM as an appropriate approach to IS research and demonstrate its background, use, and exemplary applications in the IS field. Even though much of the literature we refer to is GT-related, our claim can, in principle, be applied to other IS research methods, too. Hence, reading this chapter will also sharpen the reader's mind toward epistemological problems in pinning his/her research results in a cumulative theoretical body of IS research. However, as an approach to the generation of new theories, GTM will allow researchers to integrate additional or new understanding into the process of scientific discovery in IS.

To approach this goal, our chapter is structured as follows. In Sect. 16.2 we briefly look at GTM's historical background and its evolution from reference disciplines into IS research. Section 16.3 highlights some specificities of applying GTM in an IS context and discusses some of the issues that arise and that researchers wishing to apply GTM in IS research need to be aware of. Building on established approaches to the grounded research methodology, Sect. 16.4 introduces the GTM research process and provides a brief introduction into structuring and conducting GTM-based studies in IS. Section 16.5 looks at the current state of GTM-based publications in the IS literature and reviews two exemplary studies from the CASE context. Sections 16.6 and 16.7 discuss and summarize the chapter by highlighting GTM's potential to generate new and rich IS theories and, in turn, to contribute to the effort of building a cumulative research tradition in IS.

16.2 The Background of the Grounded Theory Method

The basic assumption of GTM is that it focuses on the understanding of a phenomenon by looking at its facets in different contexts. As an approach to generate theory, GTM does not primarily look at the variance perspective, but aims at understanding the underlying constructs, their relations, and the dynamics of these relationships. This means, in part, that the researcher takes observations from different contexts to be specific instances of the phenomenon he or she wants to understand and describe.

Pursuing this ideal of grounded research means to understand constructs and their interactions as an entity which produces certain outcomes. Part and parcel of this approach is a comparative orientation when observing the phenomenon's different facets in different contexts. Cases with many similar aspects but with different outcomes are compared to see where the key causal differences may lie. This is based on John Stuart Mills' (2002) method of differences – essentially the use of (natural) experimental design. Similarly, cases that have the same outcome are examined to see which conditions they all have in common, thereby revealing necessary causes.

The foundation of the present-day term, Grounded Theory (GT), was developed by two sociologists, Barney G. Glaser and Anselm L. Strauss. Their collaboration in research on dying hospital patients led them to write the book, *Awareness of Dying*. In this research they developed the constant comparative method later known as Grounded Theory (Glaser and Strauss 1967). Grounded Theory refers to theory that is developed inductively from a corpus of qualitative data (e.g., interviews, protocols, etc.). If done soundly, this means that the resulting theory at least fits one dataset perfectly. This contrasts with theory derived deductively from other grand theories without the help of data. Such an approach could turn out not to fit any data at all. We, therefore, speak of the GTM as a method to generate theory.

Since their original publication in 1967, Glaser and Strauss have disagreed on the process of GTM, resulting in a split in the theory between Glaserian and Straussian paradigms. This split started in the 1970s but occurred most obviously after Strauss published *Qualitative Analysis for Social Scientists* (1987). Thereafter, Strauss also published *Basics of Qualitative Research: Grounded Theory Procedures and Techniques* and *Grounded Theory Research: Procedures, Canons, and Evaluative Criteria*, together with Juliet Corbin (1990). This was followed by a rebuke by Glaser (1992) who set out, chapter by chapter, to highlight the differences in what he argued was original Grounded Theory and why, according to him, what Strauss had written was not Grounded Theory in its intended form.

The Glaserian strategy is not a purely qualitative research method, but claims the dictum that all are data. This means that not only interview or observational data but also surveys or statistical analyses or whatever comes the researcher's way can be used in the comparative process (Glaser 1992). This also includes data derived from published literature in the sciences, the media, or even fiction. Thus, according to Glaser, the method is not limited to the realm of qualitative research; which he calls Qualitative Data Analysis. His data analysis approach is devoted to descriptive accuracy, while the Straussian method emphasizes conceptualization abstract of time, place, and people. Strauss emphasizes that a concept based on Grounded Theory thinking should be easy to use, even outside of the substantive area where it was generated.

This divergence in the GT methodology is a subject of much academic debate, which Glaser calls a "rhetorical wrestle" (2008). Both strategies have their pros and cons that should not be discussed in detail here for two main reasons. First, the controversy between Glaser and Strauss boils down to the question of epistemological foundation of GTM (Kelle 2006). This chapter seeks to discuss the application of GTM in the field of IS research in order to generate IS-specific theory. The question whether a researcher does or should follow one GT philosophy over the other by using, for example, a well-defined coding paradigm is out of the scope of this chapter. Second, we believe, that colleagues from the social sciences have decades of more experience with the method and its application. Therefore, we can only contribute to the discussion if GTM is in IS context. The method's general development and refinement should be discussed in the social sciences as a whole.

Based on this brief introduction of the history of GT and GTM-based research, the next section will look at GTM from an IS perspective and highlight the opportunities that GTM-based research can generate in the context of IS research.

16.3 Applying the Grounded Theory Method in IS Research

As GTM was originally developed in sociology, one of the core questions that need to be answered is whether and how GTM can be applied to generate theory in the IS field. This is quite in contrast to the often quantitative and confirmatory IS research that has been published heavily in recent years. GTM has been developed for meeting the challenge that "verification has primacy on the current sociological scene, the desire to generate theory often becomes secondary, if not totally lost, in specific researches" (Glaser and Strauss 1967, p. 2).

When applied in the IS field, GTM offers a set of opportunities and challenges that the individual research should be aware of to profit from GTM's potential. We therefore want to highlight some of these opportunities and challenges and seek for an epistemologically sound approach to address them. This leads back to our initial question: Can the use to GTM help us to generate a cumulative tradition of theory in the IS field? The following subsections discuss this question and find arguments in favor and in contrast for applying GTM in IS research.

16.3.1 Opportunities of the Grounded Theory Method in IS Research

The reason for the importance of building theories specific to the IS context can be derived from the epistemological problems of our discipline at the intersection of computer and social sciences. Here theories, once established, cannot be guaranteed to hold true in perpetuity. In engineering, for example, even the most skillfully engineered systems can fail – even though they have been carefully constructed on the basis of natural science theories held true when they were implemented. Considering social systems, the possible foundation in social theory is even more problematic. There simply is little theory that allows for the analysis, explanation, prediction, or theoretically grounded constructions of social systems since human beings might either act according to the theory or, especially when confronted with new social environments, they might not. Describing that phenomenon, Luhmann's social systems theory (1984) speaks of contingency.

The ability to look for such contingencies of a phenomenon is one of the major advantages of GTM. As such, it can be regarded to be one representative of hermeneutic approaches in IS research that suggests the integration of behaviorist and interpretative research. With respect to the peculiarities of IS research, a hermeneutic approach offers interesting prospects. It does not believe in invariant laws of social action. In other words, in light of what has been said above, it assumes that social systems are contingent (Luhmann 1984). Therefore, it is aimed rather at idiographic knowledge, that is, at a differentiated appreciation of single cases. For IS research, Klein and Myers (1999) suggest principles that contribute to conducting and evaluating hermeneutic research.

To talk about the opportunities that the application of GTM bears in IS research, we need to look at its basic assumptions: GTM seeks theory grounded in empirical data – not based on hypotheses to be confirmed or rejected. In line with the view of reality as socially constructed, objectivity is not claimed. An emergent theory rather is one of several possible explanations of reality constructed with the researchers as active instruments and, as such, it reflects the viewers as well as the viewed. This results from an early critique of GTM to behaviorist research approach in social sciences. Accordingly, not all theories and explanations are equally relevant, credible, and acceptable. It is up to us as researchers to argue the case for the explanation which we want to present. This seems to be a valuable assumption in ISR tackling the problem of contingency.

As illustrated in Sect. 16.2, a researcher applying GTM must bear in mind that the method as such is not epistemologically geared one way or another. Acknowledging the positivist leanings of the original authors, a later adoption of the theory by interpretive researchers stresses that theory does not just emerge from data, but data are constructed from the many events observed, read about, or heard about (Charmaz 2005; Strauss and Corbin 1990). Hence, recent GTM-based research does not seek the truth as universal and lasting, but sees the research product as a rendering or one interpretation among multiple interpretations of a shared or individual reality. This later adoption might also be particularly valuable in ISR and could help to overcome the gap between the behaviorist and constructivist research paradigm.

To sum up, the opportunities of applying the GTM in ISR lie in the interpretative access to distinct social realities alongside the use to IS. With reference to hermeneutics, researchers get comprehensible empathy to given situations and contexts. The goal is to develop a pattern of interpretation that leads to (broader) theory which can be used to derive actions and design patterns (von Wright 1999).

16.3.2 Issues and Challenges in Applying GTM

Despite its opportunities and promising perspectives, the hermeneutic approach of GTM faces some epistemological challenges. The focus on few grand theories, the multiple goals GTM pursues, and the integration orientated approach seem particularly challenging. Especially in the highly dynamic IS discipline, one might immediately struggle with the focus on some grand theories and existing literature. First, because it is arguable whether grand theories exist in IS or whether borrowing theories from neighboring disciplines is sufficient in light of our discipline's race for credibility. Second, the focus might be an obstacle for creativity in theoretical thinking in IS research.

The assumption that following a certain process automatically leads to theory seems to be even more problematic. Following the Straussian stream of GTM thinking, one would assume that the quality of a theory can be evaluated by looking at the process by which a theory is constructed. This point of view contrasts with the scientific perspective that how you generate a theory, whether through dreams, analogies, or plain luck, is irrelevant: the quality of a theory is determined by its ability to explain new data. Or the other way round: a given standard process – however strictly followed – does not guarantee valuable output, that is, the development of relevant theories. In light of this, the assumptions of Glaser and Strauss seem optimistic: "It should also help students to defend themselves against verifiers who would teach them to deny the validity of their own scientific intelligence" (1967, p. 7).

One legitimate question that can be asked is whether more use of Grounded Theory in IS would simply result in more unrelated theories instead of a body of knowledge. Every researcher could be tempted to build his/her own theory instead of building on previous work. The only way to solve this issue is a constant collaboration during the research process as Strauss advocates it (Strauss and Corbin 1990). One example is Internet collaboration as in the Forum for researchers on Glaser's Grounded Theory Institute web page (Glaser 2008). In response to this critique, Urquhart et al. (2010) argue that, even given individual theorizing, one way or another, GTM leads to extended use of theoretical work.

The recent discussion on the research agenda in social research in general and IS research in particular advocates a methodological pluralism (Mayring 2001; Mingers 2001). Hence, the apparent antagonism between behaviorist (and often quantitative) and hermeneutic (and often qualitative) methods in IS research seems to be resolved. Given this development, it is arguable whether a method designed to overcome the ancient antagonism is still required for that purpose.

To sum up, and taking the points of critique above into account, the suspicion rises that the GTM-based research often collects data in a well-directed manner. In order to create theory, GTM looks at the different facets of a phenomenon in different contexts rather than at variables. One might wonder how IS researchers are able to draw that distinction. Therefore, GTM might be conducted to articulate statements of interest, that is, politically support selected artifacts. To avoid such suspicion, the researcher should be aware of these areas of conflict.

16.3.3 Awareness of Researchers Using the Grounded Theory Method

Following the discussion of pros and cons above, we want to discuss a few exemplary epistemological fields of tension that an IS researcher intending to apply GTM in the IS context should be aware of when developing grounded theories.

- *Epistemological positioning*: As stated in the sections above, the ontological and epistemological assumptions of GTM are not made explicit and developed over time – especially when applying GTM in IS research. There are elements of critical rationalism and (social) constructivism. Clear positioning is left up to the researcher who should avoid slipping down to idealism (Frank 2006).
- *Parsimony and generalizability*: On the one hand, GTM emphasizes the focus on exemplary case studies and interviews with subject matter experts. On the other hand, the indent outcome of GTM-based research is primarily theory. Quantitative elements (empirical proof of the theory) are also allowed. Hence, it is always difficult to make a case for generalization out of a single case description or derive any general patterns (Lee and Baskerville 2003) – GTM as a method does not help with this issue.
- *Qualitative and quantitative elements*: As discussed above, GTM emerged from critique on purely behavioristic research. On the other hand, concessions were made to empirical researchers. As these two views are very important in IS research, the researcher has to make clear when he or she is following a heuristic approach and when empirical proof is used.
- *Focus on cases and literature discussion*: On the one hand, GTM does not intend to give specific details on the phenomenon under investigation in order to provide an objective perception. On the other hand, GTM suggests an extensive literature study in order to reflect one's own schemes of interpretation. As discussed extensively in the GTM literature, it is questionable to what degree a practitioner in a case study (e.g., a programmer in a software project) can abstract from that project view.
- *Rigor and relevance*: On the one hand, GTM emphasizes the individual freedom of researchers in terms of interpreting his or her research results. On the other hand, GTM provides a strict corset with predicted intended outcome which often supports mainstream opinion. The researcher must therefore carefully move between the concept of truth and purely narrative elements.

As stated before, GTM as a research approach does not help with these issues. To date, the methodological discussion in the literature shows that it is exclusively in the hands of the individual researcher to determine how to approach them. The issues raised above should sharpen the awareness of the individual researcher who intends to apply GTM in the IS field. Moreover, the literature has identified a set of guidelines that help researchers to facilitate GTM's potential. For example, Urquhart et al. (2010, pp. 12–17) provide five guidelines along the GTM process that the researcher should bear in mind: (1) constant comparison, (2) iterative conceptualization, (3) theoretical sampling, (4) scaling up, and (5) theoretical integration. The next chapter elaborates the process of GTM-based research in more detail.

16.4 The Process of Building Grounded Theories in IS Research

Looking at IS-specific literature, the more formalized approach interpreting GTM as a defined methodology has received broader attention among researchers both inside and outside the IS discipline. In IS, the methodological discussion about GTM still is relatively young (Bryant 2002; Urquhart 2002; Urquhart et al. 2010). Building on Lehmann (2001), Fernández (2005) suggests an integration of the current state of the discussion on a process for GTM-based research in IS. Figure 16.1 shows a simplification of this process to illustrate GTM's principal process.

Beyond this process, various recommendations for GTM-based research are well documented in a wide range of sources (e.g., Corbin and Strauss 1990; Strauss and Corbin 1990). Urquhart et al. (2010) recently published an article on guidelines for using GTM in IS research studies. We build on their recommendations in depicting the principal process of a GTM-based study. Moreover, we embed discussions and recommendations from adjacent fields where possible (e.g., Dey 1999; Martin and Turner 1986; Melia 1996; Suddaby 2006; Turner 1983). The following subsections will summarize some of the recommendations and provide a brief overview and introduction into the various steps. The final subsection discusses some general guidelines to ensure the quality of GTM-based research and briefly highlights the properties of theories.

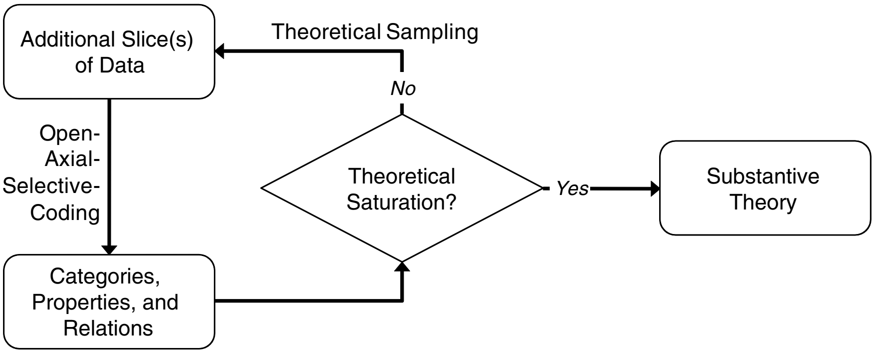

Fig. 16.1 The grounded theory method applied

16.4.1 Starting Grounded Research

There are various sources for entering the field and initiating a grounded research project. Glaser and Strauss (1967) highlight that any interesting observation or lived experience can be such a source. Miles and Huberman (1984), for example, identify "hunches" as a possible reason to start a research process. Urquhart et al. (2010) extend this list by adding anecdotal evidence and even other theories. This initial observation will serve as a basis for the research project in that it helps to more precisely define the area of enquiry and to delineate it from its environment.

Having such a preliminary understanding of the area of enquiry, the researcher will be able to focus his or her attention when entering the field (van de Ven 1992). Many tutorials on how to use GTM explicitly caution the reader against such preliminary work as it bears the risk of building up preconceptions which would, in turn, inhibit the researcher's ability to work truly grounded. While a general caution certainly is advisable, Dey (1999) puts it aptly when highlighting that there is a difference between an "open mind and an empty head." Glaser and Strauss (1967) emphasize that researchers should have a perspective on the matter at hand in order to be able to abstract meaningful data. This interpretation relaxes some of the often rather hard restrictions on preliminary work and the author's potential history within the area of enquiry.

The flexibility in terms of the research's starting point and its implications on the preconditions of Grounded Theory work has a number of advantages. One is that grounded approaches offer researchers a chance to profit from promising opportunities to enter the field (as, e.g., in Day et al. 2009). As the approaches currently discussed in the literature do not require the first observation to be purposefully sampled, researchers can leverage any form of phenomena that promises to be a relevant issue in the field. This can also help the researcher to increase his or her theory's relevance, as the initial data point will originate from an observation that neither he or she nor the subjects in the field can explain using conventional wisdom.

However, the ability to leverage opportunities should not be misunderstood as an excuse for the absence of rigorous scientific work. While GTM has been used as such an excuse in the past (c.p. the discussion in Bryant 2002), many approaches highlight the rather high standards necessary to conduct grounded work in a scientifically sound way. Especially the methodological literature in the Straussian strand of GTM research provides very clear and explicit advice on how to design the overall research process (Corbin and Strauss 1990; Strauss and Corbin 1990).

16.4.2 Data Collection

As GTM is rather an overall framework explaining how to generate theory that is grounded in empirical observations, it allows the researcher to select data collection methods that match the specific context of the research problem. Most of the time, GTM is associated with qualitative research methods. As Strauss (1987) pointed out, there are many sources of data beyond observation alone. Existing GT studies in the IS field used data generation methods such as interviews (e.g., Calloway and Ariav 1995; Seeley and Targett 1997; Work 2002), participant observations, or ethnography (e.g., Ribes and Finholt 2009; Wales et al. 2007), some forms of action research (e.g., Baskerville and Pries-Heje 1999; King 1996), informal conversations in the field (e.g., Goulielmos 2004; Volkoff et al. 2005), focus groups (e.g., Palka et al. 2009), or document analyses (e.g., Lundell and Lings 2003). Some of the papers just quoted also use a combination of two or more of these methods and build case studies (e.g., Levina and Vaast 2008) to support their grounded research projects.

To make data from these very different sources compatible and to document the research process, GTM-based research generally relies on written materials that document the grounds from which the theory will emerge. There is no general guideline with respect to the extent of documentation necessary. The two extremes here are very detailed word-by-word transcripts (which can even be amended by observed facial expressions, changes in an interviewee's voice, etc.) on one side and mere written recollections of the events in the field (e.g., memory protocols). Especially when aggregating various materials into a concise case study, all materials collected need to be documented in a case study database (Gibbert et al. 2008) to ensure the reliability of the observations. Researchers should also make sure that the entire process of how the study was conducted is documented in a transparent manner (Gibbert et al. 2008).

We believe that the choice of data sources should be guided by what is feasible in the field. If, for example, an interviewee does not agree to have the interview recorded, a word-by-word protocol will become very difficult. Generally the more detailed forms of protocols will, however, be preferable. They enable additional researchers to conduct the coding independently which increases the inter-coder reliability of the qualitative data analysis. Moreover, as the research progresses, new categories describing the phenomenon of interest might emerge from the data and checking old materials for concepts one was not aware of at the time can be difficult if the protocols are not complete. Researchers should also try to gain access to additional materials such as archival data. This will help to establish data triangulation (Mayring 2001) and, thus, increase the construct validity of their emerging theory (Gibbert et al. 2008).

16.4.3 Coding and Extracting Categories

Once the first observation has been recorded in an appropriate way, researchers have to go through an extensive process of coding their data. In general terms, coding can be described as a process of describing and summarizing the detailed materials using more and more abstract and general terms. This process is important as it will allow the researcher to extract the underlying concepts that will help build the theory.

The coding process is done in three interrelated steps: open, axial, and selective coding. Open coding is concerned with the principal identification of codes from the text describing the observations in the field. There is an n:n relation between codes and passages of the text they are describing (so-called quotes) as a code can reoccur in various places and in various texts and a certain passage of the text can contain multiple codes.

After all passages of the text have been coded, axial coding aims at the identification of the underlying theoretical categories, their properties, and the relations among them. Categories are generally nouns or verbs relating to objects or persons in the field (likely to become the constructs in the designated theory) while properties generally rely on adverbs or adjectives to describe the categories in more detail (which will help to understand and depict the constructs' nature and their interrelations). To facilitate the identification of these theoretically relevant concepts, a process theoretical perspective on the phenomenon can help. In such a setting, the investigator will generally look not just for the phenomenon itself, but will also pay attention to causal conditions, intervening conditions, actions, consequences, and the context of his or her observed phenomenon (Markus and Robey 1988; Mohr 1982; Sabherwal and Robey 1995).

Once categories and their properties have been established, selective coding will identify categories that are somewhat central to the understanding of the observed phenomenon. One can imagine such "core categories" as a central node in a network that helps to connect and explain the various categories, their properties, their relations, and changes in any of these. Table 16.1 summarizes these stages of theory emergence.

The process of coding can be done manually or using tools for computer-aided qualitative data analysis such as ATLAS.ti, anSWR, or NVivo (for advice on some tools see, e.g., Lewins and Silver 2009). In terms of recommendations, at least the results of the coding process should be documented electronically. This enables the researcher to use tools like Visio for the axial and selective coding processes. The ability to visually rearrange codes to match axial and selective structures can be of great help and makes it possible to describe the research findings graphically. Options for the graphical representation of research findings are available in most of the major software tools for qualitative data analysis.

Closely related to the aspect of preconceptions among the researchers with respect to the phenomenon under investigation, a long-standing debate in the literature discusses the contrast between the emergence of categories from the data versus the forcing of categories onto the data (Kelle 2006; Melia 1996). The roots of this debate date back to the development of different GT interpretations described in Sect. 16.2. When Strauss and Corbin (Corbin and Strauss 1990; Strauss and Corbin 1990) introduced their perspective on a methodology for GT research, Glaser (1992) suggested that such a strong orientation toward a formalization of the GT research process would lead to a situation in which the codes become of primary importance over the empirical materials. Quite contrary to this, he emphasized the continued importance of the data from the field, as they are the central source for the emergent categories that form a theoretical understanding of the phenomenon

Table 16.1 The emergence of a grounded theory

Stage	Purpose
Codes	Identifying anchors that allow the key points of the data to be gathered. Methods are, e.g., axial- or selective coding or memos
Concepts	Collections of *codes* of similar content that allow the data to be grouped
Categories	Broad groups of similar *concepts* that are used to generate a *theory*
Theory	A collection of explanations that explain the subject of the research

observed. While we find it difficult to favor one of these interpretations over the other, we want to bring this discourse to the reader's attention and highlight the importance of positioning one's research in one of these strands and follow its premises in designing one's research project.

16.4.4 Generating Additional Data

Once an observation is documented and analyzed, additional observations will have to be created to increase the emergent theory's explanatory power. From its very beginning, the GT literature strongly emphasizes the importance of theoretical sampling for this step of the research (Glaser 1978; Glaser and Strauss 1967). In GT research, the theoretical sampling should be guided by the researcher's understanding of the emerging theory (Glaser 1992). This means that the researcher will generally look for instances of the phenomenon that will have the potential to add substantial new insights to the theory (Paré 2004; Urquhart et al. 2010; Yin 2002). Eisenhardt (1989) suggests that such a sampling approach "is likely to replicate or extend the emergent theory" (p. 537). This can relate to any of the aspects that are important in the process of emergence of the new theory: categories, properties, causal conditions, intervening conditions, actions, consequences, and the context of the observed phenomenon. The importance of theoretical sampling is highlighted by Urquhart et al. (2010) who state that "theoretical sampling helps to ensure the comprehensive nature of the theory and ensures that the developing theory is truly grounded in the data" (p. 13).

For example, a theoretical description of the building of trust in e-commerce observed in the financial service sector might look substantially different from the same phenomenon if observed in online retailing. There might, however, be parts of the phenomenon that are essentially similar. While the parts that are different help to understand the contingencies of the emerging theory, the similarities that remain rather stable across multiple observations will help the relevant categories, properties, and so on to emerge from the data. This process of adding additional observations, or slices of data, helps to increase the fit of the proposed theory (Urquhart et al. 2010).

Looking for advice on how to generate such additional, theoretically sampled slices of data, the researcher can turn to the initial recommendations by Glaser and Strauss (1967, pp. 49–60) and Glaser (1978, pp. 36–54). In sampling theoretically, the research should consider both the contingencies of the cases as well as the individual categories emerging from the cases (Urquhart et al. 2010). While the former is likely to add external validity (e.g., with respect to causal conditions, intervening conditions, and the context of the phenomenon), the latter can help to improve the construct validity of the categories described (e.g., by adding to the properties and relations of the categories identified as discussed in Charmaz 2006). In both cases, sampling choices should however not try to look for confirmatory evidence or cases, but rather try to sample potentially contradictory instances of the phenomenon. This helps not to look for "more-of-the-same" data, but to actually increase the emergent theory's fit.

16.4.5 Building the Grounded Theory

Taken altogether, the Grounded Theory approach, particularly the way Glaser and Strauss (1967) developed it, consists of a set of steps whose careful execution is thought to guarantee a "good" theory as the outcome. As illustrated in Table 16.1, GTM can be understood as a process of carving out the theory from the various observations or datasets, while collecting and coding of data occur simultaneously. By adding additional observations, mere descriptions of single observations (codes) gradually become more general (concepts and categories) until they, ultimately, form a theory. This process also depicts the "emergence" of theory often referred to in the GTM literature (e.g., Urquhart et al. 2010).

After each generation of an additional "slice of data," the process of data collection and coding is repeated as described above. This iterative process continues until the marginal return of adding new observations is not high enough to substantially extend or alter the theory that emerged from the data so far. Once the analytical generalization of the observations does not add any additional insights, the categories are referred to as saturated (Fernández 2005; Glaser and Strauss 1967; Urquhart et al. 2010). They now contain all the relevant knowledge that emerged from the field. From this basis, the mature GT is then put in its final form.

Toward this final form, and as the theory matures, both the theory's scope and degree of conceptualization are likely to grow over time (Urquhart et al. 2010, pp. 9–12). Looking at the scope, the emerging theory will grow from bounded context to a substantive focus and finally to formal concepts describing the phenomenon. With respect to the degree of conceptualization, the GT will have evolved from a mere descriptive statement to an interpretation and finally into a theory.

As the theory emerges, one of the interesting questions is whether different researchers will identify the same passages or quotes as being relevant and attribute essentially the same meaning or codes to these observations. Only if various raters do the coding process independently of one another will the research team as a whole be able to attain inter-rater reliability with respect to the emerging theory. While the literature offers quite a few hints on processes which ensure such reliability (Miles and Huberman 1984; Myers 1997; Romano et al. 2003), a formal understanding is still in its early stages (Di Eugenio 2000). However, ensuring inter-rater reliability in both the research process and its results is generally regarded to be a sign of high-quality qualitative research (c.p., e.g., Gibbert et al. 2008).

16.5 The Grounded Theory Method Applied to IS Research

Despite its potential and its widespread acceptance in some of our reference disciplines, the adoption of GTM in IS research has been limited to date. In order to identify papers that apply GTM in an IS context, we conducted a literature review of the AIS senior scholars' basket of journals (Saunders et al. 2006). In structuring our review, we rely on established guidelines for reviewing and synthesizing literature (Cooper 1988; Fettke 2006; Webster and Watson 2002). Literature reviews have been identified as a well-suited approach to providing an overview of current work on a given concept in a series of disciplines (Denyer and Tranfield 2006; Mulrow 1994). All journals we reviewed were covered from their first issue to the most recent issue available in the respective electronic databases (EBSCO, ScienceDirect, JSTOR, AISeL, and IngentaConnect). We also used the homepages of the respective journals or publishers (e.g., Wiley and Palgrave Macmillan) to ensure completeness and reliability of our search. Within the databases we conducted an extended search for articles that contain the phrase "grounded theory" in their title, abstract, or keywords. The rationale for this approach is to exclude articles that only refer to GTM superficially or extend work of a previous article that was based on GTM.

The search produces a set of only 27 articles using GTM. As shown in Table 16.2, we conducted a more detailed analysis which shows that these papers can be structured into three groups: (1) papers that use GTM to actually build an IS-specific GT, (2) papers that use GTM or elements of the method but do not build GT (e.g., work with a priori theoretical considerations or which provides detailed empirical accounts of a phenomena using coding element of GTM), or (3) papers that deal with GT or GTM from a methodological standpoint (Becker et al. 2008; Heinrich 2005).

In order to provide an exemplary overview of IS publications that have used this particular method to generate IS-specific theories, we briefly introduce two seminal papers that either use GTM as a methodology (group 2) or that build a Grounded Theory using the GTM principles (group 1).

Papers in the first group of Table 16.2 rely on a grounded approach to actually build an IS-specific theory. As an example, one of the most referenced papers from this group is Orlikowski's (1993) work on CASE tools. Based on two in-depth case studies she develops a theoretical framework that helps to better understand the processes of organizational change connected to CASE tool adoption and usage in an organization. Based on a strong motivation, Orlikowski designs her study to develop a descriptive and explanatory theory. She uses various forms of interviews, document analysis, and observations to investigate two theoretically sampled organizations that introduced CASE tools prior to her study. Through iterative data

Table 16.2 Review of grounded theory articles in leading IS journals

Journal	Group 1	Group 2	Group 3	Sum
EJIS	–	Galal (2001), Volkoff et al. (2005), Work (2002)	–	3
ISJ	Goulielmos (2004), Seeley and Targett (1997)	Calloway and Ariav (1995), King (1996), Lundell and Lings (2003), Siau et al. (2007)	Urquhart et al. (2010)	7
ISR	–	Hunter and Beck (2000)	–	1
JAIS	Day et al. (2009)	DeLuca et al. (2008), Ribes and Finholt (2009), Wales et al. (2007), Webb and Mallon (2007)	–	5
JMIS	de Vreede et al. (1998), Pauleen (2003), Scott (2000)	Zahedi et al. (2006)	–	4
MISQ	Levina and Vaast (2008), Orlikowski (1993)	–	–	2
JSIS	Petrini and Pozzebon (2009)	Irani et al. (2008), Tingling and Parent (2004)	–	3
JIT	Palka et al. (2009), Webb and Gallagher (2009)	–	–	2
Total	11	15	1	27

Group 1: papers that use GTM to build an IS-specific GT
Group 2: papers that use GTM or elements of the method but do not build GT
Group 3: papers that deal with GTs or GTM from a methodological standpoint

collection and analysis, Orlikowski was able to identify a complex model of the interaction of institutional context and strategic conduct that shapes the adoption and use processes of CASE tools in both radical and incremental processes. She also provides detailed accounts of her rich empirical materials and the extensive analysis of the qualitative data she gathered. In doing so, she not only provides the reader with the results of her work. Through her narratives, she is also able to provide a convincing story to illustrate her model's findings (Eisenhardt 1991; Siggelkow 2007).

King's (1996) paper also deals with CASE tools, but focuses on an in-depth study of a single manufacturing company located in the UK. As a participant observer, King gathered a wide set of insight, experience, and knowledge about the case study host's approach to using CASE in developing new systems. While not framing his results explicitly as a stand-alone theory (group 2 of Table 16.2), his work provides very detailed accounts through the use of a project diary, interviews capturing stakeholder views, document analysis, and a selection of quantitative data documenting the development projects. As a result, King offers a set of 12 thorough observations that help to better understand the dynamics surrounding software development projects and how CASE tools can help to address the respective challenges. Grounding his observations in extant literature, King shows that the technological benefits of CASE tools are in fact outweighed by the organizational and social factors surrounding the development projects. His 12 lessons highlight the effects of the latter. Thus his work provides an important input for the development of future generations of CASE tools to go beyond the mere technological focus and provide developers with tools to holistically manage their projects.

Taken together, these examples highlight the potential of GTM-based approaches to investigate very complex phenomena in an IS context in a detailed way. Using the principle of emergence, both Orlikowski and King were able to generate interesting theoretical observations that – while grounded in extant literature and related theories – are specific to the IS context and help to advance our understanding of how to better develop, implement, and use CASE tools.

16.6 Discussion and Outlook

While a review of GTM-related literature as short as this one cannot be exhaustive, we hope that the articles discussed above provide a basic idea with respect to GTM's potential. However, more research exists that follows principles of grounded research but does not explicitly refer to Grounded Theory per se (e.g., Feller et al. 2008; Kirsch 2004; Lederer and Mendelow 1990; Ransbotham and Mitra 2009; Sarker and Sarker 2009). Rather than being exhaustive, our brief introduction of GTM is intended to make a case for GTM as a powerful approach to generate IS-specific theories. While Sects. 16.2 and 16.3 of this chapter have highlighted some potential particularities of an application of GTM in the IS context, we think that a more widespread use of this approach to theory development to explicitly build, extend, and refine IS theories can help to answer the call for an IS-specific cumulative tradition of scientific discovery (e.g., Lee 2001a; Weber 2003; Zmud 1998).

In order to do so, IS theories need to go through a process of maturation. Such a process can also be found in other scientific disciplines. In the administrative sciences, for example, Van Maanen (1989) highlights the need for a strong basis of descriptive narratives before being able to build strong theories. Quoting Weick (1992), Sutton and Staw (1995) highlight that knowledge grows by extension and that providing accounts of small but comprehensible events is a chance to build cumulative theory. The interrelationships among theory types identified by Gregor (2006, p. 630), from mere analysis of a phenomenon (type 1) to prescriptive statements of design and action (type 5), and the fact that the ability to predict and guide action is only covered by theory types 3–5 show that such a process is also present in IS theories.

We suggest that using GT-based work helps to produce the detailed empirical accounts needed to build substantive theories. These narratives have been identified as a starting point for the development of mid-range or even grand theories in IS research (Dyer and Wilkins 1991). This helps initial IS theories to have fit and relevance (Glaser and Strauss 1967) and to be current and interesting in their domains (Benbasat and Zmud 1999; Davis 1971; Lewis and Grimes 1999). Reviewing current GTM publications, we were able to identify some examples of such accounts. The works by King (1996) and Work (2002) (both group 2 in Table 16.2) document the extensive analyses the authors have conducted in their respective areas and offer a great opportunity to develop IS theories from these IS-specific contexts.

However, current IS research often seems to be reluctant to rely on such early and often small theories or theoretical accounts that have been produced from an IS-specific context. Quite to the contrary, IS researchers seem to be more enthused by relying on (grand) theories from adjacent disciplines (Weber 2003). We, however, think that IS researchers should not be afraid of the challenge to "fill our discipline with theoretical and empirical substance distinct from the substance of supporting disciplines" (Simon 1996, p. xii). A potential source of such substance is the intersection between the social, technological, and artificial sciences. With IS research as an integration of these three, research on IT in socio-technical systems is confronted with different research traditions (Alter 2002; Evermann and Tate 2009). Bridging the gap between these is one of the core challenges of the IS field and we suggest that IS-specific theory can help to do so. Lee (2001b) supports this by pointing to the value of examining the interaction between technological and social systems. Emphasizing the role of the IT artifact in theorizing in IS research, Orlikowski and Iacono (2001) highlight how IS theories can inform both research and practice on how an understanding of behavioral processes influences the design of IT artifacts and how these, in turn, impact behavioral processes. Gregor (2006) also points out the need for theories that help us understand the links between the natural sciences, the social sciences, and the sciences of the artificial to bridge this gap.

Looking at the IS literature that does explicitly build theories (group 1 in Table 16.2), GTM-based studies can be shown to help empirically mature theories from description to design while grounding them in an IS-specific context. Table 16.3 introduces a classification of the 11 group 1 papers from Table 16.2 according to the type of theory (Gregor 2006) they develop.

Day et al. (2009) (group 1 in Table 16.2, theory type 2 according to Gregor's (2006) classification scheme) use their insights from investigating the disaster response to hurricane Katrina to identify a set of factors that explain how information flows are impeded in extreme cases. Pauleen (2003) (also group 1, type 2) offers a detailed discussion how leaders can facilitate relationship building in virtual teams. These papers show that once the understanding of the phenomena grows beyond good stories alone, the identification of constructs and relations that are present beyond individual cases help to build a plausible theoretical understanding of the underlying dynamics determining the principal process of the phenomenon (Eisenhardt 1991; Eisenhardt and Graebner 2007).

Such understanding and explanation will enable predictions. A good example is Palka et al. (2009) (group 1, type 3) who built a Grounded Theory of mobile viral marketing (p. 172). Such an understanding will, in turn, give practitioners an understanding and some control of the situations they find themselves confronted with (Bryant 2002, p. 29). We think it is important to highlight that while IS research accumulates knowledge on a certain subject, these insights should also be integrated back to the larger body of (IS-specific) theory. This corresponds to the suggestion of enfolding extant literature often recommended in the context of case-based theory building (Eisenhardt 1989; Gibbert et al. 2008). An example is the paper by De Vreede et al. (1998) (group

Table 16.3 Theory types developed by GTM-based papers in IS research

Theory for …	Papers
… analysis	Seeley and Targett (1997)
… explanation	Day et al. (2009), Levina and Vaast (2008), Orlikowski (1993), Pauleen (2003), Petrini and Pozzebon (2009), Scott (2000)
… prediction	Palka et al. (2009)
… explanation and prediction	de Vreede et al. (1998)
… design and action	Goulielmos (2004), Webb and Gallagher (2009)

1, type 4) in which the authors use a grounded analysis of the acceptance of a group support system in an African context to identify constructs refining the technology acceptance model (Davis 1989; Davis et al. 1989).

Once theories reach a certain level of maturity, they are ready to inform the design of IS artifacts by serving as kernel theories (Hevner 2007; Hevner et al. 2004) to design theories (Gregor 2009; Gregor and Jones 2007; Walls et al. 1992). Looking at the current body of GTM-based research, Webb and Gallagher (2009) (group 1, type 5) suggest a methodology for multimedia systems development which they ground in a study of development processes in 16 companies.

Observing the behavior of actors and systems as they are confronted with the effects of the artifact will then serve as an opportunity to extract knowledge relevant to extend, refine, or even reject theories (Kuechler and Vaishnavi 2008). This way, in the terms of GTM, instantiations of IS theories in practice by means of designing artifacts can serve as an additional "slice of data" in the process of theoretically sampling more data to work toward theoretical saturation. Such an approach will enable the empirically grounded extension and maturation of IS-specific theories. While GTM-based research has been interpreted as a method for theory generation only, we suggest that a careful integration of grounded observations into the existing body of knowledge also allows for the opportunity to extend and refine existing theories while maintaining their empirical grounding.

16.7 Final Remarks and Conclusions

Scott (2000) finds that GTM has reported strengths that qualify it to be employed in the process of scientific discovery in our discipline. Looking at the process of GTM-based research, we think that it does, indeed, offer IS researchers with a great opportunity to defined, refine, and extend IS-specific theories. Specifically, the process of transforming behavioral theories into kernel theories for design and using the design to feed back into theory development and extension might be the origin of future IS-specific theory. Looking at the GTs we studied across this cycle, we have to concur with Weber's (2003) observation we introduced earlier: Only few of the GTM-based studies conducted to date rely on IS-specific theories when they analyze, assess, and enrich their empirical observations. Many of the papers in group 1 of

Table 16.2 build their contributions from scratch. Moreover, many of the group 2 papers rely on ex-ante theoretical work outside the IS discipline they are drawing from to inform their research.

Based on our suggestions for the process of GTM research made in Sect. 16.4 and the awareness issues we raised in Sect. 16.3, we think that research following a grounded paradigm has great potential to conduct some of the conceptual work that extends our theoretical understanding of the phenomena we study in practice. Looking at the process of theory maturation depicted above, such an addition of conceptual, theory generating work will help to build and advance our discipline's cumulative tradition and help to gain on our reference disciplines in the race for credibility.

In this chapter we introduced the GTM as an approach for building new theories from what we learn in IS research. GTM has great potential in terms of ensuring relevance of our research results through permanently grounding theoretical considerations in empirical observations. At the same time, it allows for a theoretical lens on the interpretive constructs derived from the field. As shown in Sect. 16.4, GTM also provides a framework for action. Its use creates insights that often allow us to act in ways that we may not have thought possible before, which is one of the core purposes of our discipline: Develop guidelines on how to build future artifacts that create new or enhance current socio-technical systems.

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Chapter 17
Conducting Information Systems Research Using Narrative Inquiry

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Abstract This chapter places Narrative Inquiry in the theoretical context of Grounded Theory. To begin, Grounded Theory is explained along with the concept of Grounded Theory Method, which employs the constant comparison of data obtained through qualitative interviews. Then Narrative Inquiry, within this context, is introduced and explained. The discussion leads to the necessity to adopt an interview technique within the Narrative Inquiry approach to gather interview data. Thus, a more specific technique is described known as the Long Interview Technique. This technique further requires the development of an interview guide specifically related to an individual project. This guide is referred to as an interview protocol. While the interview protocol must be developed to allow flexibility within the interview and reduce researcher bias, it must also support a consistent approach to conducting a number of interviews to gather data related to the research question. This overall approach is related to conducting research in general and more specifically information systems research. Recent information systems research investigations are presented.

Keywords Grounded Theory Method • Narrative Inquiry • Long Interview Technique • Interview protocol

Abbreviations

CIO	Chief Information Officer
CEO	Chief Executive Officer
CTO	Chief Technology Officer

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IS Information Systems
HRM Human Resource Management
URL Universal Resource Locator

17.1 Introduction

If a researcher investigates a subject area that is relatively new and evolving, it is incumbent upon the researcher to adopt an approach that facilitates the identification and exploration of emerging constructs. Information Systems is an area which contains a plethora of these opportunities. A qualitative perspective can be employed in response to this suggested approach. Qualitative researchers document the meanings that research participants use to describe their experience relative to a research question.

> Qualitative research methods are designed to help researchers understand people and what they say and do. They are designed to help researchers understand the social and cultural contexts within which people live. (Myers 2009, p. 5)

Data is gathered relative to a research question employing a technique which will facilitate subsequent analysis. The data-gathering technique must promote a consistent approach while allowing flexibility. Consistency is necessary in order to be able to analyze data gathered from a number of sources. Flexibility allows the research participant to freely respond to the research question.

The learning objective of this chapter is to provide the context and description of an approach and a technique which responds to the research issues of consistency and flexibility in qualitative research. Within the Narrative Inquiry approach, an interview protocol is developed based upon the concepts of the Long Interview Technique. The interview protocol provides the consistent approach but still allows the research participant to describe their response to the research question.

This chapter is organized in the following manner. To begin, a qualitative perspective is described. Then, a discussion of Grounded Theory (Glaser and Strauss 1967; Strauss and Corbin 1990) provides the context for the Narrative Inquiry (Scholes 1981) approach. The Long Interview Technique (McCracken 1988) is employed to operationalized narrative Inquiry. Examples of research projects in three research programs that employed this overall perspective are included for further elaboration. These examples include research programs relating to volunteer turnover of information systems professionals; information systems and small business; and the role of Chief Information Officers. Finally, the conclusions section provides general comments about conducting information systems research from the perspective outlined in this chapter.

17.2 Qualitative Research Perspectives

Qualitative researchers spend a significant amount of time investigating the experiences of research participants in their natural surroundings. The researcher and research participant work together to document meanings and develop interpretations that the research participant holds regarding a specific research question. Because the researcher and research participant work so closely together, concerns arise regarding bias, reliability, and verification.

Bias may be introduced into the data-gathering process when conducting interviews. Questions may be posed in a certain way which will bias the response of the research participant. Also, specific issues may be pursued more or less intensively. Thus, the researcher must be aware and guard against introducing this form of bias into the interview questions and data-gathering process. The development and use of a standard interview protocol serves to reduce the potential for bias. Further, posing questions in a nonevaluative manner will also address this issue.

Reliability, "… relates to the extent to which our observations are stable, dependable, and can be replicated" (Pervin 1986, p. 271). Thus, in qualitative research, reliability may be assessed by comparing the results obtained by another investigator employing the same research method to conduct a replication.

As above, verification may be assessed by replication. A qualitative researcher will present conclusions about a research question related to a specific topic. Subsequent investigations may replicate the initial research project which may support or refute the initial results.

In general, the response to the concerns about bias, reliability, and verification relates to developing and employing an appropriate research method with regards to the research question. While it is important to address these concerns, some qualitative researchers would suggest that, "… it is much better to be deeply interesting than accurately boring" (Reason and Rowan 1981, p. xiv).

In the information systems area, it has been suggested that a qualitative perspective be considered. "… information systems epistemology draws heavily from the social sciences because information systems are fundamentally, social rather than technical systems" (Hirschheim 1992, p. 28). Lee (2001) supported this definition suggesting that information systems researchers investigate, "… the phenomena that emerge when the technology and behavioral interact …" (Lee 2001, p. 247). Further, Galliers (1992) presented an information systems research taxonomy (included here as Table 17.1) to support his proposal that researchers must adopt a research method based upon both the objectives for conducting the research and the specific research question. Gallupe and Tan (1999) supported this idea by challenging information systems researchers to investigate alternative qualitative research methods.

17.3 Grounded Theory

Grounded Theory involves, "… the discovery of theory from data systematically obtained from social research" (Glaser and Strauss 1967, p. 2). The theory defines categories and properties. A category is a concept which emerges from a review of the data. A property represents a description of a category. So, the category of "communication" may have properties such as "written" or "verbal". Categories and their properties are identified through a process of constant comparison of the data. Thus, they emerge from the data. "…by comparing where the facts are similar or different,

Table 17.1 A taxonomy of IS research approaches

Modes for traditional empirical approaches (observations)							
Object	Theorem proof	Laboratory experiment	Field experiment	Case study	Survey	Forecasting	Simulation
Society	No	No	Possibly	Possibly	Yes	Yes	Possibly
Organization group	No	Possibly (small groups)	Yes[a]	Yes[a]	Yes[a]	Yes	Yes
Individual	No	Yes	Yes	Possibly	Possibly	Possibly	Yes
Technology	Yes	Yes	Yes	No	Possibly	Yes	Yes
Methodology	No	No	Yes	Yes	Yes	No	Yes
Modes of newer approaches (interpretations)							
Object	Game/role playing	Subjective/argumentative	Descriptive/interpretive	Action research			
Society	Possibly	Yes	Yes	Possibly			
Organization group	Yes	Yes	Yes[b]	Yes[b]			
Individual	Yes	Yes	Yes	Possibly			
Technology	Yes	Yes	Possibly	No			
Methodology	Yes	Yes	Yes	Yes			

[a]Includes longitudinal studies
[b]Includes future research

we can generate properties of categories that increase the categories' generality and explanatory power" (Glaser and Strauss 1967, p. 24).

A significant effort is required to collect and analyze qualitative data (Luna-Reyes and Andersen 2003). Obtaining access to research participants can be very difficult. Conducting interviews, discussed in a subsequent section of this manuscript, is very time consuming. Contents of the transcripts resulting from the interviews must be reviewed thoroughly to identify emerging themes (Glaser and Strauss 1967).

Grounded Theory may be used as a research philosophy or a data analysis technique (Urquhart 2001). When employed as a research philosophy, there is no adoption of an a priori research framework or theoretical context. The researcher poses a research question and proceeds to gather data relative to the research question. Subsequent analysis of data will provide elaboration of the underlying constructs that explain a response to the research question. When Grounded Theory is employed as a data analysis technique, it is commonly referred to as Grounded Theory Method.

Grounded Theory Method focuses on the constant comparison of data to identify emerging themes. It is common practice to identify emerging themes when conducting qualitative research (Miles and Huberman 1994). To accomplish this, the data are coded in three ways. First, interview transcripts are thoroughly reviewed and important terms and phrases relative to the research question are noted. The data may be assigned to an existing category and used to create a new category. This first step is known as "open" coding (Strauss and Corbin 1990). Second, Axial coding (Strauss and Corbin 1990) is employed to identify relationships between the categories. Usually, many transcripts are employed in this step. An overall framework starts to emerge from the data in response to the original research question. Third, selective coding (Strauss and Corbin 1990) provides further elaboration of the categories and their properties. New categories may emerge or existing ones may be further supported. Eventually, theoretical saturation (Strauss and Corbin 1990) is attained and no new categories and properties emerge from the data. Throughout the interview process and data analysis, the qualitative researcher must, "… be open to possibilities afforded by the text rather than projecting a predetermined system of meanings onto the textual data" (Thompson 1997, p. 441). Grounded Theory Method facilitates the development of a framework relative to the research question.

17.4 Narrative Inquiry

If the objective of a researcher is to record and analyze a specific story about a past event, then Narrative Inquiry may be appropriate. Narrative Inquiry involves the documentation of, "… a segment of one's life that is of interest to the narrator and researcher" (Girden 2001, p. 49). The Narrative Inquiry process involves documenting the research participant's story via, "… a sequence of events connected by subject matter and related by time" (Scholes 1981, p. 205). The concepts of subject matter and time are important considerations in the use of Narrative Inquiry.

The subject matter concept is defined by the term contextually rich, which suggests that those events experienced firsthand are more memorable and more readily remembered (Tulving 1972). Swap et al. (2001) support this contention suggesting that personal experiences are more memorable. The concept of time is defined by the term temporally bounded which suggests that stories involve a chronological series of events with a specific beginning and end. Relating the discussion to both personal experiences and organizing a sequential discussion of events facilitates the documentation of specific stories.

17.5 The Long Interview Technique

In order to document the above stories, an interview protocol is developed. Recall that the interview protocol promotes consistency across a number of interviews while still allowing flexibility for the research participant to tell their story. The interview protocol is developed within the purview of the Long Interview Technique (McCracken 1988). The protocol grounds the interview in the personal experience of the research participant (Swap et al. 2001). It also facilitates a chronological discussion of the events (Bruner 1990; Czarniawska-Joerges 1995).

McCracken's (1988) "Long Interview" technique may be used in order to provide some structure to the interview, yet allowing research participants to reflect on their personal experiences in a relatively unbiased and free-flowing manner. The four-step technique involves the following:

- Gaining an awareness of the relevant literature
- Introspectively understanding one's own awareness of the research question
- Conducting the interview during which research participants have an opportunity to tell their story
- Conducting analyses of the interview data to identify emerging themes.

The research participants are encouraged, through the research method, to thoroughly describe their interpretations of a specific experience. This process identifies important factors grounded within that experience.

During the course of the interview, research participants are asked to reflect upon their past work experiences. Initially, "grand tour" (McCracken 1988) questions are asked. These questions are general in nature and nondirective in manner, allowing the research participant to specify much of the substance or perspective of the interview. Throughout this section of the interview, "floating prompt" (McCracken 1988) questions are asked. The nature of these questions depends upon the content of each interview, and, generally, relate to the researcher's decision to pursue a thread of discussion in more detail. Specific or "planned prompt" (McCracken 1988) questions are asked near the end of the interview in order to address issues gleaned from the literature or previous investigations.

The following section presents descriptions of a series of information systems research projects which took a qualitative perspective. They employed Grounded

Theory Method and Narrative Inquiry. Specific interview protocols were developed for each project within the research programs and two are included here in appendices.

17.6 Discussion

This section includes a series of research programs relating to voluntary turnover of information systems professionals; information systems and small business; and the role of Chief Information Officers.

17.6.1 Voluntary Turnover of Information Systems Professionals

A series of projects were conducted to investigate the voluntary turnover decisions of information systems professionals (Hunter et al. 2010; Hunter and Tan 2006; Tan and Hunter 2003; Hunter and Tan 2001). Voluntary turnover is defined as "… a conscious and deliberate willingness to leave the organization" (Tett and Meyer 1993). For the investigations reported here, the research participant's resume served as the interview protocol. Previous research has shown that the resume facilitates the research participant's recall of personal experiences and their decisions about seeking alternative employment (Baker 1991). The resume provided a consistent format across a number of interviews as the questions mainly related to a discussion of the individual's career. As a slight deviation from the chronological discussion espoused by Bruner (1990) and Czarniawska-Joerges (1995), the resume was employed as the interview guide in reverse chronological order. Thus, the interview started with the most recent position and proceeded back through the resume.

Starting with the current position, the research participant was asked the following:

- Describe your current position
- Why did you take this position?
- Why did you leave the previous position?

Then questions were posed about the previous position asking the same as above and so on until the discussion reached the beginning of the research participant's career in information systems.

As is common with qualitative research, common themes were identified across the interviews (Miles and Huberman 1994). In general, it was determined that the research participants tended to identify more with their chosen profession than with a specific company. They were prepared to move to another company in order to gain experience with a technology or to stay current with that technology.

The results of this investigation were compared to the Unfolding Model of Voluntary Turnover (Mitchell et al. 2001; Lee and Mitchell 1994). There exist two categories of models related to voluntary turnover. Rational models (Mobley 1977; Steers and Mowday 1981) suggest the turnover decision is made because the individual experiences some form of dissatisfaction and that the decision process is a rational one. The second category of model is Instinctual (Campion 1991; Lee and Mitchell 1994; Lee et al. 1996; Mitchell et al. 2001) which suggests that an individual will decide to leave a company as the result of an event which may be either positive or negative. The Unfolding Model was chosen as the most appropriate because of the unique aspects of the information systems profession (Buie 1988; Couger and Adelsberger 1988; Couger et al. 1989; Lyons 1985; Smith 1988; Wynekoop and Walz 1998) which are not reflected in the more traditional models. The information systems professional may decide to leave a company not because of a negative situation or event but because of an unsolicited offer (Rouse 2001).

17.6.2 Information Systems and Small Business

The use of information systems by small business was investigated through a series of projects. One project was conducted in Eastern Canada, then one in Western Canada. The third project explored this topic on a limited international basis. Appendix A includes the interview protocol that was used for this series of projects.

There are unique aspects to consider when investigating small businesses in general and their use of information systems. First, there is no generally accepted definition of a small business. Measures such as sales, revenue, or investment may not be used because most small businesses are privately held and this information will not be made available because of confidentiality reasons. Usually, number of employees is used to categorize the size of a small business. However, there is still not agreement about the specific numbers. Thus, the researcher, at the beginning of the research project, will provide an explanation about why a specific number was chosen. Second, small business is different than large business (Stevenson 1999). Thong et al. (1994) have employed the term "resource poverty" to explain the unique aspects of small business. Thus, the small business manager does not have the resources that a large business manager may have. These resources relate to time, finances, and human resources. Third, the strategic perspective taken by small business is unique. Because of the second aspect above, small business managers will tend to commit a minimum of resources to a business decision and will prefer to make these decisions in a multistage approach in order to maintain flexibility.

The first project in this series (Hunter et al. 2002, 2001; Pugsley et al. 2000) involved investigating small business use of information systems in Eastern Canada. Two generic themes were identified relating to efficiency and dependency. The efficiency theme suggests that information systems tend to be used for everyday use and not necessarily to attain or maintain competitive advantage. Other previous research supports this finding (Berman 1997; Fuller 1996; Lin et al. 1993; Nickell and Seado 1986; Timmons 1999). The finding that small business does not use information systems strategically is also supported in other research (Bridge and Peel 1999; Dandrige and Levenburg 2000).

The second theme which emerged from this investigation relates to dependency. Thus the small business manager in their use of information systems may become dependent upon an internal champion or an external influence. The internal champion is someone from within the small business who may take on the role of a relative expert in the use of computers and the information system used by the small business. An external influence is someone outside the small business who may be able to influence the small business manager regarding the use of information systems. This external influence may be found in an accountant or vendor who provides other similar services to the small business.

The second project (Hunter 2008, 2003) was a replication of the first project. But, this time the investigation was conducted in Western Canada. The same interview protocol was employed. While similar results were determined, it provided further support for the external influence. However, in this case, it became incumbent that the external influence should understand the concept of resource poverty (Thong et al. 1994) and how it will affect the decision-making process of the small business manager.

The third project (Hunter 2005b, c; Hunter et al. 2005) was a further replication on a limited international basis. Again, similar results were determined. Thus, this project showed that there was limited variability based upon geographic location of the small business.

17.6.3 The Changing Role of Chief Information Officers

This program (Hunter 2007, 2006, 2005a) attempted to develop a more detailed understanding of the role of the Chief Information Officer.

Organizations formally recognize the strategic importance of information through the establishment of the CIO role within the organization along with appointment to the senior management committee. This appointment represents the recognition by the organization's senior management committee that they are responsible for governance of all aspects related to the use of information technology.

Unfortunately, as the CIO is a relatively new member on the senior management committee, there are issues regarding the evaluation of their performance (Marchand 2008). Indeed, the turnover rates for CIOs is double that of other members of the senior management committee (Capella 2006).

The interview protocol employed in this investigation is included here as Appendix B. A total of 18 research participants were interviewed who performed the role of CIO. They were from New Zealand (5), Taiwan (6), and USA (7). The individuals were identified through industry or personal contacts. The main part of the interview focused on the research participant's experience in performing the role of CIO.

The emerging themes related to either management issues or technology issues. The management issues included such aspects as governance, growth and change, supply chain, staff and skills requirements, user relations, project management, and performance evaluation. The technology issues related to system integration, security, data warehouse, and wireless or mobility.

In response to the issues surrounding turnover and performance evaluation, it was determined that the role expectations should be aligned between the person performing the CIO role and the CEO. The term alignment has been employed in previous research (Reich and Benbasat 2000; Seddon et al. 2002). Thus, the CEO who represents the expectations of the senior management committee may desire leadership from the CIO to create an effective vision for change through the use of information technology. Alternatively, the CEO may simply expect the CIO to efficiently manage the currently available information technology. This alternative perspective is more related to the role known as the Chief Technology Officer. So, the person performing the CIO role must understand the expectations of the CEO and other members of the senior management committee and respond appropriately in performing that role. Interpretations about the performance of the role must be clear and specific amongst all of the stakeholders.

Many organizations have both the CIO role with a CTO role reporting to the CIO. Some have both of these roles sitting on the senior management committee. This is in response to the increased complexity of the CIO role (Peppard 2007). As the CIO role has expanded to take on more of an external perspective to provide effective vision, the CTO role has become responsible for the efficient management of internal operations. Thus, consideration must be given to the alignment of these roles with the assignment of tasks and with the expectations of the senior management team. The organization benefits in many ways with these two roles as members of the senior management team. The team is more collaborative and is able to approach planning in a proactive manner. Decision making is both efficient and effective because of the immediate consideration for both the affect on business processes and the availability of technological support.

The results of this investigation did not determine the expected variability with regards to culture. The training and education of those performing the CIO role seems to circumvent the cultural background of the individual. This contention has been supported by Grover et al. (1993) and Pearson and Chaterjee (2003).

17.7 Conclusions

The above three program descriptions have included a discussion of how to employ a guide to conduct qualitative interviews. One program used the research participants' resume to organize the interview. The others employed an interview protocol which was developed based upon the research question related to the area of investigation.

In general, the objective of all three program areas was to conduct in-depth interviews to gather research participants' interpretations of a specific subject. The interview technique supported the post-interview analysis of the transcripts to identify emerging themes. Further, the technique adopted also facilitated subsequent analysis of these themes across a number of interviews. Thus, while it was considered important to allow the research participants as much flexibility as possible regarding their expression of their interpretations, it was also necessary to adopt an interview technique which would provide some level of consistency over several interviews.

Finally, the technique provides a detailed way to apply the Narrative Inquiry approach to conducting qualitative interviews. The technique contributes to a flexible yet consistent way to gather research participants' interpretations in one-on-one interviews and then to compare these interpretations based upon a number of interviews.

Appendix A. Information Systems and Small Business

A.1 Interview Protocol

The focus is now on IS

- How would you define Information Systems (IS)?
- How does your company use IS to enhance your business?
- Specifically, what are the top 3 uses of IS in your firm?
- How are decisions made to add new IS? What was the last IS addition? Why?
- Do you have an IS strategic plan? Can you expand on the plan? (Can we have a copy?)
- Is IS delivering on expectations? (Are you satisfied with your company's IS?) In what ways? In what ways is it failing to deliver?
- What IS addition has had the most impact on your organization? The least?
- What is your biggest constraint in achieving your desired IS objectives?
- What information do you need most urgently in your business?
- Has IS helped your organization in the decision-making process? Expand.
- Has IS helped your organization be more innovative? Expand.
- Has IS helped your organization in – Marketing and Selling; Financial; Manufacturing, Accounting; HRM; Supply Chain; etc.?
- Do you have any questions of us?

APPENDIX A
Information Systems and Small Business
Interview Protocol

We are interested in finding out how your "Information Systems" support your business. This interview will last about two hours and will be audio taped with your permission and the guarantee of confidentiality. To start off, we would like to collect some statistical information about you and your organization.

Date of Interview:

Name of Interviewee: Position:

Telephone: Fax: Email:

Gender: Male – Female Age 21-30, 31 –40, 41 – 50, 51 +

Years of Work Related Experience: Years with this Organization:

Highest level of Education: HS – C – U – M – PhD Professional Designation:

What are your Duties?

Name of Organization:

Year Established: Stage (Revenue): Expansion – Stable - Contraction

Type of Organization: Mfg - Retail - Service – Other:

Main Products &/or Services:

Market Served: Local – Provincial – National - International

Number of Employees: Past two years: Expanded – Contracted – Not Changed

Number of PCs operating: Networked: Yes - No

Primary means of Communication: Internal - face-to-face - phone - messages - email - other

Primary means of Communication: External - face-to-face - mail - telephone sales - email

Major form of advertising: Web page - yes - no

The focus is now on IS.

- How would you define Information Systems (IS)?
- How does your company use IS to enhance your business?
- Specifically, what are the top 3 uses of IS in your firm?
- How are decisions made to add new IS? What was the last IS additions? Why?
- Do you have an IS strategic plan? Can you expand on the plan? (Can we have a copy?)
- Is IS delivering on expectations? (Are you satisfied with your company's IS?) In what ways? In what ways is it failing to deliver?
- What IS addition has had the most impact on your organization? The least?
- What is your biggest constraint in achieving your desired IS objectives?
- What information do you need most urgently in your business?
- Has IS helped your organization in the decision making process? Expand.
- Has IS helped your organization be more innovative? Expand.
- Has IS helped your organization in – Marketing and Selling; Financial; Manufacturing, Accounting; HRM; Supply Chain; etc?
- Do you have any questions of us?

Appendix B. The Changing Role of Chief Information Officers

B.1 Interview Protocol

Part A

1. Personal History
   (a) Where were you born?
   (b) Where did you grow up?
   (c) Are you married?
   (d) Any children?
   (e) Please relate a personal interest story.
2. Family History
   (a) Parents
   (b) Siblings
   (c) Where you lived
3. Education
   (a) Where and when did you go to elementary school, high school, and university?
4. Previous Work Experience
   (a) What companies have you worked for?
   (b) What positions have you held at these companies?
   (c) What were the highlights as far as tasks performed and major accomplishments?

Part B

5. Current Position
   (a) Company background
      i. What is the industry?
      ii. When was the company formed?
      iii. What is the company's industry relationship (market share)?
      iv. What is the company Mission?
      v. Are there any unique aspects to the company that you find interesting?
      vi. What is the URL for your Web site?

   (b) Why did you accept your current position?
   (c) What issues initially required your attention?
      i. Describe the issue.
      ii. Discuss what you did.
      iii. Discuss the final result.

   (d) What issues are you currently addressing?

      i. Describe the issue
      ii. Discuss the status and anticipated outcome.

   (e) What issues do you foresee addressing or requiring your attention in the future?

      i. Describe.
      ii. How do you plan to address the issue?
      iii. What is the anticipated outcome?

Part C

6. Pick a week and tell me what you did
   (a) Describe the task
   (b) Indicate the number of hours you spend doing the task
   (c) Was there something that you did not do that week that you normally would?
7. Dealing with Users.
   (a) How do you determine what your users want/require?
   (b) How do you know that you have responded to what your users want/require?
   (c) How do you know that you have delivered what your users want/require?
8. How do you decide on investments in:
   (a) Hardware?
   (b) Software?
   (c) People?
   (d) Tools?
   (e) Techniques and methods?
9. General comments about CIOs and their emerging and evolving roles.

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Chapter 18
The Mikropolis Model: A Framework for Transdisciplinary Research of Information Systems in Society

Jan-Hendrik Wahoff, João Porto de Albuquerque, and Arno Rolf

Abstract Today information and communication technology is extensively used in business and private contexts. Rapid technological developments drive a process of tapping new areas and further penetrating existing areas of application with information and communication technology. This not only affects the way we live and work on an individual level – it affects our *society* on a global level. While the effects of information technology on individual, group, and organizational level have been, and continue to be, studied on the basis of a wide array of frameworks, models, and theories, we lack a means of doing research with respect to the societal-level aspects of information and communication technology and information systems, in particular. Questions about how technology and organization coevolve, and about how these coevolutionary processes interact with societal factors and conditions are not adequately addressed. Information systems *in society* are a genuine area of study of the information systems research community. We believe, however, that a problem-oriented, transdisciplinary approach is necessary. The Mikropolis Model presented in this chapter provides a framework for studying information systems in society in a problem-oriented, transdisciplinary manner.

Keywords Development and use of ICT • Information systems in society • Problem-oriented research • Transdisciplinarity

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Abbreviations

ICT Information and communication technology
IS Information systems
ISR Information systems research
IT Information technology

18.1 Introduction

Information Systems (IS) have been and continue to be studied as subjects in their own right. Many theories have been designed and adopted for the study of IS. The web resource (Schneberger and Wade 2010) lists about 80 such theories used in IS research (ISR). These theories provide a background against which IS may be studied in a specific and concise manner. However, theories (re-)construct the subject of research; they, thus, limit the scope of, and perspective on, the subject of research.

While as a whole exhibiting a large variety of perspectives, the majority of theories used in IS research (ISR) is focused on the individual, group, or organizational level. It may be inferred that they are, thus, limited to the study of IS and their interplay with their immediate (business and organizational) contexts.

However, acknowledging the impact of IS on society and vice versa calls for a broader scope of research that takes into account societal aspects as well. Especially the processes driving the development and use of IS[1] and the interactions with societal contexts need to be addressed in a problem-oriented manner. This means, that the development and use of Information and Communication Technology (ICT) need to be conceptualized as a societal process which, as such, is inherently problematic.

Moreover, as we will argue below, while allowing for multiple perspectives in the study of IS (Lyytinen and King 2004; Galliers 2003) as systems embedded in society, an integrative framework (Balsiger 2005) or "generalized axiomatic system" (Jantsch 1972) is necessary to provide a common terminology and to integrate multiple concepts and perspectives in transdisciplinary research on IS.

The Mikropolis Model was developed to serve both purposes: it is (1) designed for the study of development and use of ICT in society, and (2) designed to provide a common framework for multi-perspective, transdisciplinary research.

The remainder of this chapter is organized as follows: In the next section we discuss problem-oriented research and argue for a transdisciplinary research approach for IS in society. This is followed by an outline of the Mikropolis Model. The ensuing section will discuss the Mikropolis Model. Present and future research to further develop the Mikropolis Model is discussed.

[1]In the following we will refer to the *development and use of ICT*, as this voices a more general perspective which encompasses the *development and use of IS*, in particular.

18.2 Problem-Oriented Research and Trandisciplinarity

This section discusses problem-oriented research and transdisciplinarity. We will first delineate problem-oriented research from other modes of research, namely, basic and applied research. We will then discuss problem-oriented research as a mode of research addressing societal problems. Several concepts of multidisciplinary research are presented delineated from transdisciplinarity. Finally, transdisciplinarity is discussed against the background of ISR.

18.2.1 The Nature of Problem-Oriented Research

We assume three basic modes of scientific research: basic research, applied research, and problem-oriented research. With problem-oriented research being the most recently developed research approach it is necessary to describe and delineate it from basic and applied research.

Generally, the process of scientific knowledge acquisition is, rather than being induced by perception, observation or data collection, foremost driven by problems: it starts with a problem (Popper 1969, p. 104).This leads to the question: On what basis are problems defined and where, i.e., in which contexts, do they emerge? It is, as we shall demonstrate, the answer to this question that differentiates basic, applied, and problem-oriented research.

The problems driving basic research emerge from within science itself. Problems here are mainly inconsistencies in theories. New findings that are inconsistent with established theories elicited further research. Thus, basic research is problem-driven in the sense that theoretical problems drive research (Balsiger 2005, pp. 101–107; Conrad 2002). Basic research may be conceptualized as a process in which theories are constantly questioned, tested, adjusted, or replaced (see also Kuhn 1996).

Applied research starts with problems, too. Here, however, problems do not stem from within science. Problems of applied research do not emerge from theory and they do not take the form of theoretical inconsistencies, they emerge outside of science. Problems of applied research are formulated in a context of application and the aim of applied research is to solve these problems in the contexts where they emerge, making use of scientific knowledge. The results of applied research are rather products than knowledge in the form of theories and its primary aim is not to feedback into the knowledge production process dealing with theoretical knowledge (Balsiger 2005, pp. 101–107).

Problem-oriented research is driven by problems that originate in society – it addresses social problems. What sets problem-oriented research apart from basic and applied research is that in problem-oriented research the set-up of a research project is primarily informed by the problem itself and not by disciplinary science (Gibbons et al. 1994). Therefore, problem-oriented research is usually transdisciplinary as opposed to basic and applied research which are – being primarily guided by disciplinary research programs – carried out in a disciplinary manner (Balsiger 2005, pp. 103–105).

Before coming back to the concept of transdisciplinarity in more detail in subsequent sections we will now take a more detailed look at problem-oriented research and societal problems. Here we will argue that for societal problems to be studied problem-oriented approaches that cut across disciplinary borders are necessary. This leads up to our description of the concepts of transdisciplinarity.

18.2.2 Problem-Oriented Research and Societal Problems

Problem-oriented research is a research approach that addresses societal problems. This has important implications for the design of research. While basic and applied research is mostly limited to disciplinary science, problem-oriented research needs to cut across the borders of academic disciplines. The bounds of societal problems rarely adhere to the bounds set by scientific disciplines and fields of research in *academia*. The reason for this is that problems, as opposed to theory-derived research subjects, are defined from a societal perspective. This perspective incorporates a lifeworld perspective.

Following Husserl, the lifeworld (*Lebenswelt*) signifies the self-evident world as a pre-epistemological experience (Husserl 1996). Habermas, in his Theory of Communicative Action, describes the lifeworld as "the transcendental site where speaker and hearer meet, where they can reciprocally raise claims that their utterances fit the world (objective, social, or subjective), and where they can criticize and confirm those validity claims, settle their disagreements, and arrive at agreements" (Habermas 1989, p. 126).

Incorporating a lifeworld perspective in problem definition, thus, means discursively and recursively defining problems incorporating the various stakeholders and their perceptions of the issue at hand. Arriving at agreements about a problem definition is, against this background, obviously only a temporary state.

From this it becomes obvious that problem-oriented definitions of research subjects will rarely be captured to their full extent when described through the lens of a disciplinary confined approach. Due to the definition of such problems not being a priori limited by a specific discipline's view they are broader in scope. Typical problem-oriented research topics include environmental studies, sustainability, and health, for instance (Möller and Bornemann 2005; Hirsch Hadorn et al. 2008). These problems cut across the boundaries of disciplinary confined fields of research.

18.2.3 Inter- and Transdisciplinarity

Transdisciplinarity is one among a range of types of cooperation between two or more scientific disciplines. The various concepts of scientific cooperation such as pluri-, cross-, inter- and transdisciplinarity may be delineated by the degree to which different disciplines interact. Transdisciplinarity and the related term interdisciplinarity signify concepts of cooperation that involve collaboration and exchange to the extent that concepts, methods, and theories are not merely eclectically juxtaposed – as is the case for pluri- and cross-disciplinarity (Balsiger 2005) – but are transferred and incorporated so that common problem definitions, terminologies, methods, and theories arise (Porto de Albuquerque et al. 2008; Balsiger 2005; Jantsch 1970; Jantsch 1972).

While interdisciplinarity is driven by disciplines, transdisciplinary research is characterized by the primacy of the problem – the contributing disciplines are aligned on the basis of the problem at hand. In the evolution of science and its disciplinary organizational structure, disciplinarity and interdisciplinarity are dialectically related. New disciplines are born as a result of mutually interdisciplinary cooperation by existing disciplines. Two (or more) disciplines converge in a field that is closely related to but not fully captured by each discipline's main subject of study. Disciplinarity and interdisciplinarity can, thus, be said to be dialectically related (Kröber 1983, p. 578).

Transdisciplinarity on the contrary does not bear new disciplines. With regard to the disciplinary organized structure of science, transdisciplinarity is – in the original meaning of the word – *beyond* scientific disciplines. Notwithstanding that common problem definitions, terminologies, methods, and theories arise (see above), it is a trait of transdisciplinary research that the subject of study maintains its multidimensionality, inherent contradictions, paradoxes, and conflicts (Klein 2004, p. 524).

While being *beyond disciplines*, the question, whether transdisciplinarity is also *beyond* science, i.e., whether actors from outside of science are to be integrated into the process of knowledge production remains disputed. While some propagated this (Gibbons et al. 1994, p. 3), others insist that the transdisciplinary production of knowledge is limited to the realm of science and is, thus, not *trans*-science (Mittelstraß 2003, p. 11). Nevertheless, transdisciplinarity, being problem-oriented, is, as opposed to interdisciplinarity, necessarily characterized by high practical relevance.

18.2.4 Transdisciplinarity and ISR

With the aim of addressing issues that arise in the interplay between ICTs and social organization, ISR has drawn on concepts, methods, and theories form other disciplines, mainly "reference" disciplines (Keen 1987). Though, some oppose the notion of ISR as being interdisciplinary (Benbasat and Zmud 2003), other researchers (Lyytinen and King 2004; Galliers 2003) deem methodological and theoretical pluralism not only convenient but also necessary to address the dynamics found in the subject of research of ISR (Porto de Albuquerque et al. 2008).

While not arguing for a disciplinary "core" for ISR (cf. Benbasat and Zmud 2003), we deem necessary to establish a common background, for transdisciplinary research in IS, against which the multiplicity of concepts and theories used in ISR and other fields of study and disciplines may be related. Based on transdisciplinary research experiences Balsiger (2005), adapting the idea of a "generalized axiomatic system" (Jantsch 1972) argues for the need of establishing an *integrative framework* for transdisciplinary research. Such a framework should, while still allowing for multiple perspectives, provide a background and a common understanding and terminology such that different points of view, concepts, and ideas as well as research results may be related and shared among researchers with different disciplinary backgrounds (Porto de Albuquerque et al. 2008).

The Mikropolis Model presented in the next section is a framework that may serve as a "generalized axiomatic system" (Jantsch 1972) for the transdisciplinary study of ICT development and use in society.

18.3 The Mikropolis Model

As we have argued above, research that focuses on the development of use of ICT in society should be problem-oriented and transdisciplinary. In this section we describe the Mikropolis Model as a framework for this mode of research. We will give an outline of the Mikropolis Model, its background, its theoretical foundations, main perspectives, and associated concepts.[2]

18.3.1 Background

The term Mikropolis is derived from the German word for microelectronics (*Mikroelektronik*) and the Greek word *polis*. This term was chosen to imply a coequal focus on both technology and society in the study of ICTs and IS, in particular. Originally developed as a didactical instrument in computer science and business computing, the Mikropolis Model's aim was to supplement technical or expert knowledge with so-called orientation knowledge[3] (Krause et al. 2006). Therefore, the model was designed such that the interplay among information technology (IT), humans, and global society could be described and explained within the same systemic context (Porto de Albuquerque et al. 2008). The Mikropolis Model has been adopted by a number of German scholars and, as a didactical instrument, has been used in higher education for over 15 years now.

Based on the original didactical instrument the Mikropolis Model has been further developed and modified over the years to serve as an "integrative platform" (Porto de Albuquerque et al. 2008) for transdisciplinary research on development and use of ICT and its embedding into the societal context. The working group driving the development of the Mikropolis Model is a transdisciplinary network of researchers with backgrounds in information systems, computer science, environmental and business informatics as well as political science, psychology, and sociology. The Mikropolis Model itself is, thus, not only designed to serve as a

[2] For the following description of the Mikropolis model, see Rolf (1998, 2008), and the early work of Kubicek and Rolf (1985).

[3] For a definition of orientation knowledge as opposed to expert knowledge see Mittelstraß (2001, p. 75).

framework for transdisciplinary research on IS in society, it is also the result of a transdisciplinary research effort. The development of the Mikropolis Model is based in the conviction that, in the process of design and development of software and information technology, social and organizational contexts must necessarily be taken into account. This viewpoint, among others, originates in the opposition to positions formulated by formalists like Dijkstra (1989).

While being used as a framework for transdisciplinary research on the development and use of ICT in society, the Mikropolis Model was further developed and adopted to incorporate new findings. However, the model itself was kept as parsimonious as possible, so that it could (1) serve as a framework for a wide range of particular research subjects in the context of development and use of ICT, and (2) provide a common terminology for researchers from various disciplinary backgrounds.

18.3.2 Interactions

The Mikropolis Model's main theme is the description of mutual interactions in the development and use of ICT. Interaction signifies a concept of reciprocal relatedness, meaning that two (social) entities affect, influence, and act upon each other. The concept of interaction, as used in the Mikropolis Model, originates from Georg Simmel.[4] Before giving an outline of his concept of interaction, it is necessary to take a brief look at Simmel's ideas and thoughts on formal sociology.

Simmel differentiates historical, formal, and philosophical sociology, with formal sociology being the main focus of his work. Formal sociology is concerned with the *forms* of communal existence and general rules that govern the relationships among individuals and groups (Simmel 1890, p. 118). The forms[5] (of communal existence) are to be distinct from their content. While the content (the "what") of social interaction in various groups may differ, the forms of social exchange (the "how") may be similar or even identical, and vice versa, that is, similar or identical content may present itself in different forms of sociation (Simmel 1908, pp. 6–7; Deflem 2003, p. 69).

Drive, interest, purpose, inclination, psychic states, and movements is what Simmel calls content or "matter of sociation [translation by the authors]" (Simmel 1908, p. 4). Typical *forms of sociation*, which are found in groups – however different their purposes and meaning may be – are subordination, competition, imitation, division of labor, and representation (Simmel 1908, p. 7).

For Simmel, the forms of sociation or interaction (two terms which Simmel uses interchangeably) are the subject of formal sociology (Simmel 1908, p. 6). Interaction is a process in which individuals interconnect with each other and with groups and

[4] Simmel originally uses the term *Wechselwirkung* – literally "reciprocal or changing effect" (Frisby 2002, p. xxvi). *Wechselwirkung* is commonly translated as *interaction*. In this chapter *Wechselwirkung* is translated as *interaction*.

[5] According to Coser (1977), Simmel's term *form* is similar to the now more commonly used term *social structure*.

form unities and society as a whole. Society is, simply put, the sum of all interactions. This implies (1) a "mutual implication of society and individual" (Deflem 2003, p. 70) and (2) society to be understood as a process, as – in other words – *sociation*.

The concept of interaction is not limited to the interrelation of individuals. Systems and supra-individual organization, conceptualized as consolidations of interactions, interact as well. They are, though, produced and reproduced by individual interactions, lasting entities, governed by formal rules; they are autonomous, objective structures and interact as such (Simmel 1917, p. 13).

The Mikropolis Model applies Simmel's concept of formal sociology and his concept of interaction, in particular, in that it traces and describes the typical forms of interaction found in processes of development and use of IS. In the model typical forms of interaction that are located on different levels of analysis are captured and interrelated by the so-called structural elements. These structural elements of the Mikropolis Model are described in the following subsection.

18.3.3 Structural Elements

The Mikropolis Model consists of three elements providing the main structure of the model: the socio-technical core, the micro-context, and the macro-context.

18.3.3.1 The Socio-Technical Core

The socio-technical core is a generalized model of socio-technical interactions in development and use of ICT. It describes the transformation of human actions into technological artifacts and the process of embedding technological artifacts into social contexts. This process is understood as a process of de- and recontextualization. Human actions are decontextualized and transformed into technological artifacts; technological artifacts are in turn recontextualized in their context of use by human actors.

In the process of decontextualization human activity is decomposed into single actions which are broken down into single operations.[6] Operations may be understood as an aspect of actions which may be formally described and delegated to other humans, animals, or technology (Simon et al. 2008, p. 242; Floyd and Klären 1999, p. 53). The operations are then recomposed to form the so-called operational form which is a generalization of the once "situated actions" (Suchman 1987). The process of decontextualization is completed with the fabrication of the so-called auto-operational form. Auto-operational forms are formal schematic representations

[6] The process of decomposing human activities into operations described here is derived from activity theory (Leontev 1978; Kuutti 1996).

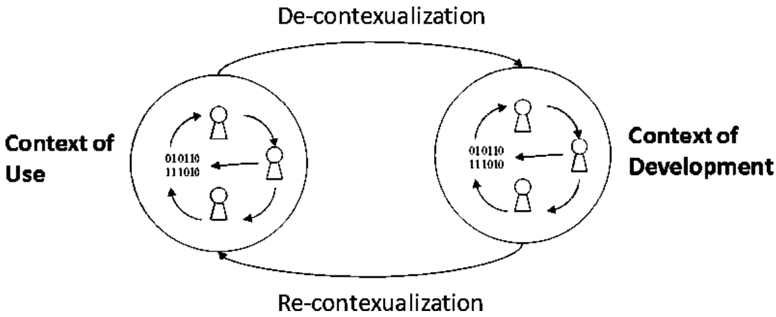

Fig. 18.1 De- and recontextualization (adapted from Simon et al. 2008)

that, like algorithms, no longer depend on social context for interpretation; they are symbolic machines (Floyd and Klären 1999, p. 71).

Simon et al. (2008) describe the process of decontextualization in short as consisting of three steps, namely, (1) explification – description of human activities, (2) algorithmization – formal specification, and (3) implementation – programming software (Simon et al. 2008, p. 248–249) (Fig. 18.1).

The recontextualization of technological artifacts is situated in the context of use. Technological artifacts are transferred back into a social context. Humans need to interpret technological artifacts which are, as shown above, generalized forms and perform tasks, regardless of the current context. More often than not humans have to adjust to new technology, when this is introduced into a social context.

As a consequence the recontextualization not only relies on providing technological infrastructure but also on providing organizational measures to let users grow accustomed to the technology and to adjust organizational processes to the requirements of technology. Since organizational processes, habits, and routines are oftentimes unique to a specific organization, while technological artifacts as generalizations are mostly not, this oftentimes leads to conflicts.

The assumptions about how to structure working processes (activities) which guide the process of decontextualization lead to a reconstruction of organizational contexts that is not in accord with the perception shared by the members of an organization. While this is true for standard software like ERP systems, for instance, this is also often the case for individual and custom software when the development process is uncoupled from – and, thus, not taking into account – the organizational development (Simon et al. 2008).

Regarding the developments of organizational forms and routines on the one hand and technology on the other hand the socio-technical core is a means which describes the constant mutual adjustments between the organizational requirements and technological possibilities. Obviously this is an ongoing process, which moves toward but never reaches a state in which all organizational requirements are fully met by technological possibilities and all technological possibilities are fully realized by organizations (see the following section for more). To capture this constant, though there is a dynamic *gap* between organizational requirements and technological possibilities, the Mikropolis Model introduces the concept of the *formalization gap*.

The formalization gap captures the gap between technologically formalized and nonformalized aspects of an organization. The Mikropolis Model further makes the distinction between preliminary and necessary formalization gaps. Preliminary formalization gaps are organizational aspects that principally could be, but as a matter of fact are not, formalized (yet) due to, for examples, not-yet existing technology that would be necessary to do so. Necessary formalization gaps on the other hand are organizational aspects that should not or cannot be technologically formalized. Necessary formalization gaps exist where it is impossible to fully describe all expectable situations that have to be met in the context of application and action is highly situated. This is the case for creative activities such as new product development and strategic planning, for example, or, more generally put, for emergent knowledge processes (Markus et al. 2002).

18.3.3.2 Micro-Context

The micro-context describes the interplay between development and use of ICT and IS on an organizational and inter-organizational level. The focus here lies on the interactions that form a process of incremental development of technology and organizations. This process of incremental development is a cyclic process in which organizational needs drive technological developments and technological developments expand organizational possibilities. It is, thus, driven by (1) demand directed at ICT and (2) possibilities offered by ICT.

In the micro-context the Mikropolis Model assumes a differentiation between (1) organizations that use ICT – the application context – and (2) organizations that develop ICT – the IT system. The IT system consists of institutions that constantly develop the theoretical and technical basis of ICT, such as universities, research and development labs, think tanks, as well as organizations and networks that develop applications of ICT, such as software companies and open-source communities, for example.

Between the context of application (organizations) and the context of development (IT system), there is a constant exchange about needs directed at, and possibilities offered by, ICT. Organizational needs concerning the further development of ICT are articulated and communicated to the IT system. Possibilities that arise as ICTs are further developed are communicated from the IT system to organizations. There is thus a constant exchange of needs towards, and possibilities offered by, ICT. This form of interaction, governing the relation between the context of application and the IT system, is commonly described as a technology push/demand–pull relation.

The coevolutionary development of organizations and ICT cannot be explained from the mutual interactions between organizations and the IT system within the micro-context alone. The entities and their interplay as described in the micro-context are embedded in society. The interactions found at this level are described in the so-called macro-context.

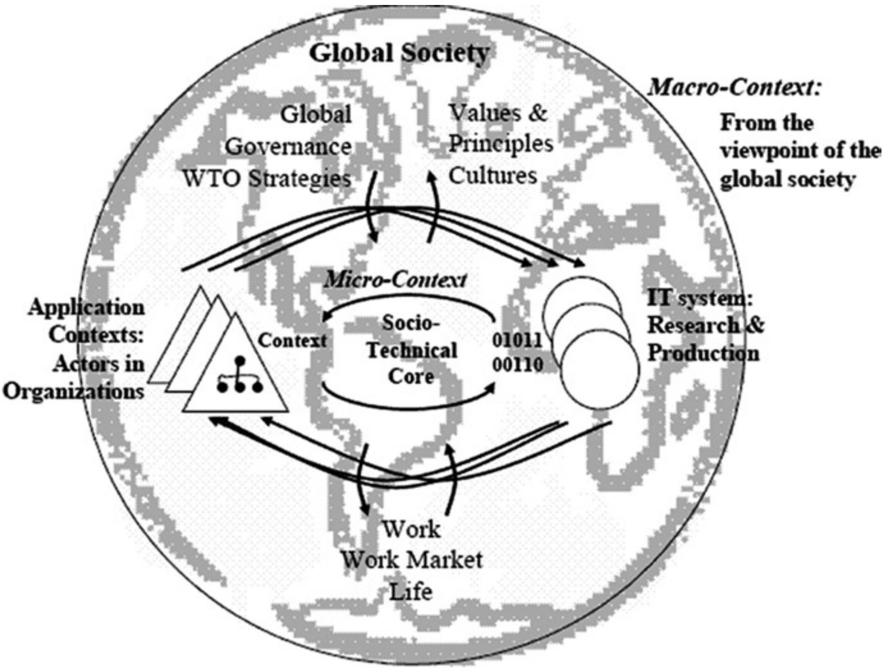

Fig. 18.2 A pictorial representation of the elements of the Mikropolis Model (de Albuquerque et al. 2008)

18.3.3.3 The Macro-Context

The macro-context focuses on the implications of ICT for the society at large, and vice versa. It describes the interplay between technological and organizational innovation and social change. The micro-context may be understood as being embedded in the macro-context. With this, the Mikropolis Model allows for tracing and describing interactions between organizations and the IT system with their societal environment (Fig. 18.2).

At this level, social norms, patterns, standards, and cultural values that guide individuals are focused as well as societal sub-systems, like economy, science, and public administration. The macro-context allows for the description of specific factors and conditions that influence the processes of technological and organizational change, as described in the micro-context. On the other hand, transformations of conditions in the macro-context induced by the micro-context may be traced and described.

18.3.4 The Temporal Perspective

As pointed out above, Simmel understands society as sociation, i.e., as a process. While the structural elements of the Mikropolis Model describe a static view, the

Table 18.1 Elements and main concepts of the Mikropolis model

Perspectives of the model	Main concepts
Socio-technical core	Decontextualization, recontextualization, formalization gap, actors
Micro-context	IT system, organizations
Macro-context	Socio-economic environment, social norms, standards, cultural values
Temporal perspective	Technology utilization path

notion of process is reflected in the temporal perspective. The temporal perspective relates chronologically separated, palpable states of interaction of the entities described in the structural elements.

The main tenet of the temporal perspective, that "history matters" (Bassanini and Dosi 2001) or – as Teece et al. (1997) put it – "bygones are rarely bygones" (Teece et al. 1997, p. 522), is derived from the theory of path dependency. The temporal perspective, thus, calls for a retrospective analysis when describing contemporarily factual states with the help of the structural elements and serves as a background for comprehensive narratives.

The temporal perspective is a means to describe the so-called *technology utilization paths*. Reflecting technological, organizational, and societal resources like paradigms, principles and standards, methods, products, and tools that influenced the becoming of actual states of socio-technical structures, these technology utilizations provide further insight. This perspective, thus, adds value in that it provides a means to describe the conditions that led to the success or failure of alternative socio-technical constellations and developments and enabling one to use them as lessons for future technology development.

18.3.5 Summary of the Main Concepts of the Model

Concluding this section, we summarize in Table 18.1 the main concepts of the Mikropolis Model along each of the perspectives presented in the previous sections.

18.4 Transdisciplinary Research with the Mikropolis Model

The Mikropolis Model presented above is both the result of, and an enabling instrument for, the cooperation of a group of researchers with different disciplinary backgrounds and perspectives working together on a variety of problems. This section exemplarily describes previous research works performed on the basis of the Mikropolis Model. One of these works is described and analyzed, so as to exemplify how the Mikropolis Model can be used as a framework for problem-oriented, transdisciplinary research that is informed about the societal issues involved in the design and use of ICTs.

18.4.1 Previous Research with the Mikropolis Model

This subsection presents selected research cases with the intention to give an impression of the applicability and areas of application of the Mikropolis Model. The question of how to apply the Mikropolis Model in problem-oriented, transdisciplinary research is addressed in the following subsection, presenting and discussing a particular case in detail.

Rolf studies the coevolutionary development of organizations and ICT (Rolf 1998, 2008). The main theme of these works is the development of organizational forms of *office work* from pre-Industrial Revolution *kontors* to modern day network organizations and their reciprocal interrelation with technological developments. These studies make use of mainly the micro- and macro-contexts as well as the Temporal Perspective.

The author shows that the emergence of modern day network organizations and their ambiguous character (e.g., regular employees vs. freelancers, local vs. global, highly standardized processes vs. flexible and modular set-up, highly formalized vs. highly informal, disintegration of organizational boundaries) are a result of organizational and technological innovations that to a large extent are mutually interrelated with socio-economical changes located in the macro-context such as deregulation and globalization.

Against the background of processes of globalization, Drews (2008) examines telemedicine and the consequences of ICT innovations on the division of labor in health care. On the basis of several cases including teleradiology, remote monitoring of intensive care unit patients, telepathology, telecardiology, teledermatology, and telesurgery, this work makes use of the Mikropolis Model to describe the mutual process of organizational and technological developments in the field.

The advance of telemedicine is driven by ICT developments which allow for including remote actors in health care. This leads to a new division of labor and, thus, changes in organizational set-ups. Some activities are relocated to remote sites/organizations which specialize in certain activities such as medical interpretation of digital imagery through radiologists in the case for teleradiology. The author shows how the exploitation of technological possibilities drives a process of standardization and super-specialization, thus, producing new socio-technical constellations (in the micro-context). Also, the author shows how these new socio-technical constellations in turn lead to new requirements in the macro-context as needs to harmonize legislation concerning liability issues and reimbursement across borders arise.

While the above works address specific domains or cases, other research using the Mikropolis Models explicitly focus on the theoretical development of the framework itself. The concept of formalization gaps, for example, is studied by Rolf (1999), Simon et al. (2008), and Drews (2010). Rolf (1999) explorers the formalization gap on higher level and particularly discusses the role of Information Systems research in the general drive to further close formalization gaps. Simon et al. (2008) contrast

Floyd's conceptualization of IT as auto-operational form with Orlikowski's adaptation of Gidden's Structuration Theory, so as to build a differentiated conceptualization of the concept of formalization gap, and then apply this to a particular case study. Drews (2010) studies the role of preliminary and necessary formalization gaps in IT consulting and derives recommendations for dealing with these gaps in practice.

18.4.2 Exemplary Case Study

In this section, we summarize and discuss results from a case study on the development of a collaboration software for a network of consultant freelancers (Finck et al. 2006; Porto de Albuquerque et al., 2008). The case study comprises the development of a collaboration application for a network of about 15 consultant freelancers working in the field of IT and management. The network was established with the goal of fostering the exchange of work experiences, knowledge, and results. Furthermore, the intention was to provide the IT consultants with vocational training and the opportunity for networking, i.e., for finding new partners for large projects and acquiring new clients via other network members. The network is completely self-organized by its members, lacking formal hierarchies or predefined roles. As such, the activities of the network heavily rely on intrinsic motivation and commitment of the individual members.

To better organize the network, several project management systems had been tested by its members in the past. However, with each of the systems tested, the usage turned out to be unsatisfactorily low. The network members blamed this on the respective software used, which they regarded as unsuitable for their tasks. Thus, they decided to develop a new collaboration system. This system was to be developed using participatory and evolutionary design methods, so as to be continually adapted to the needs of the network. In this manner, a development team was gathered that was comprised of two software developers and one human–computer interaction researcher with expertise in usability evaluations.

A systematic evaluation was carried out by the development team to define the requirements of the organization in respect to software support. For this purpose, semistructured interviews were conducted both with groups and individual members. Furthermore, the system usage was observed while working with two core members (acting as representatives) in order to discuss their usage experiences, to analyze problems that happened during system use, and to plan further developments for about 18 months. Regular workshops were organized every 2 or 3 months with the network representatives for the elaboration of design ideas (Finck et al. 2006).

After 1 year and a half of development, the evaluation results pointed to a positive resonance: the network members emphasized that online communication was indeed generally needed, and that the developed collaboration tool was adequate to their needs.

However, in spite of the widely positive feedback from the users, the actual usage of the system turned out to be notably low. This could be verified by the low frequency of new content being fed into the system, among other indicators.

To understand this paradoxical situation, the Mikropolis Model was used as an analytical instrument by a group of three researchers with backgrounds in computing and social sciences. At a first step, the members of the network were conceptualized as actors in the micro-context. The design process was analyzed with regard to these actors and their interrelations to one another, as well as the relationship that they established with the developer team. This analysis brought into light the fact that, in respect to the development process, there were actually two distinct kinds of actors in the network. On the one hand, there were a small number of actors who actively participated in the development process with ideas and suggestions, while on the other hand, there were many others who were only passively involved. This leads to the conclusion that the network as a whole was rather heterogeneous than homogeneous. Two groups of actors had been formed within the network, and power was unevenly distributed between these groups. As opposed to the ideal image of a self-organizing network of equals, a powerful informal hierarchy had in fact been established. The analysis of the actors' interests, actions, and motives showed a clear area of conflict between the propagated ideal of equal, nonhierarchical cooperation and the actual development practice.

Nonetheless, the usability tests applied by the development team on the achieved software resulted satisfactory for all members of the network, regardless of whether they had or not actively taken part in the development process. Indeed, there were no obvious reasons to assume that the development process – which was heavily influenced by only a subgroup of the actors in the network – could not lead to a result that was also satisfactory for the actors who were not directly involved. However, by tracing the technology utilization path in the network we were able to see that previous decisions regarding IT support had seldom been discussed with a substantial number of network members, but rather been made by the same group of few individuals who were especially competent with, and interested in, IT. Since several project management tools had been unsatisfactorily tested beforehand, the introduction of yet another software caused confusion amongst the actors less involved in the decision-making process, who became insecure about the continuity of software use (would the new software be replaced after a short time just like all the others?). This fact reduced their motivation to spend time learning about the new tool and using it.

The next step was to look at the macro-context. Here, we could establish the economic situation and its perception by the individual actors as the decisive factor for the low system usage. Since the actors saw each other as competitors in the same market, there was no incentive to share information that could benefit the other actors in the network. Consequently, information about work experience and contacts to potential clients were better withheld by the actors.

In this manner, using the Mikropolis Model we could disentangle the apparent paradox in the initial situation – namely, how could a system that was developed with participatory methods and that had good results in usability tests have such a low usage? The researchers concluded that the discrepancy between the stated goals, ideals, and motives of the network on the one hand, and the daily practices of the freelancers on the other, were responsible for the observed low usage of the groupware software. Despite the actors' common belief in the need for a collaboration tool, concrete occasions and tangible incentives for system use were rare. Furthermore, due to the economic pressures that the freelancers were facing in the market, it was rather sensible to be especially careful when sharing economically relevant content.

18.4.3 Discussion of the Case Study

In the case study described in the previous section, the Mikropolis Model was used as an analytical tool to help structuring the problem at hand. Before this analysis, the cause of the complex, high-level problem – i.e., the low system usage – could not be found by considering only the elements of the development project itself. Indeed, the members of the development team did their best in employing participatory methods and applying usability principles and best practices, so that everyone was puzzled by the unsatisfactory outcome of the project.

In order to shed light into this situation, the elements of the development project were first mapped to concepts of the Mikropolis Model. More specifically, actors, groups of actors, organizations, the socioeconomic situation, and their interrelations in the project were identified and related to the corresponding elements of the Mikropolis Model. In doing this, the narrow view that considered only the project itself was expanded so as to encompass elements of the socioeconomic environment in the macro-context where the project took place, as well as to analyze the historical evolution of the technological utilization path of the consultant network, including the previous experiences of the members and the building of different actor groups and power relations in the micro-context. It thus became clear, that the reason for the low system usage could not be found solely on the basis of a narrow view of the development project, but had to be explained by resorting to other wider societal contextual factors of the macro-context, according to which the consultants were competitors in the same concurred market. In this way, the initial problem was thus broken down and described in a manner that offered fresh insights and allowed the derivation of possible solutions.

Furthermore, the use of the Mikropolis Model enabled the initial design-centred perspective of the developer team to be complemented by more comprehensive social and organizational considerations afforded by an analytical perspective. The Mikropolis Model was used to frame the problem in such a way that both developers and social scientists could bring in their particular viewpoints, approaches, and methodologies to the problem, making possible the mutual understanding and exchange between the different disciplinary views. With the aid of the Mikropolis Model, the developers were thus able to make sense of, and draw conclusions from, the social analysis for future socio-technical development. One of these conclusions was the importance of considering the diversity of interests of actors and groups of actors inside the organization arenas in the micro-context. Regarding software support, they inferred the need to check whether functionalities supporting equal and intense cooperation are truly compatible with the organization's structure and its insertion in the wider societal context.

18.5 Present and Future Research

Simmel (1890, p. 13) states "that everything interacts in some way with everything else."[7] Likewise an article introducing the Mikropolis Model as a transdisciplinary platform is entitled "Knowing, how everything is connected" (Krause et al. 2006). This is the starting point for the development of the Mikropolis Model.

The Mikropolis Model assumes interaction among all entities at all levels of analysis. Within this broad context, the aim of the development of the Mikropolis Model was to trace and describe the typical forms of interaction in processes of ICT development and use, so as to offer a framework for researchers to orient themselves, thereby enabling transdisciplinary research in the area. Past and present research has concentrated mostly on the socio-technical core and the micro-context (see Sect. 4). The overall goal was to find general forms of socio-technical interaction in the different levels of analysis. In the socio-technical core, the basic form of interaction was described as a process of de- and recontextualization and the associated formalization gaps. One stream of future research shall advance in the theoretical development of the concept of formalization gaps as well as perform more empirical studies of ICT development and use relying upon the concepts of the socio-technical core, so as to improve the external validity of the concepts.

In the micro-context, the typical form of interaction is described as a technology push/demand–pull relation between organizations that use ICT and producers of ICT. This general conceptualization should be further refined to deal with the particularities of both specific fields of ICT development and application (e.g., Health IT, grassroots social media), as well as with the reality of particular systems of innovations, which can be analyzed both at the scope of different regions, countries, and continental economic regions. A contrastive study of the reality in developed vis-à-vis developing countries on the dynamics of ICT innovations would also be beneficial to improve the generality of the model concepts.

Furthermore, future research will have to focus on tracing interactions between the micro- and the macro-context. It is necessary to find and describe regular forms of interaction that may help explain the diverse interrelations of ICT development

[7] Translation by Frisby (2002, p. 50).

and use with society at large. In this sense, more research is due on the influence in ICT development and use of given cultural practices and values, social norms of certain groups, major societal challenges (e.g., climate change), and even tads and fashions. These influences could be traced with the aid of the current concepts of the Mikropolis Model so that their interplay with the elements of the micro-context could be better elucidated.

18.6 Concluding Remarks

The manifold implications of ICT on society are not being extensively addressed in ISR. We have argued for the need of a problem-oriented, transdisciplinary approach to capture societal aspects of ICT development and use, as well as to pursue a multi-perspective mode of research.

The Mikropolis Model offers a framework for problem-oriented, transdisciplinary ISR by building upon a socio-technical structural perspective of IS development, which is integrated into the micro-context of the relations between ICT producers and ICT consumers. These two perspectives are also contrasted against the backdrop of the globalized society in the macro-context, and they are put into a historical perspective by means of the Technology Utilization Paths. The analytical differentiation among these perspectives and concepts thus adds clarity to the different aspects of ICT use and development, aspects that, in fact, always take place simultaneously in the fabric of socio-technical relations.

Therefore, the Mikropolis Model affords a better understanding of the relations and interdependencies among the different perspectives, thereby helping the researcher to apprehend how complex and multifaceted the transformation process is that results from the interplay among ICT, organizations, individuals, and the social actors in a globalized world. In this manner, the Mikropolis Model provides a parsimonious and robust framework which allows for incorporating the societal context of ICT development and use while at the same time serving as an integrative platform providing basic concepts and terminology for transdisciplinary research.

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Chapter 19
Inquiring Systems: Theoretical Foundations for Current and Future Information Systems

James L. Parrish, Jr. and James F. Courtney

Abstract Inquiring systems have been a part of the information systems discipline for the past 40 years. In this chapter, we highlight the impact that the inquiring systems have had on the information systems in use in contemporary organizations as well as the potential for inquiring systems to form the theoretical foundations of the information systems of tomorrow.

Keywords Inquiring systems • Design • Information systems design theory

Abbreviations

ADDSS	Advance directives decision support system
DSS	Decision support system
EOL	End of life
GDSS	Group decision support system
MPDP	Multiple-perspective, dialectical process
NHC	National hurricane center
WWW	World wide web

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19.1 Introduction

In 1971 Churchman penned *The Design of Inquiring Systems: Basic Concepts of Systems and Organizations* (henceforth referred to as *Design*). In *Design*, Churchman draws upon his passions for philosophy and design to develop inquiring systems, or systems with the goal of producing knowledge. He accomplishes this by examining the philosophies of some of the great western philosophers (Liebniz, Locke, Kant, Hegel, and Singer), and translating those philosophies into the language of systems theory.

One might wonder if Churchman recognized the impact that his work would have. A search on Google Scholar reveals that the text has been cited over 1,500 times. A look at the disciplines that have drawn upon the work shows that Churchman has been referenced in publications relating to education, operations management, political science, public administration, psychology, and many others. It may be argued, however, that *Design* may have had the most profound effect on the field of information systems (and its related fields of decision support and knowledge management), perhaps due to the introduction of inquiring systems into the MIS literature early on by Mason and Mitroff (1973) in their classic "program of MIS research" paper.

The purpose of this chapter is to examine the impact of *Design* on information systems by looking at how the inquiring systems have formed the foundation of many of the information systems used by contemporary organizations. We do this by offering a brief description of each of the inquirers followed by systems that serve as an exemplar of that particular inquirer. Finally, we close with a discussion of how the concept of inquiring systems might evolve to serve as the foundations of the information systems that will serve the organizations of the future.

19.2 The Impact of Inquiring Systems on Contemporary Information Systems

As stated in the prior section, Churchman took the philosophical views of the western philosophers Liebniz, Locke, Kant, Hegel, and Singer, and designed systems based on their views of knowledge and of the world that each of the philosophers espoused. Being true systems, the inquirers have inputs, processes, and outputs and, consistent with his requirements, they are all teleological or goal seeking. Another feature of Churchman's inquiring systems is the feature called the guarantor. The guarantor serves to ensure that the knowledge created by the system is consistent with the philosophy on which the system is based and "true" to the extent that it is not believed to be false (Courtney et al. 1998). Having reviewed the basic components of inquiring systems in general we can now examine each of the systems in more detail.

19.2.1 The Liebnizian Inquirer

The Liebnizian inquirer is based on Liebiniz' concept of monads and can best be described as a closed system. Churchman (1971, pp. 34–35) details the following features of the Liebnizian inquirer.

1. Innate ideas, i.e., no inputs
2. Capability of producing strings of symbols that can be broken down into recognizable units (sentences)
3. Capability of classifying any unit as a tautology, self-contradiction, or contingent truth
4. Capability of forming nets of units
5. Capability of ranking the nets based on a prescribed criterion
6. A method of processing symbols and building nets such that the system will ultimately arrive at the optimal net and know when it has reached that point

As seen in the features provided by Churchman, the Liebnizian inquirer does not have inputs, per se, but is created with a set of basic axioms. A sentence generator is used to generate hypotheses which are then tested against the axioms for validity. Formal logic may also play a role in testing the hypothesis. Knowledge is created in the Liebnizian inquirer in the form of "fact-nets" comprised of contingent truths. The guarantor of the knowledge is its consistency with the basic axioms (Churchman 1971; Courtney et al. 1998; Courtney 2001).

Examples of Liebnizian inquiring systems in use today include many types of expert systems, theorem-proving systems, problem solvers, and algorithm-generating systems (Linden et al. 2007). Ross and his colleagues at Aberystwyth University in Wales have developed a "robot scientist" called Adam that is capable of autonomously generating functional genomics hypotheses about baker's yeast and experimentally testing these hypotheses by using robotic functions (Ross et al. 2009). Adam's process for generating hypotheses is coded in the artificial intelligence language Prolog. An ontology was developed in the Web Ontology Language (OWL) and its data is stored in a MySQL relational database. The database constitutes a Liebinizian fact net with over 10,000 different units in a nested tree-like structure, 10 levels deep, that relates the 6.6 million biomass measurements to their logical description. Adam can search the fact net for "orphan" enzymes whose coding is unknown and for hints as to how the enzyme may code. This knowledge is used to generate hypotheses that Adam can experimentally test. He has a robotic assemblage of centrifuges, incubators, pipettes, and growth analyzers that he can use to run the test and analyze results. He as discovered three genes that are combined coded for an orphan enzyme. King and his team verified Adam's findings through manual experiments. Adam is also capable of updating the fact net with his findings and because the database is Internet friendly, findings can be shared with the scientific community. Once Adam was set into play, the only human intervention required is oversight by a technician who makes sure that things are running properly and to clean the machine and replenish requisite materials. Adam actually goes beyond Churchman's original concept of a Leibinizian Inquirer in the sense that it can perform physical experiments, not just feats of logic.

19.2.2 The Lockean Inquirer

The Lockean inquirer stands in almost direct contrast to the Liebnizian. Whereas the Liebnizian inquirer is a closed system, the Lockean inquirer is completely open and takes its input in the form of environmental observations. The system is given a set of elementary labels with which to begin. Knowledge is then created in the form of taxonomies by a process of assigning labels to the observations made by the system with the goal being to create a "storehouse" of knowledge" (Churchman 1971; Courtney et al. 1998; Linden et al. 2007). The Lockean inquirer does not operate alone. In fact, the labels that the Lockean inquirer assigns are only deemed valid if a consensus is reached as to the label's validity by a community of Lockean inquirers. This consensus acts as the primary guarantor of the system's knowledge. Additionally, knowledge is guaranteed by the Lockean inquirer's capability of self-monitoring through a process called reflection. In this process, labels can be traced backwards from the complex to the most elementary to ensure internal validity (Churchman 1971; Courtney et al. 1998; Linden et al. 2007).

An excellent example of the Lockean inquirer in practice can be found on the image search site from Google (http://images.google.com). This site has a program that allows humans to act as Lockean inquiring systems. Users are paired together anonymously and then are shown an image from the millions of stored images in the Google database. The users are then asked to assign labels to the image. When the users agree on a label, that label is assigned to the image and the users move to another image. Users are assigned points based on the time it takes to agree on a label which makes the process an engaging game that is enjoyable as well as useful. This process helps Google to manage its information about the images by creating a more effective taxonomy by which to search for images on the WWW (Churchman 1971; Courtney et al. 1998; Linden et al. 2007).

19.2.3 The Kantian Inquirer

In some ways, the Kantian inquirer can be seen as a combination of the Liebnizian and Lockean inquirers. The Kantian inquirer takes some empirical input which is assigned time and space data via a kinematic clock internal to the inquirer. The data are then tested against several mathematical models to see which one provides the best "fit" for the data. Knowledge comes in the form of models and the degree of fit acts as the guarantor (Churchman 1971; Courtney et al. 1998; Linden et al. 2007).

It seems that most traditional decision support systems (DSS) are illustrative of the Kantian inquirer. DSS take information from various data sources such as transaction processing systems (TPS) and use that data to construct models to assist individuals with making decisions in semistructured decision environments. Semistructured decision environments are contrasted from structured decision environments by the lack of concrete decision-making criteria. As with all DSS, the decision models created by the DSS provide assistance with the structured portion of the semistructured decision, while the human decision maker must rely on intuition and experience to assist them with the unstructured portions. The Kantian inquiring system, however, may be more effective than many traditional DSS in that the assistance that it provides to decision makers is the result of evaluating several different models, as opposed to a single model.

Forecasting applications come to mind as being amenable to support from the Kantian inquirer. More specifically, those applications that support the forecasting of phenomena that can be modeled differently would be particularly well suited to this inquirer. Financial instruments (stocks, bonds, etc.) come to mind as a relevant example. If you look at the analyst ratings on any financial instrument, you are likely to see some discrepancies between the analyst's ratings. This may be caused by the analyst's use of different models in their rating process. An application based on the Kantian inquirer would take all of these models into account and provide guidance to investors based on the model that best "fit" the data.

A more concrete example is seen in use by the National Hurricane Center (NHC). The NHC feeds several pieces of data about the wind speed, movement, barometric pressure, etc. of storms into its hurricane tracking and prediction system. The system then fits the data to several forecast models such as the NHC98, NOGAPS, UKMET, and the FSU Super ensemble. The NHC's official forecast model is generally chosen from these models based on how well it is performing or, in other words, how well the degree of fit has been between the storm's behavior and the model (Linden et al. 2007).

19.2.4 The Hegelian Inquirer

The Hegelian inquirer operates on the epistemological premise that true knowledge is created through the conflict of ideas. The process begins with a worldview, the thesis, which has been deemed insufficient or inappropriate by some party. This insufficiency leads to the creation of an alternate worldview, the antithesis, which stands diametrically opposed to the original worldview. A debate then takes place between the opposing views. An overseer in the form of a "bigger mind" (Churchman 1971) that has a neutral position with respect to the debate observes it and takes the most salient points from each position. The overseer then synthesizes these points into a new worldview, which consumes the opposing ones and is more valid. The new worldview is the knowledge created by the system and its guarantor is the overseer (Churchman 1971; Courtney et al. 1998).

Since the Hegelian inquirer is based in conflict, conflict resolution and negotiation support software seems to be tailor made to exemplify this type of system. Group decision support systems (GDSS) could also fall within this category. Other examples are Mason's (1969) dialectical approach to strategic planning and the dialectical decision support methodology presented by Elgarah et al. (2002) described in the following paragraph.

Courtney (2001) has proposed a decision-making paradigm for decision support systems based on the Singerian model and the Mitroff and Linstone multiple-perspective approach. The "multiple-perspective, dialectic process" (MPDP) developed by Elgarah et al. (2002) is based on the multiple-perspective approach advocated by Mitroff and Linstone (1993), Courtney's decision-making model (2001), and the dialectic process. Courtney's model is based on inquiring systems theory, includes multiple stakeholders, and augments Mitroff and Linstone's technical (T), organizational (O), and personal (P) perspectives with ethical (E) and esthetic (A) considerations and synthesizes them into an integrated whole.

The MPDP approach calls for the integration of different perspectives including the technical, organizational, personal, ethical, and esthetic views. The design process consists of identifying relevant stakeholders, their respective worldviews, and conflicts in these worldviews. A design (thesis) and "counter design" (antithesis) are created, and prototype systems based on these designs are developed. The prototypes are presented to stakeholders who engage in a dialogue and a synthesis is formed. The process is repeated until all conflicts are resolved or resources are exhausted, and a final system is produced.

The researcher developed a decision support system prototype for zoning decisions in a county in Florida using the MPDP design theory. Stakeholder groups included the planning and zoning department staff, developers, environmental groups, citizens affected by the decision, and elected officials. Initial prototypes were developed from two opposing viewpoints and presented to each stakeholder group. The input concerning the initial prototype was integrated into a synthesized prototype that was well accepted by the planning department staff and the different stakeholder groups involved in this action research project. This showed that the design theory, based largely on the Hegelian inquiring system, is feasible and applicable to complex decisions such as zoning decisions. It illustrates how the Hegelian approach can be used to design a system that is acceptable to users with varied, conflicting perspectives.

19.2.5 The Singerian Inquirer

Churchman based his most complex inquiring system on the philosophy of his own mentor Singer. The Singerian inquirer is based on two major premises: a system of measures and a strategy of disagreement. The system of measures is central and is used to settle disputes in the community. When measurement models can no longer adequately explain some phenomenon in the world, the Singerian inquirer engages in a process of "sweeping-in" variables into the models from outside the problem domain to better explain the phenomenon. However, the process does not end here as this explanation will soon be found to be inadequate with improved measurement methods and more variables will then be swept into the analysis. Churchman referred to this system as having a "grand teleology with an ethical base" (Churchman 1971, p. 200) and it has the lofty goal of creating exoteric knowledge, or knowledge that can be shared by all humankind for the betterment of the human condition. The system of measures as well as the Hegelian overseer acts as the guarantors for the created knowledge (Churchman 1971; Courtney et al. 1998). The complex nature of the Singerian inquirer makes it difficult to find any real examples of this type of inquirer in practice although it has been used in conjunction with other theories such as Simon's decision types or Habermas' theory of communicative action to form the basis for KMS design (Hall and Paradice 2005; Linden et al. 2007; Richardson et al. 2006).

With the Singerian inquirer, Churchman also revisits his nine requirements for systems, this time recasting them in the context of the Singerian inquirer (Churchman 1971, p. 200).

1. The system has the purpose of creating knowledge that is described to be "exoteric" and oriented toward bettering the human condition.
2. The system's measure of performance is the "level" of scientific and educational excellence of all society.
3. The client is humankind, i.e., all human teleological beings.
4. The components of the system have traditionally been "disciplines"; this is incorrect if the goal is knowledge that is to be useful to the humans in every society.
5. The system has "fuzzy" boundaries that are necessary for the cooperation that creates inquiry, and in turn, the inquiry that creates cooperation.
6. In the ideal, the decision makers are everyone; the most important of which are the "heroes" who abandon the current mode of thinking and set upon a quest for knowledge in radically different ways.
7. The designers are everyone – in the ideal. Progress can be measured in terms of the degree to which the client, decision maker, and designer act as a single entity.
8. The designer's intention is to change the system so as to maximize its value to the client (everyone).
9. There is a built-in guarantor that gives a sense of optimism.

The Singerian inquirer is exemplified in many of the executive support systems (ESS) that are being used in organizations. These systems take data from organizational management information systems, decision support systems, and also "sweep-in" information from external sources to assist the executives with unstructured decisions such as those relating to issues of strategy.

The Internet, World Wide Web and applications such as Wikipedia exemplify Singerian inquirers, at least to some extent. Wikipedia attempts to share knowledge globally in many languages to anyone with Internet access. The user community is responsible for maintaining the validity of the knowledge contained within the system and users are expected to behave ethically by entering only what is believed to be valid knowledge. Thus the attempt is to send knowledge out to the international community in an ethical way.

Another example of Singerian inquirers is some health information sytems and websites such as WebMD (www.webmd.com) and the Mayo Clinic's medical information site (www.mayoclinic.com). These sites attempt to provide medical information on many diseases, medications, and treatments to the general public. Medical professionals are trained in ethical principles and are expected to maintain strict ethical behavior in their practice, thus conforming to Singerian principles. The research of Richardson (2005) also leverages the principles of the Singerian inquirer in the description of the medical system that follows.

Richardson (2005) integrates elements of the Singerian inquiring system with Beauchamp and Childress's (1994) *Principles of Biomedical Ethics* and the *Charter on Medical Professionalism* (Sox 2002), which are widely accepted in the medical community, to derive a set of ethical principles for guiding the development of healthcare information systems (HIS). The Charter incorporates the relatively new concept of patient autonomy as one of its fundamental principles, as well as the importance of patient welfare and social justice. The synthesis of these kernel theories results in a design theory, characterized by a set of design principles to guide a unique class of system, healthcare information systems.

The use of the design theory principles are illustrated by the development of a collaborative project with a local hospice. The hospice wanted an IT-facilitated patient education tool to inform patients and their families about advance directives and end of life (EOL) decisions. Advanced directives (ADs) are written or oral statements that communicate individuals' choices regarding their healthcare at the end of life and are important documents for both the individual, even currently healthy persons, and healthcare providers.

The result of this collaborative effort was a decision support system that addressed end of life (EOL) decisions that are captured in advance directives. An Advance Directives Decision Support System (ADDSS) was developed and implemented with the guidance of the HIS design principles.

The ADDSS aids individuals, healthy or ill, in making these complex decisions. The ADDSS includes a values section that serves both as an educational tool that facilitates communication between the individual, family members, and healthcare providers regarding treatment options, and also captures more detail regarding the patient's treatment preferences. The result is a values section that supplements the legal forms in the ADs that captures more detailed information regarding a patient's wishes. This can aid healthcare providers in making treatment decisions when a patient no longer has a voice.

The goal of the organization was to have a more effective education tool, facilitate communication between patients, their families, and their healthcare providers, and increase the number of advance directives completed by its patients. The hospice also participates in community efforts to raise awareness about EOL decisions, and the importance of advance directives. As a result, a secondary goal is to provide a better educational tool for the community and an increased number of completed advance directives community wide.

Richardson (the designer) worked very closely with the client (the hospice) and the decision makers (the patients) in the development of the ADDSS. This illustrates nicely the Singerian precept of the client, decision maker, and designer becoming as one. Both the designer and the hospice made every effort to ensure that the patient's autonomy was paramount in the development of the system thus adhering to ethical principles. By working with the community, the hospice helped achieve the Singerian goal of producing knowledge that is useful to humankind and that also enhances the human condition.

19.3 Conclusion and Future Research

As stated in the introduction, our purpose in writing this chapter was twofold. First we wanted to illustrate the impact that inquiring systems has had on the design of contemporary information systems. We accomplished this by describing the inquiring system and then presenting information systems that serve as exemplars of each type of inquirer. We then look at two information systems that have been explicitly founded on inquiring systems theory.

The second purpose is to illustrate the potential that inquiring systems have to serve as theoretical foundations for the information systems of the future. Inquiring systems have great potential to assist information researchers and practitioners in the design of information systems that address a wide array of organizational issues. Each type of inquiring system addresses a different class of organizational issue from very structured problems (Leibnizian inquirer) to highly unstructured (Singerian inquirer).

The potential of inquiring systems to serve as theoretical foundations for the information systems of tomorrow is especially great given the fact that they need not be confined to the five inquirers penned by Churchman. In fact, there are several philosophical foundations that could serve to extend the notion of inquiring systems. This is evidenced by the work of Guo and Sheffield (2006) and Parrish and Courtney (2010) who seek to add the philosophical stances of Habermas and Weick to the original five inquirers, respectively.

It is our view that this is an exciting area for future research. By extending inquiring systems, we can then expand the theoretical foundation on which new information system designs can be based and provide researchers and practitioners the tools needed to create the information systems for tomorrow.

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Chapter 20
Information Systems Deployment as an Activity System

Faraja Igira

Abstract The use of Information Systems (IS) and Information Technology (IT) is penetrating a wider part of human life, broadening the scope of IS research accordingly. Nonetheless, extant IS research literature shows that it is the social and organizational contexts of IS design, implementation, and use which lead to the greatest problems. Thus, there is a need for a detailed knowledge about the context of IS, and the process whereby the IS influences, and is influenced by, the context. This chapter demonstrates the application of Developmental Work Research (DWR), which is an interventionist approach based on Cultural Historical Activity Theory (CHAT) for the study of work, organizations, and technology undergoing developmental transformation. The core of the approach consists of learning, development, and research as basic elements for both practitioners and researchers. It provides a dynamic framework for understanding and analyzing many areas of IS research and practice. The link between DWR and other research approaches used in IS research is also presented.

Keywords Cultural Historical Activity System • Information Systems • Developmental Work Research • Activity System

Abbreviations

CHAT	Cultural historical activity theory
DWR	Developmental work research
HIS	Health information system

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IS Information systems
IT Information technology
ZPD Zone of proximal development

20.1 Introduction

Information System (IS) is an interventionist discipline concerned with understanding and formalizing the interaction of Information Technology (IT) and human activity systems. However, the extant IS research literature shows that it is the social and organizational contexts of IS design, implementation, and use which lead to the greatest practical problems (e.g., Walsham 1993; Liu and Yu 2004; Heeks 2006). In this regard, it is of crucial importance that IS research and practice associates technology innovation with the context within which it is embedded (Avgerou 2001).

Cultural Historical Activity Theory (CHAT) or Activity theory as it is also known has the potential to provide robust approaches to the study and understanding of the complex and dynamic socio-technical and organizational contexts into which IS is deployed (Crawford and Hasan 2006; Igira and Gregory 2009). The theory aims at understanding human beings and the social entities they compose in their natural everyday life through an analysis of the origin, structure, and processes of their activities (Kaptelinin and Nardi 2006).

CHAT approaches and methodologies in IS research are still emerging. This implies that there are interesting opportunities for further application of these approaches in the ever-changing IT and IS field. It is through the application of CHAT approaches in different empirical IS research that we can further improve their applicability in various areas of IS research and practice.

There are several concepts and approaches within CHAT, but the mostly used approach in IS research is Developmental Work Research (DWR), which is the focus of this chapter. Despite its application, DWR methods have not been developed towards its applicability for the international audience in IS research. This is contributed by the fact that the application of DWR have mostly been in IS research projects that were conducted in Finland where very little results have been published in English (Korpela et al. 2004). This chapter provides a demonstration of DWR for the understanding and analysis of different areas of IS research and practice. Examples from the author's own intervention research within the health care organizations are used for further elaboration of different concepts.

CHAT and DWR in particular center on the notion that the way humans undertake an activity is influenced by the social and organizational contexts around them and their ability to develop an understanding based upon previous experiences in order to make logical actions. This is important to consider when deploying a new technology-based IS with which humans will interact.

The rest of the chapter is organized as follows. The next section reviews the origins and use of CHAT in general and in IS research in particular. This is followed by a discussion on how the DWR approach can be used for the study and understanding of IS.

The next section provides a brief description of the link between DWR and other research methods used in IS research. Lastly, the chapter concludes by highlighting areas in IS research and practice that can be addressed with DWR approaches.

20.2 Cultural Historical Activity Theory (CHAT)

CHAT traces its roots from the Soviet Union in the 1920s. Its basic foundations were laid by Vygotsky's concept of *tools mediation* (Vygotsky 1978) and Leontiev's notion of *activity* (Leont'ev 1978, 1981). Vygotsky's concept of tools mediation focused on the idea that human's interactions with their environment are not direct ones but are instead mediated through the use of cultural tools, signs, and desire. He illustrated that cultural tools, signs, and desire enable individuals to redefine and change their circumstances. In this regard, Vygotsky connected mediation and agency as the genesis of voluntary actions in individuals. However, in Vygotsky's approach the unit of analysis remained individually focused: mediation by other human beings and social relations was not theoretically integrated (Engeström 2001).

By expanding Vygotsky's concept, Leontiev's notion of activity expressed the idea that activities consist of *goal*-oriented *actions* that are completed through *operations* influenced by specific *conditions*. The notion helps to conceptualize the interrelatedness of various actions in an activity, and also how they are linked to the goals and shared objective of that activity. Furthermore, it expands Vygotsky's conceptualization of tool mediation by focusing on the social origins of intentional action. However, Leontiev's notion of activity has been criticized of putting much emphasis on the what side of the activity (what is being done) and paying little attention to the who side of the activity (those engaged in carrying out the activity) (Davydov 1999).

Drawing on the works of Vygotsky and Leontiev, among others, Engeström (1987) developed the concept that the complex interaction of individuals with their environment can be examined using a historically evolving collective activity system. He defined an activity system to be composed of the following elements: *subject, tools* and *artifacts, object, community, rules, division of labor,* and *outcome*. A *subject* is an individual or subgroup whose agency is motivated towards the solution of a problem or purpose. The *object* refers to the purpose (reason) individuals and groups of individuals choose to participate in an activity, and it is what motivates the existence of an activity. The relations between the subject and the object are not direct and are rather mediated by *tools, rules, division of labor,* and *community*, indicating the role of mediation in CHAT approaches. *Tools* refer to culturally produced means for changing the environment and achieving goals. The *division of labor* refers to the horizontal actions and interactions among members of the community and to the vertical division of power and status. The *community* is the participants who share the same object that shapes and lends direction to the shared activity at hand. *Rules* regulate actions and interactions within an activity. The *outcome* is the results or consequences that the subject finds once the activity is completed. Figure 20.1 depicts the core elements of an activity system.

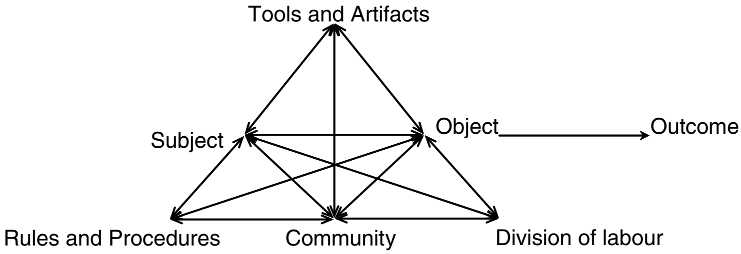

Fig. 20.1 The structure of a human activity system (Adapted from Engeström 1987, p. 78)

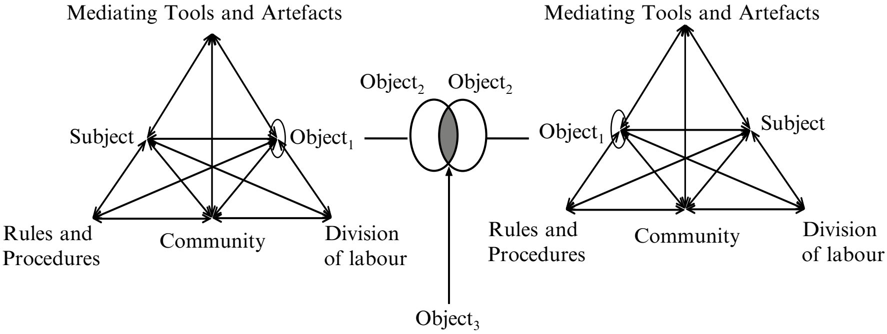

Fig. 20.2 Two interacting activity systems (Adapted from Engeström 2001)

Engeström (2001) expanded the basic activity system model (Fig. 20.1) by considering the interactions and overlaps between multiple activity systems (Fig. 20.2). In these interactions, the elements of an activity system are always produced by some other activity system. Likewise, the outcomes of an activity system are usually intended for some other activity, either as a means, object, or subject of the later. Furthermore, the object of an activity system expands from an initial state – object 1 to object 2 and a potentially shared or joint object 3. By providing feedback to the respective activity systems, the third object (object 3) gives rise to a driving force for the transformation of the original activity system.

In this regard, the unit of analysis becomes the plurality of different activity systems that mutually interact; promoting multiple perspectives and voices, dialogues, networks, and collaboration between activity systems (Engeström 2001; Yamazumi 2006).

The different CHAT concepts and approaches have traditionally studied learning and instruction in the context of schools and other educational institutions (e.g., Engeström 1987; Sue 1993). It was only in the end of the 1980s when CHAT was introduced in human–computer interaction (HCI) research (e.g., Bødker 1989). Since then CHAT's ideas have been a viable means for analyzing the context and practice of the use of technologies in workplaces (e.g., Nardi 1996; Kuutti 1996;

Korpela et al. 2002). In general, the research field has expanded from educational institutions to workplaces in which the deployment of new technologies and IS has become a pertinent research subject.

20.2.1 Developmental Work Research (DWR)

DWR is an interventionist approach for studying change and development in human activity and the organization of work. The approach is based on perspectives from CHAT and is oriented to understanding collective work practices in the process of change (Engeström 2005; Miettinen 2005). DWR approach assumes that the historical development of activity systems proceeds in the cycles of emergence, transformation, and solving of inner contradictions within the activity system, referred to as an expansive cycle or developmental cycle (Engeström 1987, 1999, 2005). These contradictions are historically accumulating structural tensions which emerge in the execution of day-to-day tasks making people to change their activities and simultaneously change themselves (Engeström 2001). Identifying the internal contradictions of the activity system which have catalyzed development can provide a collective mirror for those involved in the activity, helping them to identify the sites or sources of discoordination, and suggesting potential avenues for expansive change (Engeström 2005).

Accordingly, the analysis of contradictions in an activity system accords understanding of its developmental trajectory. They can be analyzed into four levels (Engeström 1987): primary, secondary, tertiary, and quaternary (Fig. 20.3).

Primary contradictions refer to inner contradictions within each constituent element of the central activity system. Secondary contradictions appear between the constituent elements of the central activity system. Tertiary contradictions appear between the dominant form of a central activity and an introduced culturally more advanced form of the central activity. Lastly, quaternary contradictions appear between the central activity system and its neighbor activities within its network relations.

An expansive cycle details six stages in generating change (see Fig. 20.4). The *first* is concerned with participants in an activity system questioning and criticizing aspects of existing practice. The *second* is an analysis of the situation to determine the causes identified during the questioning process. The analysis serves as a basis for planning a solution to the contradictions in the present praxis. The *third* is an attempt at modeling a new approach that addresses the issues identified in the first and second stages. Such modeling involves the creation of times and places where people's involvement in a shared activity with cultural tools can produce change in their practice. Vygotsky referred to these as zones of proximal development (ZPD) for the collective activity system.

The ZPD is a "collaborative construction of opportunities for individuals to develop their abilities" (Lantolf 2000, p. 17). It represents the difference between what one could do alone and what one could do with assistance (Vygotsky 1978).

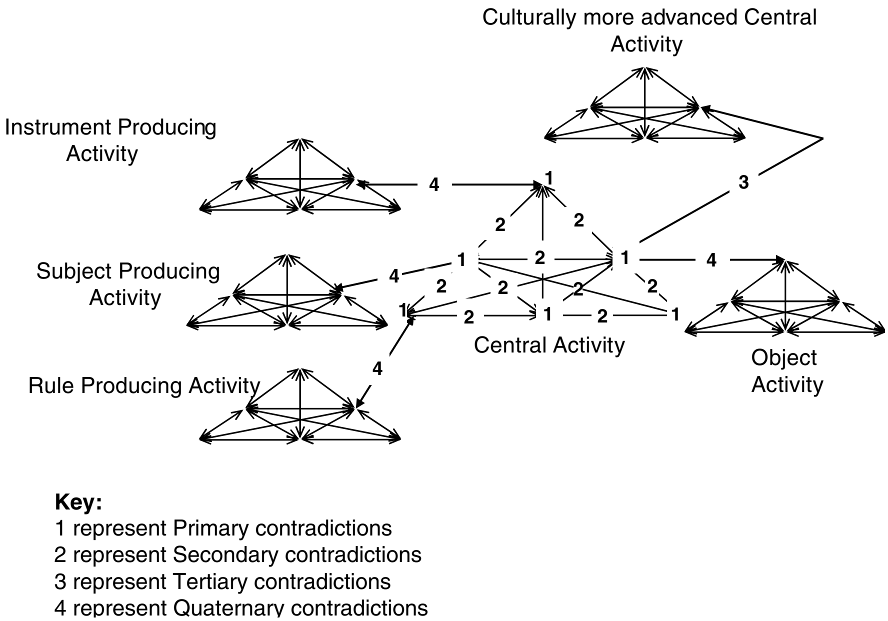

Fig. 20.3 Four levels of contradictions within an activity system (Engeström 1987)

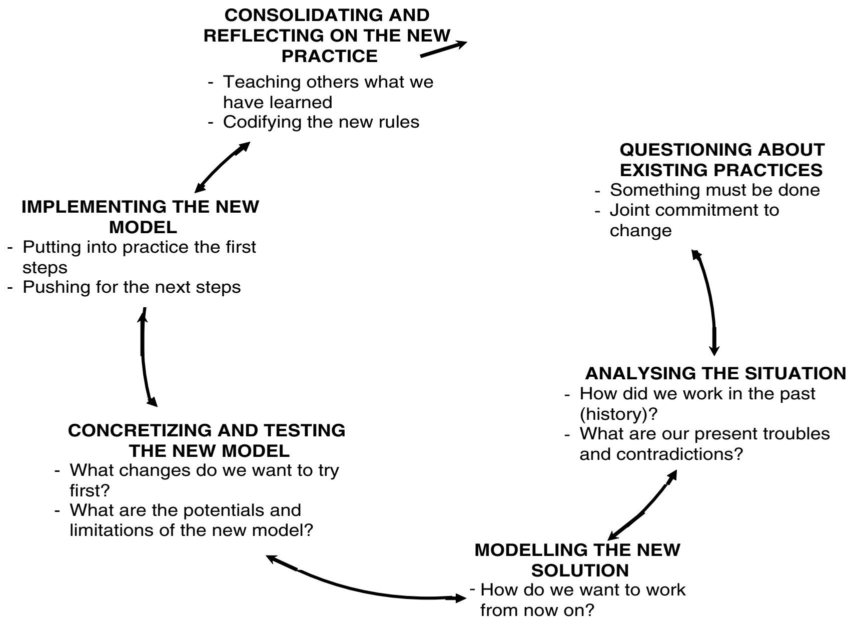

Fig. 20.4 The phases of an expansive cycle (Engeström 2005)

For example, for IS users that assistance could come from peers or coworkers and technological tools such as computers, IS experts, etc. However, it is important to note that during this process the ones who are assisted do not merely copy the offered capability; rather they translate what is offered to them in their own ways. In this regards, IS deployment activities are focused not on the transfer of skills from the expert to the novices (learner) but on collaboration between the expert and the learner that enables the learner to participate in changing IS practices (Igira and Gregory 2009).

The *fourth* stage involves an examination and testing of the model to establish its potential and limitations. The *fifth* is the implementation of the model in order to concretize its application to practice. The *sixth* stage involves reflection and evaluation of the model and a consolidation process where the outcomes of the model become a new and stable form of practice.

The phases of an expansive cycle represent possibilities that can be realized through active development work and conscious learning activity (Virkkunen and Kuutti 2000; Engeström 2005). An expansive transformation is achieved when the object of activity is reconceptualized to embrace a radically wider horizon of possibilities than in the previous activity system.

Accordingly, new tools will not come from nowhere. They are built on innovative ideas emerging from the current work practice and its inner contradictions. Through the development and use of tools, human beings both change the activity that they are engaged in and transform their mental perceptions about that activity (Engeström 1999). However, the development can also be hampered because participants cannot develop an agreeable solution to the contradictions or do not recognize the systemic and collective nature of their problems and try to manage the situation by individual solutions (Virkkunen and Kuutti 2000). In this situation, negotiation takes the form of improvization and bricolage, namely, constructing solutions by means of ad hoc combinative tinkering with available imperfect resources and tools (Engeström 2001).

DWR emphasizes the skilful contributions of people throughout organizations that are essential to accomplish work but are too often unrecognized, the valuation of skills that are usually rendered invisible, and how skill is socially achieved in a situated activity (Engeström and Escalante 1996; Engeström 2007). Consistent with Vygosky's view of mediation and agency, humans do not solely appropriate the cultural historical and material resources available to them, but they also create new social and material forms, patterns of relation, and tools in expansive cycles of development (Foot 2001).

20.3 How to Use DWR in IS Research

With a DWR approach, the basic research method in CHAT is not traditional laboratory experiments but the formative experiment which combines active participation with monitoring of the developmental changes of the study participants. The IS discipline is characterized by constant emergence of contingences that require pragmatic responses. Since an accurate prediction of the future IS deployment is impossible, the strength of DWR is in its acceptance of this possibility (Nathanael et al. 2002). To understand and analyze different areas in IS from a DWR approach requires a consideration of the following three main aspects:

1. The starting point should be a consideration of IS as a work activity system embedded in the social and organizational context (Kuutti 1991).

   From a DWR approach, IS is conceptualized as networks of people (subject) who use the IS to improve organizational performance (object), technological and nontechnological tools and artifacts, organizational routines and rules, the outcome (results or outputs), and all stakeholders (community) benefiting from the outcome of the respective IS. Accordingly, IS is viewed as an integral part of the day-to-day work activities of the organization in which it is to function. It is a systemic formation and mutual relationships exist between all its constituents as well as between its constituents and the constituents of other activity systems within the network. In this regard, the roles and tasks of people within the organization are intertwined with the functioning of the IS and the architectures of their work environments.

   For example, the Health Information Systems (HIS) activity system can be conceptualized to consist of the subjects who include doctors, nurses, and health managers. The object of work is health care data for improved health care performance. Tools include register books, paper forms, computers, pens, calculators, etc. The community consists of the covered population, patients attending the health facility, and health care workers (doctors, health managers, nurses, donor agencies, etc.). Furthermore, HIS activities are guided with certain rules and procedures and the division of labor. The division of labor determines who is responsible for data collection in each health care department (e.g., the in-charge of the department), report preparation and reporting to the required level or person (e.g., health information officers) and decision-making powers (e.g., heads and managers of the HIS). The rules regulate, for example, what data to collect, the reporting routines, and the hierarchy of reporting. Finally, the outcome includes the intended health care information for decision-making purposes. Changes in one constituent of the HIS activity system may result in changes in other elements. This implies that, in designing new technological tools we also design new conditions of use for a collective HIS activity (such as establishing new division of labor, rules, etc.).

   Moreover, a particular activity system does not exist in isolation but interacts with other activity systems. The HIS activity system illustrated earlier is part of a network of interacting activity systems, such as the health care medical work (provision of health care services), the health management activity system, the medical training activity system, etc.

   In understanding and analyzing the interrelationships between the constituents of an IS as an activity system, CHAT and DWR in particular contains features like *mediation, historicity*, *multivoicedness*, and *contradictions*, which are considered essential in IS design and implementation discussions (Kuutti 1996; Korpela et al. 2004). These features are further elaborated in the paragraphs that follow.

Mediation: Vygotsky (1979)'s conceptualization of mediation reflected the fact that human activity is always mediated by cultural means or artifacts, such as language and tools. With Engeström (1987)'s extension in DWR approach, the current key notion of mediation presents the view that an activity system is mediated by historically and culturally created tools and artifacts, on the one hand, and by social properties, such as community, division of labor and rules, on the other hand. Accordingly, an activity is always a materially and socially mediated object-oriented practice (Lehenkari 2000). For example, in organizations that are characterized by a hierarchical way of working, mediation by social properties is as important as mediation by tools and artifacts. With most decisions being done at the higher levels in the organization, activities at the lower levels are guided by specific rules, the division of labor, and aspects from the community.

For example, the mediation aspect can be useful in identifying what tools and artifacts people (subjects) bear on the object of IS activity system (improved organizational performance), both those tools that the organization provides and the tools that people bring (might bring) from their previous involvement in other activity systems. This is a particular problem in IS research and practice due to the fact that some IS tools such as a computer are pervasive and they may crowd out others or make them less visible.

Historicity: The historical development of different elements in an activity is one of the key issues DWR is emphasizing. In many occasions the recent state of IS affairs is difficult to understand without a reference to the historical development that has produced it. Activity systems are typically institutionalized working communities. Accordingly, participants themselves are analyzed as historically and culturally formed activity systems. In a DWR perspective, technological tools are social entities that are developed and redeveloped as a result of historical social and cultural transformation that occurs in the environment in which the activity is carried out (Kaptelinin 1996).

Keeping with the example of the HIS activity system described so far, the register books, paper forms, and procedures for data collection and reporting have been accumulated over a long period of time; not only as a result of the historical evolution of the country's health care system and of the health care organization but also in response to changes and advances in health care practices and technologies. Understanding the HIS activity system thus requires understanding the historical evolution of its tools.

Historicity in IS deployment can reflect experiences in older IS practices and technologies. As a result, the new practices and technologies can be made consistent with existing set of activities and thus create the potential to radically transform them.

Multivoicedness: According to CHAT, different subjects (whether as individuals or a team) in the community bring with them their voice, that is, their interests and conceptions of the object and its development in the network (Miettinen 2005). This can be through their position in the division of labor and/or their familiarity with the mediating tools available to them (Engeström 2001). Therefore, the concept of multivoicedness helps in directing attention to the different actors' varying interests, motives, and tools (including concrete technologies, knowledge, resources, and languages) for shaping the object.

Health care work, for example, is characterized by different stakeholders with multiple viewpoints, different needs, and inconsistent and evolving knowledge basis. When designing and implementing a computerized system for the HIS activity illustrated earlier, doctors, nurses, and health managers, for example, bring their own experiences from their work practices. However, the doctors' and nurses' experience may differ from that of the health manager due to their position in the division of labor and familiarity with the mediating tools at hand. Likewise, the doctors' and nurses' decision-making power in relation to the design and implementation of the HIS are probably constrained by the health managers' decisions.

An emerging issue in IS research and practice is the need to explicitly negotiate and specify different ways of working together. Each person in a socio-technical IS brings unique cultural history, personality, and knowledge base and thus interprets, makes sense of, and responds to, the system individually. The diversity and complexity of human responses increases both complexity and potential of the IS being deployed. In activity-theoretical analyses, mismatches between the different voices are examples of manifestations of contradictions within and between activity systems (Engeström 1987). These diversities are resolved overtime, through negotiations, whereby participants in the IS deployment process establish new practices as well as revert to the old ones.

Contradictions or tensions: The existence of mutual relationships between the elements of an activity system, between activity systems, along with the multi-voicedness of activities results in contradictions (Engeström 1987). From a DWR perspective the term contradiction is not to be understood as problem, obstacle, conflict, or breakdown. Rather, contradictions indicate a misfit within elements, between elements, between different activities, or between different developmental phases of a single activity (Kuutti 1996). Accordingly, contradictions triggers innovation and change within the elements and/or within the activity system.

The concept of contradiction is probably the most important in understanding and analyzing IS with the focus on transformation. In the context of IS, contradictions manifest themselves as disturbances, which interrupt the fluent flow of work within the respective IS. Analyzing these disturbances as they occur in a given social practice provides a method for uncovering sources of change and transformation of IS. The concept of contradictions or tensions can be applied in two different but interlinked ways. One focus can be the analysis of contradictions in everyday work practices surrounding the deployment of IS and how IS users work around these tensions to get the work done and facilitate further design of the IS. The other focus can be on how contradictions trigger the need for an improved IS.

2. Allow participation so that shared interpretations of IS could be developed and take into account that these interpretations will be emerging as more experience is accumulated.

   Experiences from Participatory Design approaches have indicated that participation and how to participate has to be negotiated and adapted to the local setting

(Puri et al. 2004; Kiura 2006). While practitioners immersed in the everyday IS work practices can verbalize a part of their ordinary practices during participatory design, another part remains unarticulated because these aspects are either too mundane or taken-for-granted for recognition. To gain access to this invisible or tacit knowledge that nevertheless is integral to the accomplishment of everyday work, participants in the IS/IT deployment processes have to pay attention to the emerging contradictions within a work activity system. The DWR approach described in this chapter emphasizes that analysis of user requirements should be an ongoing process throughout the IS deployment process whereby understanding emerging contradictions help designers to understand not only what users talk about but also what can be found in silence.

3. Both collective and individual aspects of work must be taken into account (Korpela et al. 2004).

   DWR, with its emphasis on the need to look at real activities in real situations, helps in studying the context in which users work for the purpose of IS deployment. However, the needs of an individual as a part of different activity systems might differ and cause tensions within and between activity systems. In this situation, the individual is likely to follow the practices that facilitate the achievement of her/his individual object of work.

   Addressing the interrelations between the needs of individuals and the multiple activity systems (or multiple objects of activity) in which they take part helps in understanding the dynamics in IS practices that requires a substantial adaptation to individual objects of work. In this analysis, an IS is examined with regard to the judgment and reasoning required in its use. Such analysis in turn helps to understand and describe the actual performance of IS applied to certain specific object of work.

20.4 DWR in Relation to Other Methodologies Used in IS Research

CHAT and DWR in particular hold several methodological principles in common with action research, practice-based approaches, cultural or cross-cultural approaches, and other theories such as actor network theory (ANT) and structuration theory. DWR and action research methodologies both emphasize the cooperation between researchers and practitioners; they value practical knowledge, the researcher acquiring multiple roles and fostering personal and content-related change. However, in DWR the researcher's task is not to try to change behavior as in Action inquiry or research but to start a dialogue about existing traditions in relation to the prevailing circumstances (Nilsson 2000). By perceiving the activity in an organization as culturally and historically constituted the focus in DWR is transferred from individual's behavior to the organization's traditions and methods of working. That is, the object of analysis and development is the whole collective activity system of the work place (Engeström 2005).

DWR approach relates to practice-based approaches (e.g., Nicolini et al. 2003; Strati 2007), which emphasize the social and post-social interaction, collective negotiation, and the construction of the legitimacy of the practice itself within a specific organization setting. These approaches argue that knowing and doing in an organization is contextual and materially embedded. Tools and other material aspects of doing are central to organizational actors, activity, and knowledge.

DWR approach helps in studying and analyzing interactions as embedded in the social context. In this approach humans are seen as full participants in their activity systems. Likewise, communities and contexts are constantly changing and being changed which results in changed opportunities for development. The approach aims at reconstructing contexts in practice so that individuals and their social partner and the activities in which they engage are continually transforming and developing in mutually integrated ways. However, rather than considering context as simply a situationally created space, DWR approach conceptualizes context as an entire activity system composed of the subject, object of activity, tools, community, rules, division of labor, and outcome of the activity. This principle differentiates DWR from other approaches to context, for example, cultural or cross-cultural approaches in which context and culture are seen as variables that influence development (Robbins 2005).

CHAT, ANT, and structuration theory share foci on everyday and historically evolving design, use, and continuous adaptation of artifacts and technologies; critical reflection on the production and reproduction of relations between people, things, and nature; continuous learning and knowledge and potential for transformation through our interactions and practices; an appreciation of the particularities and contingencies of social contexts and configurations of human–machine and other human and nonhuman collectives; and design for negotiation between the multiplicities of objects, activities, logics, and systems (Igira and Gregory 2009, p. 447). For contemporary discussions of the differences and similarities between CHAT and ANT, see for example, Engeström and Escalante (1996), Bratteteig and Gregory (1999), Miettinen (1999, 2001), and Kaptelinin and Nardi (2006). Comparative discussions between CHAT and structuration theory are offered by Bratteteig and Gregory (1999) and Widjaja and Balbo (2005).

20.5 Conclusion and Future Research

This chapter has reviewed DWR as a CHAT-based approach for the study, understanding, and analysis of IS. With DWR approach, what motivates the emergence and creation of new tools (such as new technologies and new IS) and how new technologies and IS are deployed can be studied. How are work practices and interactions changed and reproduced during these processes can as well be studied.

The cyclic nature of how people interact and refine their work practices as illustrated by the expansive cycle points out to the need for an iterative IS deployment process that can grow and change as the needs of the community change. The significance of CHAT and DWR in particular lies in its ability to analyze the dynamic human interactions mediated by technological and nontechnological tools at both the individual and social levels. The approach can as well help to grasp the emergent features in individual and social transformation resulting from the deployment of IS.

With the sensitivity to tensions and openness to reorganization, the potential exists for older IS and IT to be examined in light of more contemporary offerings. In this process, the IS deployment becomes part of the transformation of the whole activity system to solve its contradictions. This idea helps to surpass the narrow view of IS or IT deployment as a step from one status quo to a targeted new stable state and to grasp the continuation of the qualitative change of the IS activity system with all its constitutive elements. Accordingly, the DWR is a tool for understanding the developmental dynamics of IS and IT as activity systems and is thus a useful framework for negotiating the form that IS might take in order to be able to meet the present and future organizational needs. Such situations are central to current IS research and practice.

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Chapter 21
The Work System Method as an Approach for Teaching and Researching Information Systems

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Abstract The Work System Method (WSM) was developed in a series of publications over the last decade by Steven Alter. It is a significant theoretical development in the field of Information Systems (IS) and has a growing support base. This chapter satisfies the need in IS research and practice for a review of the major concepts in the WSM and the most recent developments in related research. It is based on extensive literature review of publications by the originator of the methodology and other authors as well as on the experience of the authors with it. Possible directions for future work are provided for enhancement of IS development and education.

Keywords Work System Method • Information Systems development • Information Systems education

Abbreviations

ERP	Enterprise resource planning
IS	Information systems
IT	Information technology
SA&D	Systems analysis and design
SDLC	Systems development life cycle
WSLC	Work system life cycle
WSM	Work system method

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21.1 Introduction

The Work System Method (WSM) emerged over the last decade as an important development in Information Systems (IS) theory and practice (see Alter 2006b; Petersson 2008; Madsen and Vidgen 2009 and others). Several important recent debates and developments in the IS field were explored also by significant publications dedicated to it. These include the discussion on the nature of the Information Technology (IT) artifact that took place early in the past decade (see Orlikowski and Iacono 2001; Alter 2003), attempts to revitalize the systems approach in IS (see Alter 2004, 2007a; Mora et al. 2007), a surge in design science and systems analysis and design research in IS (see Bajaj et al. 2005; Alter 2009; Alter and Browne 2005; Tan et al. 2008), developments in Information Systems and Service Science (Alter 2007b) and the more general issue of defining IS and the role of theory in IS (see Alter 2008).

The multifaceted WSM publications by Steven Alter justify the relevance of the WSM for IS practice, research, and teaching. At the same time we need to point that there are many unexplored directions for research related to the WSM and the more general area of systems thinking applied to IS as indicated in Alter (2004, 2008), Alter and Browne (2005), Petkov et al. (2008), and Misra et al. (2009). The publications on the WSM have grown in numbers over the last 8 years and the circle of authors that have used the WSM or quoted it in their work is widening. Apart from Alter (2008) there is no other recent summary account on recent published work related to the WSM. This justifies the purpose of this chapter: to provide a reflection on current research on the WSM at the end of the decade and some directions for its use in IS education and IS practice. We hope that as a result readers may navigate more easily through the body of knowledge on the WSM.

The next section of this chapter examines briefly the features of WSM theory and the status of current WSM research. This is followed by a discussion and a review of evaluations and extensions of WSM concepts. At the end is presented a conclusion summarizing the main issues in the chapter and providing some directions for further research on applying WSM in IS education and development.

21.2 Introduction to the Work System Method and Related Current Research

This section introduces basic notions of the WSM, shows the process of applying it, and attempts to present a summary of current research developments related to it. The main references for that are publications by Steven Alter (available also at www.stevenalter.com), but some of the conclusions are based on our previous work on WSM in Petkov and Petkova (2008), Misra et al. (2009), and Petkov et al. (2010). Thus we provide a brief WSM primer. It cannot be more detailed simply due to the many facets and size of the WSM theoretical base.

The way WSM was defined by Alter has been refined over the years. Thus in 2002 he states that the WSM is an approach for understanding and analyzing systems in organizations whether or not IT plays an essential role (Alter 2002). The emphasis on rigor and at the same time on providing a nontechnical accessible approach for analysis is more pronounced in a subsequent book on the subject: "The WSM provides a rigorous but non-technical approach to any manager or business professional to visualize and analyze systems related problems and opportunities" (Alter 2006b). The same source represents most comprehensive justification for the WSM and how to apply it to define a work system, analyze it, formulate recommendations for improvement, and guide its evolution (see Alter 2006b).

A crucial issue is the *definition of the notion of work system* and how it relates to IS. It may be demonstrated best by the following quote from Alter (2008, p. 451):

> A work system is a system in which human participants and/or machines perform work (processes and activities) using information, technology, and other resources to produce specific products and/or services for specific internal or external customers.
>
> An IS is a work system whose processes and activities are devoted to processing information, that is, capturing, transmitting, storing, retrieving, manipulating, and displaying information.
>
> Thus, an IS is a system in which human participants and/or machines perform work (processes and activities) using information, technology, and other resources to produce informational products and/or services for internal or external customers.

The above formulation distinguishes clearly between work systems in general and IS in general. Alter (2006b, 2008) stresses that the emphasis is on developing an understanding about work systems, a notion that he borrows initially from the theory of socio-technical systems (see Alter 2006b) and elaborates further by providing greater clarity about its components and relationships to IS and other notions.

The above quote clarifies that an IS is just one type of work system. Alter (2009) notes that sometimes the IS can be the work system of interest if we deal with a fully automated work system. Another issue is the case when the IS overlaps significantly with the work system that it supports. The latter are labeled as IT-reliant work systems in Alter (2008) with examples such as highly automated manufacturing systems, package delivery systems, and others. Alter (2008, p. 451) stresses that a clear IS definition should distinguish between IS and IT-reliant work systems (of which IS are a special case whose processes and activities are devoted to information and that produce informational products and services).The importance of understanding the relationship between work systems and IS becomes more clear when we relate to the many failures in IS development that are due to poor understanding of the initial problem facing IS developers (more related thoughts can be found in Alter 2006b).

The WSM (Alter 2006b) is based on *two major components: the work system framework*, representing a static description of the work system, showing how a work system operates at a particular point in time and *the work system life cycle*, focusing how a current or proposed work system evolves over time. Detailed definitions of the elements of the work system framework are presented in Alter (2006b, 2008).

The work system framework (a model for organizing an initial understanding of how a particular work system operates and what it accomplishes) and the work system life cycle (WSLC) (a process through which a specific work system is created and changes over time through planned and unplanned changes) have complementary roles (see Alter 2006b).

The *work system framework consists of nine elements*, four internal and five external (Alter 2006b). The four internal elements, considered part of the work system, include processes and activities, participants, technology needed to enable completion of processes and work items, and information or knowledge base needed. The five external elements, viewed as outside of the work system, yet important for understanding its purpose and operation include strategy (both business and IS/IT), infrastructure needed to support the work system, environmental factors, product and services, and customers (internal customers who are employed by the enterprise work system users and external, economic customers of the enterprise).

A summary of the six central components of the work system framework for a specific problem situation constitutes a convenient initial representation of a work system called *work system snapshot* (see Alter 2006b).

Alter (2006b) introduces a *three-step process for the analysis of a work system*:

> *Identify the system and problems*: Identify the work system that has the problems that launched the analysis. The system's size and scope depend on the purpose of the analysis.
>
> *Analyze the system and identify possibilities*: Understand current issues and find possibilities for improving the work system.
>
> *Recommend and justify changes*: Specify proposed changes and justify the recommendation.

This process is quite natural as it corresponds to the typical problem-solving process in operations research, considered to be one of the reference disciplines for IS.

A very useful feature of WSM is the ability to *conduct the analysis of a work system at three levels of detail* depending on the actual purpose and granularity of analysis. Thus, at level one, rough definitions of the work system and the problem of concern are provided; while at level two, a number of specific prompting questions for each of the three steps of the analysis are explored. Those questions provide deeper information and perspectives on the problem situation. Then at level three a number of diverse techniques like checklists, diagrams, and any other relevant data are employed that can provide finer understanding of the problem situation at a specialist level.

More details and examples of applying WSM analysis at different levels during the three process steps (as defined earlier) are provided in Alter (2006b). Various possible relationships between an IS and a work system are described in Alter (2002, p. 96). Guidelines for analyzing work systems within the three-step process described above are presented in Alter (2006b).

The body of knowledge on WSM continues to develop and most of the subsequent publications by Alter after 2006 introduce *new dimensions of WSM research*. A significant development of WSM theory is the *WSM metamodel* introduced in

Alter (2010). It captures the distinction between socio-technical systems (IS can often be classified as socio-technical systems due to the active roles of human participants) and pure technical systems (fully automated IS). The metamodel creates a bridge between the summary description of a system and the more detailed models of the subsystems that are developed during systems analysis and design and a link between socio-technical business analysis and the technical analysis by IS professionals (Alter 2010).

The dynamic view of a work system through the WSLC model describes how work systems change over time through a combination of planned change (explicit projects with initiation, development, implementation phases) and unplanned change (incremental adaptations and experimentation) according to Alter (2009). It has evolved from its initial formulation in Alter (2002) in two new directions recently:

- Providing understanding of *service organizations* (see Alter 2007b).
- Developing detailed representations of the roles of users and developers in IS projects at the various steps of the WSLC (see Fig. 5 in Alter 2009). That represents a *radical move from the notion of user participation in IS development to project collaboration* that is characterized by the following:
  - The system being created or improved is an IT-reliant work system, not an IT system.
  - The relevant life cycle models are various versions of the WSLC, not IT-focused SDLC models.
  - For both research and practice, project collaboration is a more fruitful focus than user participation.
  - The most meaningful success metrics are business metrics (not IT metrics) related to the product and process of development and implementation. (Alter 2009)

Another recent development is the introduction of *service responsibility tables* as a way to capture major issues related to a work system (see Alter 2007b). Further reflections on WSM research are presented in the next section.

21.3 Discussion, WSM Evaluation, and Extensions of WSM Research

Alter (2006b) stresses that past dominance of single ideas like Total Quality Management and Business Process Reengineering are not sufficient to influence the IS field profoundly. The WSM is more broadly applicable than techniques "designed to specify detailed software requirements and is designed to be more prescriptive and more powerful than domain-independent systems analysis methods such as soft system methodology" (SSM) (Alter 2002). A detailed comparison of the work system framework with other frameworks for understanding of IS can be found in Alter (2010). Alter (2010, p. 4) notes that the WSM applied to IS can be characterized as "theory for understanding" in terms of the various types of theories in IS discussed by Gregor (2006).

The comparison of philosophical and epistemological aspects of the WSM and SSM (see Checkland 1999) requires a broader investigation which is beyond the scope of this chapter. According to Petkov et al. (2008), a possible starting point for exploring their areas of applicability could be the classification of strategies for doing systems analysis provided by Bustard and Keenan (2005). They view SSM as being relevant in situations in which the focus is on the development of a long-term vision of the environment in which a computer system is to be used, along with identification of appropriate organizational changes (see Bustard and Keenan 2005). A rough attempt to link WSM with the Bustard and Keenan (2005) classification of project situations may position WSM in their category B which assumes greater attention to the environment of IS in a way similar to other top-down and system approaches. We may speculate that WSM might be applicable to other project situations involving possible combinations with agile methodologies (see Boehm and Turner 2004) and SSM. However, the general question about where Alter's approach stands in the Bustard and Keenan (2005) classification is an open topic for research requiring both theoretical work and field experimentation. These issues are reflected in an ongoing research project of several of the authors of this chapter in collaboration with two doctoral students at the Durban University of Technology in South Africa.

Another South African PhD student at the University of Cape Town is attempting to structure the understanding of agile software development practices using the lexicon provided by the WSM together with the guidelines provided by Alter (2006b). The motivation for using the concepts of the WSM is that it gives a lens to describe and understand the works systems that exist in software projects where participants claim agile practices are adopted. The use of WSM is seen to be advantageous because it gives the researcher access to a phenomenal domain that can be probed to excavate embodied and tacit assumptions which underpin work systems. Alter has not promoted the WSM method in such a light but its power as a lexicon to describe a phenomenal domain relevant to work systems has huge potential.

The systemic nature of the WSM (see Alter 2007a) and its applicability to understanding business and IS problems are its most distinctive and important characteristics for IS research and practice according to Petkov and Petkova (2008). The WSM is a relevant and important systems approach applicable to IS analysis and design according to Petkov et al. (2008). Petkov et al. (2008) concluded that the WSM has a potential to be used in combination with other relevant methods to change the attitudes of clients in managerial and operational user roles for the purpose of developing better understanding of organizational problems.

The WSM has a relatively short history and a small but growing group of followers. Yet the multifaceted scale of Alter's work, bringing together systems ideas with WSM concepts and traditional IS methods for deeper understanding of work systems and IS, has very strong appeal. This was stressed also by participants at a 2010 panel discussion at the European Conference in IS (Petkov et al. 2010).

Petkov and Petkova (2008) note that most of the earlier work related to the WSM by other researchers than Alter has been related to the potential application of its concepts (e.g. see Siau et al. 2004; Casey and Brugha 2005 and others). Kosaka (2009), for example, stresses the value of WSM as an approach for doing systems analysis for nontechnical people.

In recent years, however, the interests of researchers in WSM are associated with its direct integration in their own work. Thus Møller (2006) uses the system perspective of a business process as a work system as a theoretical lens for the development of business processes. Davison et al. (2008) apply aspects of WSM in their methodology for the analysis of the knowledge sharing practices at a large organization. Petersson (2008) applies some of WSM ideas in his design theory promoting socio-technical pragmatism. A further dimension of related work is the attempt to provide heuristic rules for conversion from a summary description of a work system snapshot into use cases presented in Tan et al. (2008).

There have been very few attempts so far by other researchers for providing any hints of critical analysis of the role and applicability of WSM as a socio-technical approach to IS development (see Korpela et al. 2004). The only potential criticism of WSM that has been voiced in the literature is actually a warning based on general assumptions about soft systems approaches which might apply to WSM: according to Madsen and Vidgen (2009, p. 4) "the WSM has much promise, but may come to suffer from the same barriers to method adoption and diffusion as ETHICS and Multiview, namely that it is developed in an academic context, that it advocates a systems concept that goes well beyond IT, and that it is perceived as a comprehensive method despite the author's guidelines on how to use it in a flexible way." The latter issues are worth investigating in future fieldwork for their validity with respect to WSM. The above warning may be linked also to the importance of how WSM is introduced in IS education as a way to expand its base.

There was little investigation of WSM applied in IS education prior to 2006, as noted briefly in Alter (2006b). Ramiller (2005) describes the use of the work system concept for understanding the notion of business processes in an undergraduate IS course. An overview of various aspects of the experiences in teaching WSM concepts to executive MBA students over a decade appears in Alter (2008). Various pitfalls in analyzing systems in organizations based on investigating 200 masters projects are presented in Alter (2006a).

The first rigorous field laboratory experiment to test the impact of WSM was presented in Petkov and Petkova (2008) who explored the role of the work system framework for improvement of student understanding of an IT related work system problem in an introductory IS course. It was about the analysis of a business situation resulting from enterprise resource planning (ERP) implementation difficulties illustrating the typical problems of many ERP projects: poor planning, lack of proper analysis of the existing business processes, inadequate training, project delays resulting in user dissatisfaction, and business difficulties. By comparing student learning in the control and experimental group measured through the use of projects and rubrics as a direct assessment tool, they concluded that the Work System Framework has a positive impact on student understanding of IS implementation problems.

More recently, Truex et al. (2010) report results obtained when advanced MBA students at a major East Coast US university used a work system analysis template to perform preliminary analyses of work systems in their own organizations for class projects in spring 2009. The deliverable was a five-part management report (executive summary, background, system and problem, analysis, recommendation and justification) plus an appendix. The latter included tables for summarizing the "as is" work system, assessing how well it operates and where problems exist, summarizing a proposed "to be" work system, and clarifying why proposed changes probably would improve performance. Scoring of each report by two highly qualified readers led to the conclusion that these students could use the work system analysis templates effectively.

Alter's proposal for IT-reliant work systems to replace the IT artifact as the focus of the IS discipline (see Alter 2003) has deep implications for introducing greater clarity in the scope of IS research. Since the nature of the IT artifact is a central issue in IS research, it indirectly affects possible future work on the WSM and Systems Analysis and Design, an issue that is covered next.

Misra et al. (2009) note that the aspects of design science research discussed by Hevner et al. (2004) had a direct impact on the renewed interest in Systems Analysis and Design (SA&D) teaching and research (see Bajaj et al. 2005). Misra et al. (2009) provide possible directions for further applications of the WSM in SA&D, following the conceptual model for IS research and design science work according to Hevner et al. (2004) and the ideas in Bajaj et al. (2005):

- Investigation into the systemic nature of WSM (see Alter 2007a).
- Investigate both the theoretical and practical value of Sysperanto, a language aimed at providing better understanding between clients and software developers (see Alter 2008) compared to other ontologies in the IS literature.
- Analysis of any differences between the way "work system" is used by Alter and those researchers working in other areas of IS or between notions like work system and "human activity system."
- Testing in practice of the idea about IT-reliant systems to replace the IT artifact as the focus of IS research as argued by Alter (2003).
- Investigation into the applicability of WSM for service systems (see Alter 2007b).
- Provide evidence from case studies, laboratory experiments, and field experiments on the applicability of the WSM in SA&D in IS education.
- Establish the utility of the main artifacts of the WSM mentioned above to practicing IS developers with respect to improving their understanding of the work system and the systems analysis tasks associated with an IS project.
- Further issues relate to their potential in providing a balance between agility and discipline in IS development, along the suggested SA&D research directions in Bajaj et al. (2005).

The above dimensions of future WSM-related research as well as those outlined by Alter (2004) and Alter (2008) provide rich opportunities for exploring substantial issues in IS development.

21.4 Conclusion and Possible Future Research on WSM Applied to IS Education and IS Development

This chapter was organized along one of the goals of the book for which it was written: to produce a practical summary of the main ideas in the WSM and a guide for researchers on latest developments in it. The chapter summarized in an accessible way the features of WSM and the process for its application which will be helpful to those interested in learning about this methodology. It is not a substitute for the seminal publications on the WSM by Alter and is not intended to provide all details revealing the potential of WSM. It is impossible in a short chapter to match the richness and diversity of WSM ideas developed over the last decade.

A possible limitation on the strength of a conclusion for the WSM appeal could be that the number of papers containing the phrase "Work System Method" authored by others than Alter is just below 130 as of 24 September 2010 according to Google Scholar. That is not a small number, however, for the period since Alter (2002) was published. Alter's WSM papers alone have been cited more than 600 times according to another search in Google Scholar at the same time. That supports our findings here that WSM ideas are of interest to a growing number of other researchers and postgraduate students from diverse countries.

As an extension of our analysis so far, we provide some ideas for future WSM-related work along four dimensions of IS research similar to those used for organizing a discussion at a recent panel on systems thinking in IS which featured WSM as a central topic (see Petkov et al. 2010):

- Improvement in the role of business professionals in IS development through the application of WSM.
  - Test in field conditions the impact of WSM ideas on the quality of project collaboration between clients and IS developers.
  - Analyze the impact of applying WSM for the quality of client requirements elicitation.
  - Introduce simpler and more diverse WSM-related techniques, enabling the formulation of client requirements.
- Strengthening the impact of WSM on traditional IS research.
  - Explore the impact on IS research of the clarity and simplicity of the definition of IS along WSM principles.
  - Investigate the implications for IS research of Alter's suggestion for IT-reliant work systems to become the IT artifact.
  - Develop further ideas bridging WSM-based business analysis with technical approaches to IS modeling.
  - Explore the possible limitations of the WSM.
  - Integrate further systems ideas with WSM in IS research.

- Enabling the wider use of WSM concepts in ICT development by IT practitioners.
  - Educate IT practitioners about WSM concepts through the channels of continuing professional education.
  - Document more case studies in different software development organizations to validate the claims for the applicability of WSM and to distil from the accumulated knowledge best practices and critical success factors relevant to flexible, high-quality software development teams (as suggested in Petkov et al. 2008).
  - Explore the applicability of "Sysperanto" (see Alter 2007a, 2010) to foster a common language for all stakeholders in software development.
  - Build methods and tools based on WSM to facilitate the communication process between software developers and customers.
  - Introduce WSM and other systems thinking ideas in undergraduate and graduate IT education.
  - Conduct further fieldwork on introducing WSM concepts in IS courses and gather data in longitudinal studies of such activities.
  - Investigate what elements of WSM are most suitable for particular courses at different levels in undergraduate IS education and at graduate level.
  - Introduce in a meaningful way WSM concepts in Systems Analysis and Design and Software Engineering courses.

Many of the above research suggestions aim at bringing awareness of WSM to those that are practicing IS development or are studying to become IT professionals. The guiding motivation for the authors of this chapter was to show the relevance of WSM ideas to IS that could inspire further theoretical and practical investigations. Following the analysis in this chapter we may conclude that the WSM is an important development in the field of IS which has a growing impact on many facets of IS research and a significant potential to improve IT practice. We hope that our summary of WSM ideas and possible directions for future work may strengthen further those roles of the WSM.

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