

Advances in Theory and Practice of Emerging Markets

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Digital India

Reflections and Practice

Advances in Theory and Practice of Emerging Markets

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ISSN 2522-5006

ISSN 2522-5014 (electronic)

Advances in Theory and Practice of Emerging Markets

ISBN 978-3-319-78377-2

ISBN 978-3-319-78378-9 (eBook)

<https://doi.org/10.1007/978-3-319-78378-9>

Library of Congress Control Number: 2018943842

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Printed on acid-free paper

This Springer imprint is published by the registered company Springer International Publishing AG part of Springer Nature.

The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Preface

According to the World Economic Forum, India has the fourth largest number of PhD students graduating every year and is still attempting to increase the research impact in terms of quality and quantity. In keeping with the global emphasis, research in the field of e-Governance (Gupta and Jana 2003; Shareef et al. 2011; Singh et al. 2017) has been an important activity for the Ministry of Electronics and Information Technology, Government of India (MeITy). In order to create an innovative ecosystem and to enhance India's competitiveness in these knowledge intensive sectors, MeITy has been implementing the Visvesvaraya PhD Scheme. The scheme is also in line with the aim of fulfilling the commitments made in National Policy on Electronics (NPE) 2012 and National Policy on Information Technology (NPIT) 2012. Further, capacity building is a priority of the National e-Governance Division, evident in the various programmes in its folds and also in the success of the first PhD Colloquium hosted in March 2017. As a part of this scheme, National e-Governance Division (NeGD) and Ministry of Electronics and Information Technology (MeITy), Government of India, together with Indian Institute of Technology, Delhi, have organized a Doctoral Colloquium on November 25, 2017, held at Hotel Pullman, Aerocity, New Delhi. This volume presents the papers presented in the Doctoral Colloquium 2017 on Digital Government Research.

The Doctoral Colloquium in Digital Government Research proved to be a forum where doctoral students from various disciplines relevant to digital government research shall meet to present their research work; discuss their ideas and concerns with senior faculty, peers and practitioners; and assist in building their professional networks. It is aimed to open up a forum for exchange of ideas between doctoral students, leading academicians in India and abroad, and researchers from industry to identify new avenues of research and application to align management education with Sustainable Development Goals and national priorities. The focus is primarily on Digital India (Thomas 2012; Kar et al. 2017), smart cities (Mustafa and Kar 2017), and e-governance initiatives (Rana et al. 2017; Singh et al. 2017). For achieving and sustaining such goals, the role of the 17 Sustainable Development Goals (SDGs) adopted by all member states of the United Nations in September 2015 plays a critical role. These goals set ambitious objectives across the three dimen-

sions of sustainable development – economic development, social inclusion, and environmental sustainability – underpinned by good governance (Kates et al. 2005; Griggs et al. 2013). They represent an unusually complicated agenda for governments, requiring a new orientation of governments and a new approach to multi-stakeholder policy design and implementation. This Colloquium proved to be an invigorating confluence of the best brains from the academia, government, and industry in the domain of digital governance.

The Colloquium welcomed submissions from doctoral students specialized in a broad range of research areas relevant to digital government, such as Informatics, Information Systems, Public Administration, Economics, Law, Sociology, Computer Science, Management, and other related fields. Thematic areas for submission include Knowledge Societies, Urban Operations and Logistics, Issues in Managing Emergent ICTs, Smart Analytics for Urbanization, Policy and Governance, and Sustainability and Functional Enablers for Smart Economy (Coglianese 2004). The Doctoral Colloquium received 21 high-quality papers. Each paper has been blind peer reviewed by at least two experts in the domain. After the review process, 12 papers were accepted for presentation and inclusion in the Colloquium proceedings. Each presentation was followed by an open in-depth discussion, with feedback provided to the student by session mentors and peers. All accepted papers are included in these Colloquium Proceedings and student participants received a certificate of scholastic excellence. In addition, Best Paper Awards were organized to recognize excellence of outcome. Best paper(s) may be fast tracked to the Special Issue on “Digital Nations – Smart Cities, Innovation & Sustainability” in Information Systems Frontiers (ABDC A Category, ABS 3* journal), published by Springer Nature. The articles in these proceedings are briefly outlined here.

The articles appearing in the Colloquium cover discussions surrounding digitization and its impact. Arora and Kaur share insights surrounding the driving forces behind retaining customers in this era of digitization through their study in the Indian context. Gayathri et al. propose activity recognition frameworks in their work surrounding smart homes and ubiquitous environments that offer ambient assisted living to its residents. Jayaprakash and Pillai present interesting insights regarding the role of businesses in attaining United Nation’s Sustainable Development Goals (SDGs) through corporate social responsibility and ICT moderation. Roy’s study, on the other hand, addresses concerns surrounding political economy of social media with a focus on restructured concepts of privacy and security by using the theoretical framework of Michel Foucault’s panopticon and governmentality. Duggal et al. highlight the importance of social networking sites, including Twitter, Google Trends, and Yahoo Finance, amongst others, for providing inputs to investors surrounding the Indian Financial Market (National and Bombay Stock Exchange). Aggarwal et al.’s study focuses on the portfolio diversification post the advent of Bitcoin in the Indian market. The authors use eight indices spread across six asset classes and employ three investment including “long only,” “constrained,” and “equally weighted” to construct optimal portfolios.

Further, Grover et al. use Twitter analytics for analyzing the inclination of leading social influencers toward SDGs by mining the conversations of the top 100

CEOs. Singh et al. conceptualize a framework for the assessment of the overall outcomes from e-government projects in a multi-stakeholder scenario with a focus on service providers. Mustafa and Kar, on the other hand, develop a conceptual model which can be put to use for measurement of information risk while using digital services. The authors take into consideration the perceived risk, trust in service provider, perceived size and reputation of the digital service providers. Srivastava's work aligns with transparency concerns in the Indian context and raises research questions for empirical examination of the concept of transparency. Findings of the study expand the understanding of factors affecting transparency in public and private organizations. Singla and Hooda highlight the SAP-LAP approach to value chain development for the government sector. Rajput and Singh provide an overview on the current trends and future perspective of Industry 4.0 with a focus on advances in the domain which has enabled systematic functionalities for cyber-physical systems. Further, Kumar and Gupta propose an effective framework surrounding socio-digital planning for the design and implementation of various policies for smart cities. Aswani et al. investigate the impact of the Investor Awareness Programme (IAP), initiated by the government for educating rural citizens surrounding financial aspects. Lastly, the work by Kar et al. does the analysis of stakeholders for the IoT ecosystem after integrating practice and academic literature in the domain.

The success of the Doctoral Colloquium is due to the efforts of numerous people and organizations involved. We thank National e-Governance Division (NeGD) and Ministry of Electronics and Information Technology (MeITY), Government of India, for their operational support in successful organization of the Colloquium. We further thank the research scholars from across India for choosing the Doctoral Colloquium in Digital Government Research organized by Indian Institute of Technology, India, to submit their manuscripts. We were overwhelmed with the responses to receive a large number of high-quality manuscripts from them in such a short time ever since the call for papers in the Doctoral Colloquium was published. The Colloquium would not have been possible without the support and advice of the International Co-chairs: Prof. Wojciech Cellary, Department of Information Technology, Poznan University of Economics and Business, Poland; and Elsa Estevez, Department of Computer Science and Engineering, Universidad Nacional del Sur, Argentina. The authors have greatly benefitted from the insights and suggestions provided by the co-chairs in aligning their research work to existing theories and models. The final submissions included in the proceedings are an improvised version post feedback from the co-chairs. The Colloquium would not have been successful without the organizing co-chairs from IIT, Delhi, and NeGD. A special thanks for Prof. Yogesh Dwivedi for his support in bringing out this proceedings. We finally thank the editorial team of *Advances in Theory and Practice of Emerging Markets*, Springer Nature, for publishing the proceedings and helping the Doctoral Colloquium to disseminate and impart the collective knowledge across the globe in the form of this edited book.

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Chapter 1

The Driving Forces Behind Customer Retention in a Digitized World: Evidence from India (A Partial Least Squares Approach)



Sangeeta Arora and Harpreet Kaur

Abstract This study seeks to develop and empirically validate a customer retention model. Based on past studies in the marketing research, we compiled a comprehensive set of constructs and hypotheses and established causal relationships between them. To measure the variables enumerated in the conceptual framework, a well-structured questionnaire was designed. Evaluation of the model with the help of AMOS-SEM was considered initially; however, due to the complexity of causally interlinked relationships in a conceptual framework (as the presence of serial and simple mediations), the results were analyzed using AMOS-SEM and partial least squares structural equation modeling (PLS-SEM) approach together. Contrary to some assertions in the past literature, the results suggested inertia has a positive relationship with customer satisfaction. Furthermore, quantitative analysis supported by empirical qualitative pieces of evidence from the survey exhibited that partial mediations were found among the constructs. The empirical results as hypothesized illustrate (a) customer loyalty was positively influenced by customer satisfaction, switching barriers, perceived price fairness, and trust and (b) inertia has no significant influence on customer retention and customer loyalty but found to be positively associated service quality. In conclusion, the managerial implications, limitations, and suggestions for future research are provided.

Keywords Customer retention · Customer loyalty · Inertia · Partial least square · Model development

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1.1 Introduction

Delivering a high-quality service is a significant retailing strategy for creating an advantage in today's dynamic and competitive retail environment (Reichheld and Sasser 1989). While some organizations are delighted with attaining customer satisfaction, acquiring and sustaining customer loyalty is proving to be the ultimate aim of many contemporary service organizations. Customer retention and developing long-standing relationships with clients are the key building blocks for creating value in service organizations (Gupta et al. 2004). Reichheld and Kenny (1990) assert that the fundamental basis for consumer retention is the notion that this practice increases company profits by reducing the costs generated by gaining new customers. The key objective of consumer retention is to incur "zero defections" from customers generating profit. Reichheld (1996) adds that by referring to customers in a friendly manner, the chances of losing customers are reduced. Furthermore, maintaining consumer goods and services that are important to customers in meeting their needs and desires plays a key role in retaining customers (Reichheld and Kenny 1990). For these reasons, both marketing practitioners and researchers are interested in forces that drive "establishing, developing, and maintaining successful relational exchange" (Morgan and Hunt 1994, p. 22).

1.2 Research Gap and Research Objectives

Numerous studies have examined the association between customer retention and relationship duration (Bolton 1998; Pfeifer and Farris 2004; Reinartz and Kumar 2003; Verhoef and Donkers 2005; Dreze and Bonfrer 2009). Relevant here as well is research into the role of service quality in generating customer satisfaction and loyalty in banking sector (Ndubisi and Wah 2005; Lenka et al. 2009; Bedi 2010; Ganguli and Roy 2011; Kaura and Datta 2012; Kaura 2013). The association between service quality, trust, satisfaction, and customer bonding has also been demonstrated elsewhere in the service industry. Amid all this research, however, there has been no clear account of the causal relationships among service quality, customer bonding, trust, and satisfaction nor any assessment of the relative usefulness of such factors as predictors of customer loyalty (Bolton and Drew 1991; Cronin and Taylor 1992; Harris and Goode 2004). It is known that customer loyalty increases relationship duration (Verhoef and Donkers 2005; Kumar and Reinartz 2016) and has a significant association with customer retention. For these reasons, existing research on customer loyalty has focused on satisfaction (Fecikova 2004) and various switching barriers (Gerpott et al. 2001; Lee and Cunningham 2001). These researchers recommended that it is very much crucial to study the other potential leading factors. It was in this context that the theory of the switching barriers was advanced (Jones et al. 2002). The impact of trust, satisfaction, and switching barriers on customer retention has also been analyzed (Ranaweera and Prabhu

2003). Harris and Goode (2004) have examined trust as a major determinant of customer loyalty, and Gounaris (2005) has argued that customer bonding and trust are particularly significant for service organizations and are ascertained by customers' assessments of the services they receive to a considerable degree. As suggestive as these studies have been, there are remaining gaps in the understanding of customer retention. The present research is accordingly designed to address the following outstanding questions:

1. While earlier work has suggested that customer retention is a function of satisfaction, switching barriers, and loyalty, these perspectives usually been studied in isolation. Integrating these various perspectives and investigating empirically the factors that build customer retention in a banking context are therefore steps that can advance the understanding of repeated buying behavior.
2. There is a dearth of empirical research determining the potential antecedents of customer loyalty and their influence on customer retention. The most important concern is to identify the determinants that induce customers' willingness to stay loyal to an existing service provider and strengthen the relationship by establishing ties between them, as loyal customers improve profitability by spending more on the firm's products/services by recommending the company to other consumers and through repeat purchase (Bowen and Chen 2001).
3. Existing studies have not analyzed the consequences of corporate image and perceived price fairness on the customer loyalty and then customer retention.
4. There is a lack of empirical research on antecedents of customer retention and in a causal relationship marketing framework.
5. Past studies have not recognized the impact of service quality or customer satisfaction on inertia (Ranaweera and Neely 2003).
6. There has been no attempt to investigate mediating effects of satisfaction, corporate image, trust, switching barriers, inertia, and customer loyalty in a single model in the B2C service sector, which makes this an imperative area of research with implications for marketers, in particular, for the advancement of customer retention.
7. The significance of customer retention has been well documented in marketing literature for the last four decades; however, the advancement and empirical validation of a customer retention model for the service sector, in particular, has not been properly addressed and theorized.

Seeking to fill the abovementioned gaps, the present research project is designed to contribute insights in three key ways. First, we aim to develop and empirically validate a customer retention model, particularly in the financial sector, such as the banking sector. Since the customers are not loyal to a particular bank, the banks are forced to cultivate a strong loyal customer base that will not be influenced even in times of fierce competition. Consequently, it is imperative for the survival of Indian banks to maintain and develop the relationships with existing customers by adopting customer-centric strategies (Roy and Shekhar 2010). Second, we aim to propose, operationalized, and test the conceptual model with the help of partial least squares as PLS-SEM path modeling. Based on past studies on marketing research,

we compiled a comprehensive set of constructs, hypotheses, and established causal relationships between them. Third, given the innermost position to customer loyalty as it acts as a mediator between the preceding factors and customer retention, we planned to examine our theory in the context of banking and, consequently, contribute additional insights into global service frameworks. We begin by discussing the theoretical and empirical background of the model, the hypotheses, and then the methodology used. Lastly, concluded with the evaluation of the results, findings, and implications (managerial and theoretical) for the future research.

1.3 Conceptualizations

Our framework presents customer loyalty as an outcome of perceived price fairness, corporate image, trust, customer satisfaction, inertia, and switching barriers. Perceived price fairness, service quality, and customer bonding are modeled as exogenous constructs. As mediating relationships between behavioral outcomes and certain antecedents can well explain what impels a loyal customer in running a stable customer relationship (Wiener 1982), we introduce satisfaction, trust, corporate image, inertia, switching barriers, and customer loyalty as potential mediators in our conceptual framework. The details of the conceptualizations of the constructs are as follows.

1.3.1 *Service Quality*

Despite the consensus that service quality is uniquely structured, there are still conflicting opinions over issues regarding how to measure it. Parasuraman et al. (1988) developed the SERVQUAL instrument, which is based on the computed disconfirmation approach. This approach measures the distance between consumer expectations and the actual performance (both factors are assessed post-service). This approach has faced intense criticism from researchers for various reasons. There is increased preferential support for Cronin and Taylor's (1992) and Gronroos' (2001) "perceptions only" approach. On the other hand, the literature review indicates that service quality is a multidimensional construct, meaning it involves numerous dimensions including tangibility, responsiveness, reliability, empathy, and assurance (Gronroos 1984; Parasuraman et al. 1985, 1988; Lewis 1993; McDougall and Levesque 1994). Although there is a wealth of research indicating a relationship between specific dimensions of service quality and customer loyalty through satisfaction (such as Levesque and McDougall 1996; Jamal and Naser 2002; Wong and Sohal 2003), there is little evidence to suggest a relationship between opinions of overall service quality perceptions, customer satisfaction (Cronin and Taylor 1992; Anderson and Sullivan 1993; Taylor and Baker 1994; Oliver 1997), and loyalty (Zeithaml et al. 1996).

1.3.2 Customer Satisfaction

Customer satisfaction is one of the integral components that help organizations pursue success in their respective industries. As an element of marketing, customer satisfaction is often prioritized as it provides the linkage between the process of purchasing and consumption. As such, customer satisfaction is attributed as a strong component of behavior outcomes and is construed through word of mouth endorsements and instances manifested by loyalty. According to McDougall and Levesque (2000), the business environment has become more competitive than ever before, thus forcing businesses to prioritize their efforts on creating and maintaining a loyal customer base.

1.3.3 Corporate Image

A review of the marketing literature reveals that research on the concept of corporate image has captured the imagination of scholars and practitioners (Nguyen and LeBlanc 2001; Balmer and Greyser 2006). Corporate image is a particularly complicated concept (Flavian et al. 2004). Worcester (1997) defined the corporate image as “the net result of the interaction of all feelings, impressions, experiences, knowledge, and beliefs people have about a company.” In this perspective, corporate image is described as the overall impression made on the minds of the public about a firm (Barich and Kotler 1991).

1.3.4 Perceived Price and Fairness

In the service context, perceived price is playing a significant role in decision-making. Customers’ perception of price has been studied in terms of the perceptions of price fairness (Bolton et al. 2003), price perception (Munukka 2005), and price equity (Bolton and Lemon 1999). They confirmed the imperative role of price in consumers’ purchases; therefore, perceived price and fairness have an immense impact on consumers’ judgments regarding service.

1.3.5 Customer Bonding

A majority of researchers (e.g., Coleman 1990; Moorman et al. 1992) emphasize the importance of trust in business transactions, arguing that trust shapes behavioral intention and reflects a relationship where one party depends on another and demonstrates a degree of exposure and insecurity. It is clear that trust will only develop

if a number of assurances are put in place. Cross and Smith (1996, p. 54) argued that placing an emphasis on customer relations can have a significantly positive impact on easing doubts about the nature and future of the relationship. The authors asserted that this was because the bonding process itself essentially shapes the relationship and was designed to benefit both parties.

1.3.6 Trust

Based upon Morgan and hunt (1994), trust is defined as the level of integrity, honesty, and competence that one party identifies in another. They found that trust is positively linked to an extent of sharing the same values and timely information to solve arguments and align expectations and perceptions. It is generally viewed as a critical factor in the development of continuing desire to maintain long-term relationships with customers. Trust also reflects credibility (Ganesan 1994, p. 3), and credibility affects the long-term orientation of a customer by reducing the perception of risk associated with opportunistic behaviors by the service organization (Ganesan 1994; Chaudhuri and Holbrook 2001).

1.3.7 Inertia

Huang and Yu (1999) defined inertia as a state where a person purchases the same brand passively and repetitively in a nonconscious process. This nonconscious form is dissimilar to the loyalty as a degree of consciousness implicated with decisions, such as continuing buying. Lee and Cunningham (2001) and White and Yanamandram (2004) defined inertia as an indifferent, unemotional, and convenience driven behavior. Inert customers prefer the status quo and lack the motivation to care about decisions. The conceptualization of inertia, which we adopted in this study, is related to the nonconscious form of retention, which comprises passive service benefaction with no true loyalty and an unwillingness to disburse effort.

1.3.8 Switching Barriers

Jones et al. (2002) explained that when a consumer faces problems in altering their service provider, the variables that are responsible are called switching barriers. Fornell (1992) noted that due to emotional pressure or the potential for social or financial harm, a consumer may opt to continue with their existing service provider, regardless of whether they are content with them or not. Ultimately, switching barriers act against the incentives to change providers, which stem from the standard of the relationship. Other studies have identified particular variables such as the appeal of

other providers, i.e., attractiveness of alternatives (Kim et al. 2004); social bonds, i.e., interpersonal relationships (Jones et al. 2002); and switching cost (Kim et al. 2004); these will be amalgamated in this research in order to represent switching barriers.

1.3.9 Customer Loyalty

A pertinent issue is customer loyalty, which Jones and Sasser (1995) defined as the sense of affinity or fondness for a particular firm's services, goods, or staff (p. 94). The degree of customer loyalty has been associated with the amount of consumption that occurs in a firm, which is why an established tool that market researchers have adopted the use of behavioral scales to determine customer loyalty. Oliver's (1997) characterization of loyalty, which also focuses on the conduct and perspectives of consumers in relation to allegiance, was utilized here following the evaluation of various features of loyalty. As Rundle-Thiele (2005) observed, there are various definitions and characterizations of customer loyalty, as well as the means of measuring it. Typically, the conduct and perspectives of consumers have been characterized as defining loyalty and used to gauge the degree of adherence.

1.3.10 Customer Retention

Customer retention is a process followed by a seller to minimize chances of clients abandoning brand loyalty and taking their customer elsewhere. This process starts from the first time the organization and the customer interacts and continues henceforth. Ro King (2005) noted that retention is crucial to companies, since it is far less costly to hold on to an existing customer than to secure a new one. Dawkins and Reichheld (1990) pointed out the worth of customer retention in the banking industry. There is a strong case to be made for customer retention. Firstly, it is more cost-effective to keep existing customers than to acquire new ones, since it is an expensive process to find replacements for customers who have defected. Reichheld and Kenny (1990) explain this phenomenon by stating that the opening stages of a commercial relationship are the most costly ones for the seller. Established customers tend to buy more goods or services and often recommend the company to others if they have a positive experience of dealing with it. Healy (1999) adds that long-term customers are less demanding of the company's time and more accepting of changes in price. Healy noted that a fall of 5% in customer defection can result in a doubling of profits.

1.4 Hypotheses Development and Research Model

Over the past few years, service quality has been strongly emphasized in academia and service organizations. Bitner et al. (1994) asserted that a better service quality turned into a satisfied customer and makes this relationship more sensitive. Guided

by this, Sureshchandar et al. (2003) recognized that service quality is strongly connected with customer satisfaction and reported that these two constructs are dissimilar in nature. The results are concurrent with the findings of Cronin and Taylor (1992) and Bahia et al. (2000). In addition, Gounaris (2005), Chiou and Droke (2006), and Akbar and Parvez (2009) stressed that there is a positive impact of service quality on trust. Furthermore, Kandampully and Suhartanto (2000, 2003), Hu et al. (2009), and Lemon and Wangenheim (2009) recognized that a strong association existed among service quality, corporate image, and customer loyalty. They further stated that in the determination of customers' intention to repurchase, recommend, and exhibit loyalty, service quality and corporate image are the critical components. Although the route of service quality, customer satisfaction; service quality, trust; and service quality, image is fairly well valued for the services sector; however, the research in the banking sector is quite limited (Hu et al. 2009). Moreover, there is an inadequate research on the direct relationship among service quality, inertia, and switching barriers. Hence to be consistent with the previous research, we thus formulated the following hypothesis:

- H_{1a}:** The overall service quality is positively associated with customer satisfaction.
- H_{1b}:** The overall service quality is positively associated with trust.
- H_{1c}:** The overall service quality is positively associated with inertia.
- H_{1d}:** The overall service quality is positively associated with corporate image.
- H_{1e}:** The overall service quality is positively associated with switching barriers.

A general assumption is that a positive corporate image will have a positive impact on consumers' behavior toward the brand, such as more positive word-of-mouth reputation, the opportunity to command premium prices, and enhancing buyers who are more loyal (Martenson 2007). Corporate image and customer satisfaction are two key ways to customer loyalty for the majority of service organizations, either in retaining or attracting customers (Andreassen and Lindestad 1998). Hence, the following hypotheses are formulated to investigate this relationship in Indian banking context.

- H_{2a}:** Customer satisfaction has a positive influence on corporate image.
- H_{2b}:** Corporate image has a direct effect on customer loyalty.

Perceived price and fairness performs an essential part of the selection of a bank because the price structure in the banking industry is relatively more complex than the other service contexts, such as hotels, education, etc. Jiang and Rosenbloom (2005) proposed the positive impact of price on customer loyalty for Indian retail supermarkets. The results are concurrent with the findings of Varki and Colgate (2001), Yieh et al. (2007), and Eshghi et al. (2008) who put forward the direct positive relationship of price perceptions with customer satisfaction or loyalty. Although the relationships are well studied in the past, empirical studies that observe the relationship in Indian banking sector are quite limited (Kaura et al. 2015). Accordingly, the following relationships are hypothesized as being:

H_{3a}: Perceived price and fairness relates positively to customer satisfaction.

H_{3b}: Perceived price and fairness relates positively to customer loyalty.

Even though the route of customer bonding as an antecedent of trust has been well explained in the existing literature (Crosby et al. 1990; Durkin and Howcroft 2003; Howcroft et al. 2003), but the relationships among customer bonding, satisfaction, and trust in business-to-customer context, particularly in the banking sector, is quite limited. Specifically, trust reduces uncertainty in an environment in which consumers feel vulnerable since they know that they can rely on the trusted brand (Chaudhuri and Holbrook 2001, p. 82). Sirdeshmukh et al. (2002) examined the relationship of trust with customer loyalty and its influence in management practices and policies taking airline and retailing industry as an example. Same results also supported by Ribbink et al. (2004) and Akbar and Parvez (2009). Therefore based on these arguments, we hypothesize that:

H_{4a}: Customer bonding is positively related to trust.

H_{4b}: Customer bonding is positively related to customer satisfaction.

H₆: Trust has a positive influence on customer loyalty.

Business organizations have moved to not only make customer satisfaction a corporate goal but also to foster it so as to provide a competitive edge over their competitors in the service industry. Therefore, companies strive to enhance customer satisfaction through innovation that ensures and guarantees the production of quality goods and services (Boulding et al. 1993; Licata and Chakraborty 2009; Das et al. 2010). Findings from studies conducted on customer satisfaction reports that service quality is precedent to an individual's response to and satisfaction of the services consumed (Spreng and Mackoy 1996; De Ruyter et al. 1997). Many studies confirm the positive relationship of customer loyalty and trust with customer satisfaction (Namkung and Jang 2007; Han and Ryu 2009; Ryu et al. 2010). However, using the past studies and an inadequate research on the direct relationship between inertia (Pont and McQuilken 2005; Terblanche 2006) and switching barriers, we propose the following hypotheses:

H_{5a}: Customer satisfaction has a positive influence on customer loyalty.

H_{5b}: Customer satisfaction has a positive influence on customer trust.

H_{5c}: Customer satisfaction has a positive influence on switching barriers.

H_{5d}: Customer satisfaction has a positive influence on inertia.

The influence of switching barriers on the loyalty and retention has been empirically established in numerous settings: employer-to-employee relationships (Weiss and Anderson 1992) and business-to-business (Heide and Weiss 1995). Only few have studied the relationship in a business-to-customer context (Lee et al. 2001; Lam et al. 2004; Li 2015). In line with the past literature, we hypothesize that:

H_{7a}: Switching barriers has a direct positive effect on customer loyalty.

H_{7b}: Switching barriers has a direct positive effect on customer retention.

An extensive research on the relationship between customer loyalty and retention has been conducted in the past. Dick and Basu (1994) introduced the concept of “spurious loyalty” and “no loyalty,” which further augmented by Rowley and Dawes (2000). Guided by this, Lin et al. (2000) and Ranaweera and Neely (2003) recommended a model where the relevance of inertia was evaluated by the competitive and dynamic structure of the industry. They further originated that the inertia has no significant relationship with customer retention, as the state of inertia was bound to be unbalanced, manifesting no brand or inadequate commitment (Yanamandram and White 2006; Lai and Chen 2011). On these grounds, it is expected that the more inert the bank customers are, the higher the probability of customers to stay with the current service providers. Thus, following hypotheses were formulated:

H_{8a}: Inertia is positively associated with customer loyalty.

H_{8b}: Inertia is positively associated with customer retention.

Oliver defined customer loyalty as a strong pledge to engage in the repeat purchase of a particular goods or service over a long-term period, regardless of any potential switching conduct brought about by the marketing campaigns or contextual factors (p. 392). Gounaris et al. (2005), Gupta and Zeithaml (2006), and Reinartz et al. (2008) investigated the strength and direction of the association between customer loyalty and retention and found that loyalty drives customer retention. Based on these discussions, we hypothesized that:

H₉: There exist a strong and positive relationship between customer loyalty and customer retention.

The preceding discussion recommended that the aforementioned constructs also perform the mediating function in a specific relationship. Therefore, the following hypotheses were advanced:

H_{10a}: Customer satisfaction mediates the relationship between service quality and trust.

H_{10b}: Customer satisfaction mediates the relationship between customer bonding and trust.

H_{10c}: Customer satisfaction mediates the relationship between service quality and switching barriers.

H_{10d}: Customer satisfaction mediates the relationship between perceived price fairness and customer loyalty.

H_{10e}: Customer satisfaction mediates the relationship between service quality and inertia.

H_{10f}: Corporate image mediates the relationship between customer satisfaction and customer loyalty.

H₁₁: Corporate image mediates the relationship between service quality and customer loyalty.

H₁₂: Trust mediates the relationship between customer satisfaction and customer loyalty.

H₁₃: Switching barriers mediate the relationship between customer satisfaction and customer loyalty.

H₁₄: Inertia mediates the relationship between customer satisfaction and customer loyalty.

H_{15a}: Customer loyalty mediates the relationship between switching barriers and customer retention.

H_{15b}: Customer loyalty mediates the relationship between inertia and customer retention.

Figure 1.1 portrayed a hypothesized customer retention model depicting various antecedents, potential mediators, and consequences.

1.5 Research Methods

1.5.1 Participants and Procedure

To measure the variables enumerated in the conceptual framework, a well-structured questionnaire was designed. For this sample, top 20 banks, 10 each in public and private sector, were selected on the basis of the ratings (*on the basis of profitability*) reported by Moneycontrol, 2015. The data were collected from the three major cities of a northern state of India, i.e., Punjab. A sample of 750 bank customers, namely, 350 customers each from private banks and public banks, was employed to test the aforementioned hypotheses (as proposed in Fig. 1.1). Using judgment sampling, the survey targeted customers of the main branch of the selected banks in each of the three cities, i.e., Jalandhar, Ludhiana, and Amritsar. Only 683 questionnaires were found as completed and valid, thus producing a response rate of 91% which was

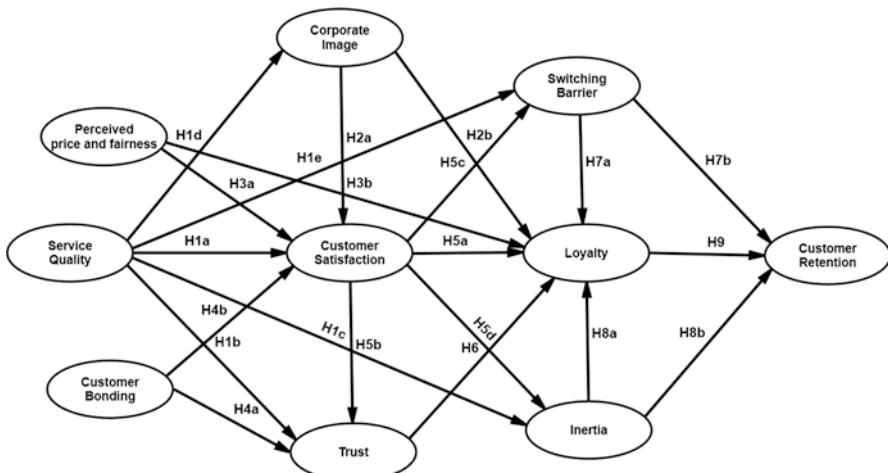


Fig. 1.1 Hypothesized model depicting antecedents, mediators, and consequences in customer retention model

more than enough to make sure the generalizability and statistical reliability. A majority of customers included in the sample study were males (53%), aged 21–30 years (36%), self-employed (34%) with income in the range Rs. 6,00,000–Rs. 9,00,000 (\$10,000–\$15,000; 31%), and postgraduates (43%; see Table 1.1). The dimensions in the model (based on previous studies) were computed using 5-point Likert scales, i.e., 1 (strongly disagree) and 5 (strongly agree).

1.6 Data Analysis

Evaluation of the model with the help of structural equation modeling (SEM) covariance based approach was considered initially; however, due to the complexity of causally interlinked relationships in a conceptual framework (as the presence of

Table 1.1 Demographic profile of the respondents

Demographic variables	Frequency	Percent
<i>Gender</i>		
Male	363	53.1
Female	320	46.9
<i>Age group</i>		
21–30 years	247	36.2
31–40 years	234	34.3
41–50 years	156	22.8
More than 50 years	46	6.7
<i>Education background</i>		
Undergraduate	78	11.4
Graduate	257	37.6
Postgraduate	293	42.9
Others	55	8.1
<i>Occupation</i>		
Self-employed	232	34.0
Govt./public sector employee	225	32.9
Private sector employee	166	24.3
Student	60	8.8
<i>Average annual income</i>		
Less than 3,00,000 (\$5000)	162	23.7
3,00,000 (\$ 5000) – 6,00,000 (\$ 10,000)	99	14.5
6,00,000 (\$10,000) – 9,00,000 (\$ 15,000)	215	31.5
More than 9,00,000 (\$ 15,000)	207	30.3
<i>Type of the bank</i>		
Private bank	358	52.4
Public bank	325	47.6

simple and parallel mediations), we estimated the model using SEM and partial least squares structural equation modeling (PLS-SEM) approach (Wold 1974, 1983) together. Baron and Kenny's (1986) approach was used to assess the presence or absence of mediation effects. On the suggestions of Anderson and Gerbing (1988), the acceptable fit of the measurement model and structural model should be first computed for relationships among latent constructs. To indicate the hypothesized relationships, Pearson correlations among the constructs were initially calculated (Table 1.2).

1.6.1 Measure Validation with Confirmatory Factor Analysis (Measurement Model)

The main aim of this step of the analysis was to recognize and eradicate badly performing items. Nineteen items were removed. The fit indices like goodness-of-fit index (GFI), adjusted goodness-of-fit index (AGFI), Bentler–Bonett NFI, root mean square error of approximation (RMSEA) etc. were ascertained along with descriptive statistics (Table 1.3) to determine the reliability of the constructs. Reliability shows the extent to which measures are free from random error and signifies the proportion of true variance in a test, i.e., unity minus proportion of error variance (Edris and Meidan 1990; Malhotra 2006). Cronbach alpha, more than 0.60, indicated the inter-item consistency of each construct (see Table 1.3). The dimensions were computed often at different times, an application of these scales elevates a concern of common method biasness. To ease the concern of common method biasness in the sample, Harman's single-factor test was carried out. The measures of all of the dimensions were entered into an exploratory factor analysis using SPSS (Podsakoff et al. 2003). If the commonly extracted factor explained the majority of the variance, the sample would undergo a common method biasness issue (Kharouf et al. 2014). The results revealed that the appeared factor explained 27.2% of the variance, which thus confirmed common method biasness was not a big biasing factor in our analyses.

A confirmatory factor analysis (CFA) using AMOS version18 was conducted to test the plausibility of the proposed model and confirm the convergent and discriminant validity. The obtained fit indices determined the plausibility of the proposed model ($\chi^2 = 5315.44$; $df = 3534$; $p < 0.05$; $\chi^2/df = 1.504 < 4$; $GFI = 0.849 > 0.85$; $AGFI = 0.837 > 0.85$; $NFI = 0.899 > 0.9$; $CFI = 0.964 > 0.95$; $TLI = 0.962 > 0.95$; $RMSEA = 0.033 < 0.7$) as all the values are within the prescribed threshold limits (Hair et al. 1998).

After the ascertainment of model fit indices through CFA, next stage is to determine the convergent and discriminant validity. From the measurement model, convergent validity determines the extent to which the items in a single scale gauge the underlying construct (Peter 1981; Reynolds et al. 1993). As exemplified in Table 1.3, all factor loadings are above 0.60, thus validating the convergent validity of the constructs. Additionally, the average variance extracted (AVEs) of all the constructs

Table 1.2 Pearson correlations among studied variables

	SERVQUAL tangibility	SERVQUAL reliability	SERVQUAL responsiveness	SERVQUAL assurance	SERVQUAL empathy	SWB switching cost
SERVQUAL tangibility	1					
SERVQUAL reliability	0.559*	1				
SERVQUAL responsiveness	0.186*	0.425*	1			
SERVQUAL assurance	0.405*	0.641*	0.407*	1		
SERVQUAL empathy	0.270*	0.388*	0.272*	0.368*	1	
SWB switching cost	0.243*	0.453*	0.332*	0.318*	0.320*	1
SWB interpersonal relationships	0.182*	0.384*	0.281*	0.233*	0.264*	0.574*
SWB attractiveness of alternatives	0.194*	0.406*	0.088*	0.211*	0.240*	0.523*
Perceived price and fairness	0.189*	0.430*	0.322*	0.430*	0.303*	0.458*
Customer bonding	0.036	0.332*	0.307*	0.393*	0.249*	0.371*
Trust	0.236*	0.602*	0.436*	0.577*	0.283*	0.384*
Corporate image	0.176*	0.473*	0.490*	0.391*	0.212*	0.527*
Customer satisfaction	0.173*	0.364*	0.333*	0.309*	0.127*	0.342*
Loyalty	0.038	0.114*	0.137*	0.254*	0.139*	0.081*
Customer retention	0.171*	0.336*	0.351*	0.264*	0.220*	0.465*
Inertia	0.173*	0.191*	0.205*	0.214*	0.122*	0.108*

SERVQUAL service quality, *SWB* switching barriers

* $r \geq 0.12$ is significant at $p \leq 0.05$

SWB inter-personal relationships	SWB attractive-ness of alterna-tives	Perceived price and fairness	Customer bonding	Trust	Corporate image	Customer satisfac-tion	Loyalty	Customer retention	Inertia
1									
0.649*	1								
0.395*	0.309*	1							
0.356*	0.301*	0.556*	1						
0.423*	0.349*	0.521*	0.492*	1					
0.494*	0.360*	0.493*	0.480*	0.602*	1				
0.421*	0.306*	0.448*	0.495*	0.530*	0.637*	1			
0.062	0.090*	0.187*	0.350*	0.093*	0.025	0.207*	1		
0.491*	0.399*	0.459*	0.366*	0.349*	0.476*	0.448*	0.190*	1	
0.346*	0.139*	0.226*	0.167*	0.183*	0.219*	0.183*	0.115*	0.307*	1

Table 1.3 Scale validity and reliability

Constructs	No. of original items	No. of retained items	M	SD	Cronbach's α	Fit measures				Factor loading range
						Model fit	CMIN/DF	RMSEA	GFI	
SERVQUAL tangibility	6	5	16.9	6	0.937	2.560	0.050	0.992	0.975	0.994 0.997 0.78–0.84
SERVQUAL responsiveness	5	5	16.8	6.12	0.936	3.347	0.062	0.989	0.968	0.995 0.991 0.995 0.64–0.87
SERVQUAL empathy	6	4	14.1	4.25	0.878	1.56	0.05	0.945	0.932	0.997 0.994 0.997 0.73–0.84
SERVQUAL assurance	6	4	14.8	5.47	0.895	5.309	0.109	0.987	0.936	0.989 0.967 0.989 0.65–0.86
SERVQUAL reliability	7	5	15.7	5.61	0.918	1.425	0.008	0.997	0.991	0.996 0.994 0.996 0.74–0.83
Trust	7	6	25.3	7.75	0.95	4.348	0.07	0.976	0.952	0.989 0.983 0.989 0.75–0.87
Perceived price and fairness	7	6	24.7	7.86	0.943	8.045	0.102	0.956	0.913	0.972 0.958 0.972 0.78–0.82
Corporate image	7	5	16.5	5.67	0.914	1.072	0.01	0.948	0.934	0.968 0.964 0.968 0.65–0.86
Customer satisfaction	7	7	23.9	7.54	0.933	1.642	0.031	0.991	0.981	0.997 0.996 0.997 0.72–0.84
Customer bonding	9	7	21.9	7.29	0.939	2.152	0.04	0.987	0.974	0.996 0.994 0.996 0.62–0.83
Customer loyalty	7	7	24.2	8.33	0.948	5.289	0.079	0.973	0.947	0.987 0.981 0.987 0.74 – 0.83
Inertia	7	6	21.3	6.65	0.946	2.734	0.05	0.984	0.969	0.993 0.981 0.993 0.61–0.86
SWB interpersonal relationships	6	5	17.1	5.57	0.922	5.994	0.114	0.972	0.916	0.982 0.964 0.982 0.64–0.84
SWB attractiveness of alternatives	5	4	13.8	4.45	0.895	2.087	0.058	0.997	0.984	0.998 0.997 0.998 0.76–0.85
SWB switching cost	6	4	12.9	4.17	0.855	2.066	0.042	0.997	0.983	0.998 0.994 0.998 0.68–0.86
Customer retention	7	6	24.2	7.67	0.937	7.312	0.09	0.96	0.92	0.98 0.97 0.98 0.78–0.86

SERVQUAL service quality, SWB switching barriers

varying from 0.64 to 0.74 were above the recommended threshold limit of 0.5 (see Table 1.4; Bagozzi et al. 1991). The composite reliability of all measures was above 0.8 (Hair et al. 1998). All these values signify a high degree of convergence between the items and their respective constructs. The discriminant validity demonstrates that there is no collinearity among the explanatory variables. It can be measured by comparing AVEs of the individual measures with the shared variance between measures. According to Fornell and Larcker (1981), if the square root of AVE is larger than the phi coefficient (correlation coefficient as shared variance) between two constructs, it is likely that these two constructs have discriminant validity. The correlation coefficients estimate AVEs, and the square root of AVEs are displayed in Table 1.4. The diagonal values are the square root of AVEs provided in bold, and correlation coefficients are given in the lower half of the matrix. As shown in Table 1.4, the results revealed that every diagonal value is higher than the corresponding correlation coefficients which confirm that these seven constructs hold discriminant validity.

Service quality (tangibility, empathy, reliability, responsiveness, and assurance) and switching barriers (attractiveness of alternatives, switching costs, and interpersonal relations) were second-order constructs in the customer retention model. T-coefficient values were used to examine the plausibility of second-order constructs over the corresponding first-order models. If the T-coefficient value is more than 0.80, it is likely that second order models existed, giving more accurate and parsimonious representation of the model structure (Marsh and Hocevar 1985). The values for service quality and switching barriers were 0.871 and 0.892, respectively, (calculated as a ratio of chi-square of first-order with chi-square of second-order model).

1.6.2 Hypotheses Testing with PLS-SEM (Structural Model)

Because of the complexity of the model, the structural model results are calculated with the help of partial least squares path modeling. PLS is one of the variance based SEM methods which has been christened as a “silver bullet” (Hair et al. 2011) and considered as “most fully developed and general system” (McDonald 1996, p. 240). On the suggestions of Hu and Bentler (1999) and Henseler et al. (2014), the SRMR and rms Theta (as a measure of absolute fit) and NFI (Bentler and Bonett 1980; as a measure of incremental fit) were used as a criteria to determine the goodness of fit of the structural model in PLS-SEM, whereas the d_ULS and d_G should be more than 0.05 (Lacobucci 2010). Table 1.5 manifested the fit of the structural model.

Figure 1.2 portrays the bootstrapping results of the structural relationships in the hypothesized model using the PLS path modeling methodology. The properties of

Table 1.4 Psychometric properties of the measurement model and its constructs

	CR	AVE	SWB attractive-ness of alter-natives	Trust	Inertia	Customer retention	Corporate image	Customer satisfaction	Perceived price and fairness
SWB attractiveness of alternatives	0.898	0.687	0.829 ^(a)						
Trust	0.942	0.732	0.363	0.855 ^(a)					
Inertia	0.925	0.672	0.354	0.644	0.820 ^(a)				
Customer retention	0.945	0.743	0.296	0.653	0.508	0.862 ^(a)			
Corporate image	0.909	0.667	0.095	0.013	0.055	0.180	0.817 ^(a)		
Customer satisfaction	0.937	0.681	0.432	0.537	0.380	0.499	0.191	0.825 ^(a)	
Perceived price and fairness	0.933	0.667	0.395	0.575	0.663	0.505	0.128	0.478	0.817 ^(a)
Customer bonding	0.944	0.707	0.338	0.535	0.531	0.536	0.340	0.431	0.526
Loyalty	0.955	0.753	0.316	0.564	0.605	0.529	0.224	0.493	0.631
SWB interpersonal relationships	0.919	0.694	0.587	0.530	0.438	0.425	0.035	0.526	0.497
SWB switching cost	0.863	0.612	0.472	0.597	0.431	0.369	0.051	0.507	0.427
SERVQUAL empathy	0.877	0.640	0.301	0.350	0.316	0.223	0.050	0.289	0.367
SERVQUAL assurance	0.904	0.654	0.229	0.475	0.560	0.385	0.120	0.311	0.519
SERVQUAL reliability	0.888	0.665	0.429	0.526	0.504	0.449	0.055	0.419	0.568
SERVQUAL responsiveness	0.920	0.697	0.142	0.663	0.456	0.539	0.143	0.504	0.465
SERVQUAL tangibility	0.932	0.734	0.156	0.131	0.189	0.153	0.046	0.154	0.220

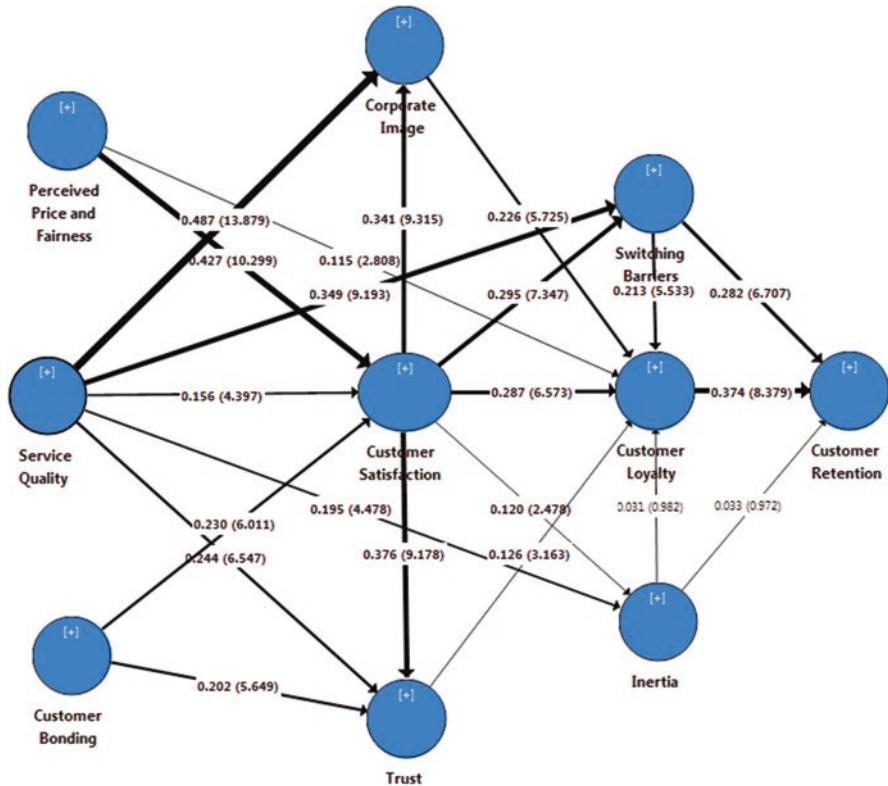
CR composite reliability, AVE average variance extracted

^(a) denotes the square root of AVE

Customer bonding	Loyalty	SWB inter-personal relationships	SWB switching cost	SERVQUAL empathy	SERVQUAL assurance	SERVQUAL reliability	SERVQUAL responsiveness	SERVQUAL tangibility
0.841^(a)								
0.643	0.868^(a)							
0.398	0.391	0.833^(a)						
0.425	0.440	0.522	0.783^(a)					
0.357	0.377	0.346	0.418	0.800^(a)				
0.433	0.441	0.313	0.418	0.432	0.809^(a)			
0.328	0.549	0.414	0.495	0.367	0.600	0.815^(a)		
0.441	0.508	0.343	0.436	0.257	0.432	0.494	0.835^(a)	
0.022	0.126	0.146	0.210	0.193	0.342	0.457	0.103	0.857^(a)

Table 1.5 Overall fit measures of the model

Measures	Estimated model	References
SRMR	$0.076 < 0.8$	Hu and Bentler (1999); Lacobucci (2010)
d_ULS (Squared euclidean distance)	$13.959 > 0.05$	Lacobucci (2010)
d_G (Geodesic distance)	$1.557 > 0.05$	Lacobucci (2010)
rms Theta	$0.076 < 0.12$	Henseler et al. (2014)
NFI	$0.901 > 0.9$	

**Fig. 1.2** The structural model results. Note: Bold lines denote strong relationships; light lines denote weak relationships; and very light lines denote no significant relationships; t-values for standardized path coefficients are shown in parentheses

the causal paths inclusive of standardized path estimates and T-statistics for the model are reported in Fig. 1.2 and Table 1.6. As exhibited in Table 1.6, all hypotheses were fully supported except Hypothesis (8a) and Hypothesis (8b), i.e., positive association of inertia with customer loyalty and retention.

Table 1.6 Parameter estimates

Hypothesis	Hypothesized directions	Standardized path coefficients	Critical ratio	Hypothesis
H_{1a}	Service quality → customer satisfaction	0.156	4.347***	Supported
H_{1b}	Service quality → trust	0.244	6.599***	Supported
H_{1c}	Service quality → inertia	0.195	4.324***	Supported
H_{1d}	Service quality → corporate image	0.487	13.608***	Supported
H_{1e}	Service quality → switching barriers	0.349	9.728***	Supported
H_{2a}	Customer satisfaction → corporate image	0.341	9.338***	Supported
H_{2b}	Corporate image → customer loyalty	0.226	5.715***	Supported
H_{3a}	Perceived price and fairness → customer satisfaction	0.427	10.6***	Supported
H_{3b}	Perceived price and fairness → customer loyalty	0.115	2.78**	Supported
H_{4a}	Customer bonding → trust	0.202	5.587***	Supported
H_{4b}	Customer bonding → customer satisfaction	0.23	5.779***	Supported
H_{5a}	Customer satisfaction → customer loyalty	0.287	6.612***	Supported
H_{5b}	Customer satisfaction → customer trust	0.376	9.089***	Supported
H_{5c}	Customer satisfaction → switching barriers	0.295	7.225***	Supported
H_{5d}	Customer satisfaction → inertia	0.12	2.495**	Supported
H₆	Trust → customer loyalty	0.126	3.152***	Supported
H_{7a}	Switching barriers → customer loyalty	0.213	5.897***	Supported
H_{7b}	Switching barriers → customer retention	0.282	6.516***	Supported
H_{8a}	Inertia → customer loyalty	0.031	0.993	Not supported
H_{8b}	Inertia → customer retention	0.033	0.91	Not supported
H₉	Customer loyalty → customer retention	0.374	8.749***	Supported

*** $p < 0.01$ (two sided) ** $p < 0.05$ (two sided)

Mediating Effects

To determine the presence or absence of mediation effects, certain conditions should be met. These conditions are as follows: there must be a significant relationship between dependent and independent variables; of mediating variable with the dependent and independent variable; and the relationship between dependent and

independent variable must get weakens or insignificant in the existence of mediator. According to Hayes (2017), parallel mediations were tested by controlling the corresponding direct effects in the outer model. To validate the presence of full or partial mediations, bootstrapping was used (Hayes 2009). As exhibited in Table 1.7, all hypotheses were fully supported except Hypothesis (15b), i.e., customer loyalty mediates the relationship between inertia and customer retention.

1.7 Discussion and Implications

The present research contributes to the existing marketing literature by testing the mediating effects in a single comprehensive model. Contrary to some assertions in the past literature, the major findings of this research are as follows: (a) inertia has a positive association with customer satisfaction ($\beta = 0.12$, t -value = 2.495, $p > 0.05$) and service quality ($\beta = 0.195$, t -value = 4.324, $p > 0.05$) and (b) perceived price fairness has a strong influence on customer loyalty ($\beta = 0.115$, t -value = 2.78, $p > 0.05$). The empirical results as hypothesized illustrate (a) customer loyalty was positively influenced by customer satisfaction ($\beta = 0.287$, t -value = 6.612, $p > 0.05$), switching barriers ($\beta = 0.213$, t -value = 5.897, $p > 0.05$), corporate image ($\beta = 0.226$, t -value = 5.175, $p > 0.05$), perceived price fairness ($\beta = 0.115$, t -value = 2.78, $p > 0.05$), and trust ($\beta = 0.126$, t -value = 3.152, $p > 0.05$); (b) in contradiction of our expectations, the results do not advocate a positive relationship of inertia with customer loyalty and retention (Ranaweera and Prabhu 2003); and (c) out of all the structural relationships, corporate image was found to be highly associated with service quality ($\beta = 0.487$, t -value = 13.608, $p > 0.05$) followed by perceived price and fairness on customer satisfaction ($\beta = 0.427$, t -value = 10.6, $p > 0.05$). Furthermore, quantitative analysis, supported by empirical qualitative shreds of evidence from the survey, exhibited that partial mediations were found among the constructs.

Research in the area of customer retention has been sparse until recently. Our conceptual framework incorporates existing theories and provides direction for the future research. In line with the above hypotheses, we have identified driving forces behind the customer retention. As recommended by our proposed model, customer retention can only be achieved if the development of its antecedents and mediators is appropriately administered. Recent research has focused on the customer loyalty. We suggest that service quality is a key requirement to build loyalty as a behavioral response from its customers. Hence, service managers and academic researchers should now focus on recognizing customers' perceptions of service quality as well as how these perceptions eventually lead to customer satisfaction, corporate image (Nguyen and Leblanc 2001), customer loyalty, and customer retention (Verhoef and Donkers 2005).

The present research enables the marketer to understand that if the banks are to remain competitive, they must move with the times and continue monitoring customer retention through its antecedents. Since very few customers are loyal to a

Table 1.7 Bootstrapping analysis indirect effects

Hypothesis	Hypothesized directions	Indirect effects		Hypothesis (type of mediation)
		Path coefficients	T-statistics	
<i>Hypotheses (simple mediation)</i>				
H_{10a}	Service quality → customer satisfaction → trust (H_{1a} + H_{5b})	0.082	5.450***	Supported (partial mediation)
H_{10b}	Customer bonding → customer satisfaction → trust (H_{4b} + H_{5b})	0.103	5.522***	Supported (partial mediation)
H_{10c}	Service quality → customer satisfaction → switching barriers (H_{1a} + H_{5c})	0.046	4.003***	Supported (partial mediation)
H_{10d}	Perceived price fairness → customer satisfaction → customer loyalty (H_{3a} + H_{5a})	0.151	7.341***	Supported (partial mediation)
H_{10e}	Service quality → customer satisfaction → inertia (H_{1a} + H_{5d})	0.019	2.338***	Supported (partial mediation)
H_{10f}	Customer satisfaction → corporate image → customer loyalty (H_{2a} + H_{2b})	0.077	4.828***	Supported (partial mediation)
H₁₁	Service quality → corporate image → customer loyalty (H_{1d} + H_{2b})	0.19	7.738***	Supported (partial mediation)
H₁₂	Customer satisfaction → trust → customer loyalty (H_{5b} + H₆)	0.047	2.814***	Supported (partial mediation)
H₁₃	Customer satisfaction → switching barriers → customer loyalty (H_{5c} + H_{7a})	0.14	6.721***	Supported (partial mediation)
H₁₄	Customer satisfaction → inertia → customer loyalty (H_{5d} + H_{8b})	0.081	4.707***	Supported (partial mediation)
H_{15a}	Switching barriers → customer loyalty → customer retention (H_{7a} + H₉)	0.098	6.060***	Supported (partial mediation)
H_{15b}	Inertia → customer loyalty → customer retention (H_{8b} + H₉)	0.012	0.958	Not supported (no mediation)
<i>Hypotheses (parallel mediation)</i>				
H₁₆	Service quality → customer satisfaction → customer loyalty → customer retention (H_{1a} + H_{5a} + H₉)			Supported (partial mediation)
	(i) Service quality → customer satisfaction → customer loyalty			
	(ii) Customer satisfaction → customer satisfaction → customer retention			

(continued)

Table 1.7 (continued)

Hypothesis	Hypothesized directions	Indirect effects		Hypothesis (type of mediation)
		Path coefficients	T-statistics	
H₁₇	Service quality → corporate image → customer loyalty → customer retention (H_{1d} + H_{2b} + H₉)			Supported (partial mediation)
	(i) Service quality → corporate image → customer loyalty			
	(ii) Corporate image → customer loyalty → customer retention			
H₁₈	Service quality → customer satisfaction → switching barriers → customer loyalty → customer retention (H_{1a} + H_{5c} + H_{7a} + H₉)			Supported (partial mediation)
	(i) Service quality → customer satisfaction → switching barriers			
	(ii) Customer satisfaction → switching barriers → customer loyalty			
H₁₉	Service quality → corporate image → customer satisfaction → switching barriers → customer retention (H_{1d} + H_{2a} + H_{5c} + H_{7b})			Supported (partial mediation)
	(i) Service quality → corporate image → customer satisfaction			
	(ii) Corporate image → customer satisfaction → switching barriers			
	(iii) Customer satisfaction → switching barriers → customer retention			

*** $p < 0.01$ (two sided) ** $p < 0.05$ (two sided)

Note: All mediations have been tested with the final model, controlling for corresponding direct effect

particular bank, the banks must find the way to cultivate a customer base that will remain loyal, even in times of fierce competition. Consequently, to ensure the survival of Indian banks, it is imperative to maintain and enhance the relationships with the existing customers by adopting customer-centric strategies (Roy and Shekhar 2010). They can identify the antecedents of customer retention and develop effective marketing strategies to attract new and retain existing customers by responding well to complaints and taking full responsibility for product performance. In order to enhance customer loyalty, as it acts as a potential mediator, financial service providers should promote a sense of community mindfulness by engaging customers with their products/services. Developing relationships with customers denotes treating them impartially, boosting core service with added value, and most importantly, offering a customized service for each customer. While guaranteeing that existing customers are pleased with the service, managerial staff should build loyalty schemes with a view to persuading customers away from their competitors (McIlroy and Barnett 2000). After understanding the significance of building customer relationships, the marketing division needs to decide which customers they are interested in developing close relationships with in the near future (Rust and Chung 2006). The primary concern of this retention approach is that when dealing with a customer, in business to consumer marketing, organizations must consider advancing a long-term view of their relationships with their customers. Therefore, marketers need to understand how much to spend to prevent customers from switching companies (Garland 2002) and build long relationships with them.

Drucker (1973) reminds us of the principle that any business success is ascertained by the customers and not the service provider. It is extremely significant that the organizations should link their business processes to provide a satisfying customer experience. For this, the management needs to define customer satisfaction metrics, which will help to provide good relations between perceived price attributes and customer satisfaction. Accordingly, the management must focus on three to four attributes at once. The reason being is that customer offers comprise a number of benefits. Therefore, merely improving one attribute is not sufficient enough to improve customer satisfaction toward the whole offer. Managers should also instill a positive culture of customer orientation in employees and offer guidance in terms of “relationship banking.” Moreover, more attention must be given to correct segmentation policy in terms of the target consumers. The management can no longer target all consumer segments within the remit of a single marketing strategy. To persuade target audiences in terms of their perceptions and selection decision criteria pertaining to banks, they can use the constructs proposed within this research as part of their advertising strategy.

In summary, this research provides valuable insight into customer decision-making and evaluation process that would benefit executives and marketing experts involved in bank marketing, advertising campaigns, and strategic decisions. They can evaluate the constructs employed in the present study and adapt them as a foundation for relationship marketing, advertising, and retail marketing by tracking changes in consumer attitudes and bank service proviso.

1.8 Limitations of the Study

The certain limitations must be discussed that imply future research directions. In discussing these limitations, we developed a model for a developing country (i.e., specific to an Indian population). The results may vary due to cultural and economic differences, particularly in terms of developed countries. The study is restricted to a single market, i.e., banking sector and a representative sample of banking institutions and customers. Future research which enlarges the sample universe could yield more concluding insights. Additionally, the moderating effects of gender, trust, and switching barriers could produce constructive marketing intelligence for the financial institutions. The foreign banks have been kept out of the purview because of its less availability of branches in the province. The future research should also be made to explore the leading factors of customers who switch to other banks and shift to the competitors.

To conclude, this paper would go so far in expanding the academic research in the field of customer retention and in fine-tuning the banks’ marketing strategies at large.

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Chapter 2

Activity Recognition and Dementia Care in Smart Home



K. S. Gayathri, K. S. Easwarakumar, and Susan Elias

Abstract Smart home is a ubiquitous environment that aims to offer Ambient Assisted Living (AAL) to its occupants. The activity modeling framework proposed in this research work skillfully integrates ambient intelligence into the home environment by a collective process of activity recognition, abnormality detection, and decision making. Moreover, the activity modeling strategy employed in this research work efficiently models both the data and domain knowledge for activity recognition. The primary task in designing an activity recognition system involves the construction of activity model that represents occupant's Activities of Daily Living (ADL). To achieve activity recognition and abnormality detection competently, it is essential for the activity modeling strategy to consider the design challenges of uncertainty modeling, contextual modeling, composite modeling, activity diversity, and activity dynamics. The challenges of activity dynamics and data uncertainty are well addressed through data-driven approaches, whereas the challenges of activity granularity, contextual knowledge, and activity diversity are well addressed through knowledge-driven approaches. Therefore, activity recognition frameworks are proposed in this research work, where the first framework represents the activity model as a Markov Logic Network and the second framework represents the activity model as a probabilistic ontology. Each of these approaches offers both uncertainty and contextual modeling for activity recognition by integrating data-driven and knowledge-driven techniques. Moreover, this research proposes an assistive dementia care system through smart home that offers functional assistance to the dement occupant during critical situations without the help of caretaker.

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Keywords Ambient assisted living · Smart home · Healthcare · Dementia care · Abnormality detection · Decision support

2.1 Introduction

Smart environment has progressed into a prime research area with the development in the field of machine learning, artificial intelligence, and sensor technologies. The use case considered in this research is a smart home, and it involves the modeling of the Activity of Daily Living (ADL) and Ambient Assisted Living (AAL) for applications relating to occupant monitoring and healthcare (Cook and Das 2007; Cook et al. 2009; Augusto et al. 2010). Sensing, reasoning, and responding effectively are the primary challenges related to the design of smart home environments. Smart homes are designed to support the occupant needing assistance to complete their daily routines independently without the help of a caretaker (Amoretti et al. 2013; Cook and Das 2007). The assistive smart home monitoring system recognizes and detects abnormality in occupant behavior and performs decision making to remotely alert the caretaker during critical situations (Augusto 2012; Lotfi et al. 2012). Thus, smart homes have found extensive applications in various socially relevant problems (Alam et al. 2012).

Activity recognition (AR) is the most important process in incorporating ambient intelligence into smart homes (Cook et al. 2009; Augusto et al. 2010). The primary task in designing an activity recognition system involves the construction of an activity model that represents the occupant's behavior and activity pattern for recognition (Cook 2012). The routine activities referred to as ADL are preferred for activity modeling for the reason that these activities help in defining normal scenarios within the smart home, and any deviation is detected as abnormality (Augusto et al. 2010).

Digital India focuses at various key initiatives; Internet of Things (IoT) is one such technology that aids to achieve the vision of smart Digital India specifically smart cities (Singh 2017; Kamel Boulos and Al-Shorbaji 2014). India Ageing Report 2017 reveals that around 20% of the Indian population are aged people and depend on the caretaker to carry out their daily activities (Giridhar et al. 2017). Moreover, 4.1 million people in India are affected with dementia, and approximately 3 billion US dollars is spent on dementia care every year. It is thus essential that promotion of the digital age focuses on a critical aspect of human welfare, namely, healthcare. Design of assistive healthcare system through smart home is thus the focus of this research that intends to offer better quality living, independent living, and ambient assisted living to the citizens.

2.1.1 Challenges in the Design of Activity Recognition for Smart Home

- Modeling uncertain data
- Sensor data are generally noisy and uncertain; statistical approaches are required to analyze from ambiguous data. Thus, the approach of activity modeling should provide mechanisms to handle uncertain data.
- Modeling context information
- Activities in smart home are executed under different contexts such as specific locations, objects, time, and situations. Thus, the activity modeling approach should facilitate situation-aware computing to handle spatial-temporal sensor data through context modeling and recognition mechanisms.
- Modeling composite activity
- Composite activities are complex patterns of temporally related simple activities. The activity modeling mechanism needs to explicitly define the structure of various temporal relations so as to recognize sequential, interleaved, and concurrent composite activities. Thus, the activity modeling mechanism requires to model both simple or composite activities.
- Modeling activity diversity
- Most of the activity functionalities are common among occupants, but certain actions differ according to the individual's preference. These variations among occupants in structuring activity model lead to a large number of ADL variants. Representation and handling ADL variants are challenging tasks, and thus the modeling approach through its representation mechanism should encode activity diversity efficiently.
- Modeling activity dynamics
- The occupant's need and preferences may change over time. The activity model needs to learn these preferences and update itself by representing the latest changes in occupant's interests. Therefore, the activity modeling mechanism employed must be flexible enough to incorporate these variations.
- Modeling activity granularity
- Activities are of different granularity, for instance, "Make hot drink" is a higher-level granularity of "Make coffee" and "Make tea." The modeling approach preferred in the design should facilitate hierarchical ordering among its representation to handle activity granularity so as to enable reusable and scalable activity model.

2.1.2 Motivation for the Proposed Research Work

- ADLs executed by the occupant are generally characterized as complex event patterns that are either simple or composite in nature. Simple activities are an ordered sequence of events, whereas composite activities are temporally related

simple activities (Augusto et al. 2010). The existing activity recognition systems independently model simple ADL or composite ADL. Thus, an activity modeling and recognition framework is required to model both simple and composite ADL's within a single system.

- In existing systems, probabilistic machine learning approaches are employed in activity modeling to handle uncertain and incomplete sensor data. Context-aware computing is brought into the activity models through symbolic approaches of artificial intelligence techniques. The setback is that none of the activity modeling frameworks have addressed the modeling of uncertain sensor data and context-based reasoning within a single framework. Hence, it is essential for the activity modeling and recognition framework to integrate uncertainty and context-based reasoning into a single structure for effective recognition.
- The impact of the global demographic change has made elderly care critical, which needs to address issues both from a societal and economic perspective (Draper 2013; Wimo et al. 2017; Amoretti et al. 2013). The aging populations in different stages of dementia are unable to manage their daily activities and are gradually becoming reliant on caretakers, thus making dementia care a demanding social problem. Excessive care is required for the dement occupant to carry out their daily living which involves enormous amount of resources in terms of time, money, and manpower (Lotfi et al. 2012). It is noticeable that the overhead incurred in dementia care is immense, and hence assistive healthcare systems are indispensable.

Therefore this research proposes an activity modeling and recognition framework for smart home that effectively models and recognizes both simple and composite ADLs of the occupant. A combination of machine learning and artificial intelligence approach that handles activity granularity, contextual knowledge, activity diversity, activity dynamics, and data uncertainty is employed. The proposed activity modeling framework is extended to design dementia care system that recognizes abnormality in occupant behavior. Intelligent decision support system to carry out short- and long-term decision making for dementia care is also proposed.

2.1.3 Objective of This Research

- To offer ambient assisted living environment through the design of activity recognition system for smart home
- To design dementia care system using smart home
- To recognizes both simple and composite ADLs
- To integrate uncertainty reasoning and context-based reasoning for activity modeling

2.2 Related Work

Based on the type of sensors employed in smart home for monitoring, activity recognition is categorized into vision-based activity recognition and sensor-based activity recognition (Chen et al. 2012a). Video cameras are used in vision-based approaches to monitor the occupant and environment. Video sequences are subsequently analyzed to perform activity recognition using computer vision techniques such as feature extraction, movement tracking, structure modeling, movement segmentation, and action extraction (Chen et al. 2012a; Aztiria et al. 2010). Vision-based activity recognition has several advantages in modeling smart environment, but privacy of the occupant is a major concern. Thus, occupant monitoring using video camera is not an appropriate way in the design of smart home. Moreover, the challenge of modeling activity diversity, activity dynamics, and activity granularity could not be well addressed through vision-based approach. Therefore, this research focuses on activity modeling for smart home using sensor-based activity recognition.

Sensor-based activity recognition has developed with the advancement in the field of sensors, network technologies, and machine learning strategies. Wide varieties of sensors are employed for activity monitoring, and each of these sensors is different in their characteristics, functioning, output signals, and working principle. These sensors are either fixed on various objects in the environment or worn by the occupant (Chen et al. 2012a). The data obtained from sensors are generally time series data that represent state change or parameter value. The acquired data are then processed through statistical and knowledge engineering algorithms to facilitate activity recognition.

Based on the mode of sensor deployment, activity recognition is further categorized into two major groups, namely, wearable sensor and dense sensor-based recognition (Chen et al. 2012a). Wearable sensors are sensors that are placed on human body for monitoring and are used for measuring vital information such as heart rate, pulse rate, skin temperature, etc. Some of the commonly used wearable sensors are accelerometer, Global Positioning System (GPS), and biosensors (Chen et al. 2012a; Atallah and Yang 2009). Though wearable sensors have several advantages, it endures a few limitations. The foremost constraint is the willingness or forgetfulness of the occupant to wear such devices. Ease of use, battery life, and size of device are the other issues related to wearable sensors.

Every activity in smart home is characterized as a sequence of events, where each event can be described in terms of physical objects manipulated in the environment for its execution (Chen et al. 2012a). Sensors are fixed onto various objects within the environment, and the ongoing activity can be recognized effortlessly through objects in use, such as sleeping can be recognized with bed sensor “ON” status. Thus, object sensors play a vital role in activity modeling. Restrictions of body-worn sensors and initiative of object-user interaction in smart home have directed the modern trend of activity modeling toward dense sensing-based approach. Hence, this work mostly focuses on modeling the activity recognition

system through dense sensors, while few wearable sensors are employed in the design of assistive healthcare systems that measure vital signs of the occupant.

Current research works on sensor-based activity modeling have employed either data-driven or knowledge-driven approach for its design (Chen et al. 2012a). Activity modeling through data-driven approach utilizes probabilistic and statistical models, whereas activity modeling through knowledge-driven approach utilizes knowledge representation models. Data-driven activity models are built using generative, discriminative, or data mining approaches (Chen et al. 2012a; Atallah and Yang 2009; Aztiria et al. 2010). Generative approaches use probabilistic models, whereas discriminative approaches use classification models to represent the complete description of input sensor data space. Commonly used generative approaches are Naive Bayes classifier (NBC), Hidden Markov Model (HMM), and Dynamic Bayesian Networks (DBN) (Rashidi et al. 2011; Rashidi and Cook 2009). Discriminative approaches have emerged for the reason that generative approaches require adequate data to learn complete probabilistic representation for activity modeling. Discriminative approaches address this issue by building activity recognition system as a classification model. Commonly used discriminative techniques are nearest neighbor (NN), support vector machines (SVM), artificial neural network (ANN), and boosting techniques (Chen et al. 2012a). Both generative and discriminative approaches employ supervised machine learning strategies for its modeling that requires labeled dataset.

Clustering is a data mining approach that is preferred to model from unlabeled dataset. The process of grouping similar objects together based on certain features or characteristics is called clustering. Existing activity recognition systems of smart home have employed clustering for its modeling. The approach in the work of Rashidi and Cook (2009) has employed k-means clustering to realize abnormality in start time and duration of an activity (Hoque and Stankovic 2012). Since the activity of the occupant is characterized as a sequence of events, the traditional data point clustering approaches fail to model the activity patterns of smart home. Hence, clustering approach in smart home requires to group event sequences rather than individual data points. The difficulty in pattern clustering lies in the definition of similarity measure to discover correspondence between two related complex activity patterns. In this direction, the work of Rashidi and Cook (2010) employed long common subsequences for calculating the similarity measure between two patterns. The issue is that this approach does not take ordering of actions or patterns into consideration while modeling and has a limitation to process the temporal information encoded in the sensor data. Various similarity measures like Levenshtein edit distance, Manhattan distance, and Euclidean distance were used in many smart home systems, but the constraint is that they are not capable to capture similarity between two event sequences that are composite in nature. Hence, event pattern clustering algorithms with suitable similarity measure to group relevant composite activity patterns are required for modeling the activity recognition system.

On the other hand, knowledge-driven approach represents occupant behavior as a reusable contextual model that describes activity as relationship with objects, space, and time using logics and ontology (Chen et al. 2012b). The represented

activity model through logical formalisms is semantically clear, follows universal representation, and eliminates cold start problem. Additionally, ontology activity models are preferred than the first order logic as ontology is independent of algorithm choice facilitating interoperability, reusability, and portability. Despite the fact that ontology is semantically clear, it has restrictions in handling uncertainty and temporal inputs. Moreover, activities may not be deterministic in nature, and hence modeling non-deterministic composite activities involving temporal relation is a major concern in both logic- and ontology-based approaches.

Thus, from the survey on activity modeling approaches, it is found that both data- and knowledge-driven strategies have their own advantages and disadvantages. The challenge of uncertainty modeling and activity dynamics is taken care by the data-driven approach, whereas the challenge of activity granularity, activity diversity, and contextual modeling is better addressed through the knowledge-driven approaches. Comprehensive research on activity recognition has been accomplished using either probabilistic models or knowledge based models individually. Therefore, this research work attempts to bring in an innovation in the AR system design by integrating probabilistic inference over the represented domain knowledge in order to efficiently recognize the ongoing activity.

2.3 Proposed Markov Logic Network-Based Activity Recognition System in Smart Home

This research work proposes a novel framework for activity recognition to model both simple and composite activities (Gayathri et al. 2015b). Markov Logic Network (MLN), a statistical relational learning approach, is utilized for the design (Richardson and Domingos 2006). The significant aspect of MLN is that it combines probabilistic and logical reasoning in a particular structure. The effective utilization of MLN in the proposed framework facilitates the recognition of uncertain data and also provides a means for context-based reasoning through its probabilistic and logical structure. The proposed activity recognition system models simple activities through soft rules and composite activities through hard rules. Proposed MLN-based activity model has been tested with standard smart home dataset, and the performance is measured in terms of precision, recall, and F-measure. Proposed MLN (hybrid approach) has high F-measure than existing HMM (data driven) and ontology (knowledge driven) activity modeling approaches. The reasons for better performance are that MLN incorporates domain knowledge and probabilistic reasoning in a single framework for recognition, where weighted soft rules of MLN aid probabilistic reasoning within domain knowledge. Moreover, hard rules of MLN facilitate easy modeling of composite activities. However, HMM performs only probabilistic reasoning, and ontology performs only domain knowledge reasoning. Thus, the proposed MLN-based activity recognition performs better than the existing activity modeling approaches.

2.3.1 Proposed Abnormality Detection System for Dementia Care

Ambient assisted living provided through the proposed MLN-based activity recognition system support the relevance of smart home in modeling healthcare systems. This research work proposes an assisted living framework for dementia care by extending MLN-based activity recognition system for detecting abnormality in occupant behavior. Uncertainty in the context of dementia care materializes from the occupant condition of memory loss, generating incomplete activity event sequences. The activity recognition system should be capable to model such uncertainty. Furthermore, dementia care system requires to model additional information provided by the caretaker and doctors, thereby making context-based reasoning crucial for modeling dementia care systems.

The activity modeling and recognition framework using Markov Logic Network has a provision to handle uncertainty and context-based reasoning and thus has been innovatively extended in this proposed dementia care system for modeling abnormality detection (Gayathri et al. 2015a). Proposed design of dementia care is brought in by the hierarchical approach employed for modeling the recognition system. Comprehensive study on dementia care reveals the major factors contributing to abnormality in occupant behavior are time, location, duration, and objects used to execute an activity. Proposed framework ably models each factor at appropriate layers in the hierarchical framework based on the priority in recognizing abnormality. The factors with higher priority are modeled at lower layers for immediate processing, thereby facilitating quick decisions. The lowest layer is related with objects that jointly recognize the activity, and higher layers model features of the activity such as time, duration, and location. The competence of the proposed dementia care system comparing with existing approaches is precise in terms of instantaneous recognition of abnormality that in turn aids in the effective decision making. Experiments were carried out to compare the proposed MLN-based hierarchical framework with that of non-hierarchical framework. The results showed that non-hierarchical system takes more time to respond than hierarchical MLN. Since, the non-hierarchical framework models all the factors together for abnormality detection, the average response time to detect abnormality is more than that of the hierarchical system.

2.3.2 Proposed Intelligent Decision Support System for Dementia Care

Smart home modeled for dementia care requires extending abnormality detection to decision support system. The design of intelligent decision support system (IDSS) is crucial in dementia care as the system needs to decide on an action to handle abnormalities in occupant behavior. The novelty of the proposed design is to offer two levels of decision making, that is, short-term decision making and long-term

decision making. Short-term decision making decides on quick actions, while long-term decision making decides developmental stage of dement occupant.

Markov Logic Network-based activity recognition and abnormality detection system put forward the essential data required to model the proposed IDSS. The recognized abnormality factors are tabulated and labeled manually with alerts generally recommended for the recorded abnormality. The labeled dataset obtained from activity recognition system is utilized by the learning module of IDSS to build the decision-making system for dementia care. Representation of MLN structure is critical in the design of short-term decision-making system (STDM) as it establishes an association between abnormality factors (object, location, time, and duration) and actions (low, high, and emergency alert). Soft rules of MLN are used to model the influencing abnormality factors for decision making. The abnormality factors combined with ADL has more impact toward decision making and thus incorporated in the proposed design. The hard rules in IDSS of dementia care precise information about the occupant and the environment. Any healthcare application requires modeling of human vital signals like glucose monitoring oral, rectal, and skin temperature; heart rate; and blood pressure for decision making. The influence of these vital parameters toward decision making is better provided by the caretaker or the doctors. Thus, the proposed STDM system represents hard rules to model the vital parameters in dementia care.

The task of long-term decision-making system (LTDM) is to offer assessment on developmental symptom of dementia. It is an effort to provide progressive opinion about the dement occupant to the caretaker/doctors for suitable action. The level of dependence of the occupant to complete their ADL is the key factor to measure onset and developmental stage of dementia (Collin et al. 1988). General practice to measure the occupant dependency is to monitor and record the observations manually, but it is labor intensive and error prone. Hence, the proposed LTDM automates this process with a weighted average statistical measure that collectively models the recognized abnormality factors and its frequency for decision making. In future, the proposed IDSS for dementia care could be modeled with multi-criteria decision making (Khatwani and Srivastava 2015) to further enhance the performance of the system.

2.3.3 Proposed Probabilistic Ontology-Based Activity Modeling and Recognition

Unified representation in modeling and semantically clear reasoning makes ontology-based activity modeling ideal over other knowledge representation techniques. The standard practice in designing ontology is to first gather knowledge from domain experts and subsequently modeling the ontology structure. But this proposed research work brings in innovation by constructing the ontology from the hierarchical structure obtained by executing a novel event pattern clustering

algorithm over the smart home dataset. The proposed event pattern activity modeling (EPAM) framework is an unsupervised machine learning approach that derives event patterns from sensor data, which is later utilized to design an ontology activity model (Gayathri et al. 2014). Activity event sequences are generally discontinuous, and the EPAM accounts this factor, with the use of Jaro-Winkler similarity measure that groups varied event sequences of similar activities together. The clustered event patterns are further utilized to extract knowledge about event ordering and contextual description of each activity. Though the approach of activity modeling using ontology enhances context-based recognition, it has its limitation in handling temporal and uncertain data. This research work proposes an approach to integrate temporal model into ontology-based recognition system. Later, the collective temporal and ontology model are extended to execute probabilistic inferences on the represented knowledge by a novel utilization of Markov Logic Network. Thus, the proposed work augments ontology-based activity recognition using probabilistic reasoning to enhance the activity recognition process.

The novelty of the proposed design is in the integration of probabilistic reasoning into domain ontology using Markov Logic Network (MLN). This proposed activity recognition framework has two primary components, namely, ontology-based activity model and the Markov logic inference network (Gayathri et al. 2017). Activity patterns mined using EPAM framework and domain knowledge are utilized in the proposed framework to construct the terminology box (TBox) and assertion box (ABox) of the ontology and transformed into a MLN to facilitate probabilistic context-based reasoning. In the translation process, TBox of the ontology is transformed into first-order logic based on the model theoretic semantics property of description logic. Weight learning is then performed over the generated first-order rules and individuals of the ABox, to generate the MLN activity model having the weighted first-order rules.

Probabilistic inferences for the event sequences during run time are performed by a Maximum A Posterior (MAP) query over MLN to predict the most probable activity of the occupant. The sensor events generated during run time are continuous and need to be converted to event sequences by a segmentation process so as to enable activity recognition. In real time, it is complex to segment events to obtain complete event sequences of an activity. The precision in activity recognition depends on the generated event. The existing work employs either fixed-interval or location-based segmentation, and the events sequences generated are generally incomplete. Thus the proposed system introduces a hybrid of location and fixed interval-based segmentation that reduces the generation of incomplete event sequences, thereby increasing the accuracy of recognition process. The proposed segmentation approach at first employs location-based segmentation to produce event sequences. It is later shifted to fixed-time interval based, if the duration spent by the occupant in a location is below a minimum threshold or above a maximum threshold. The event sequences produced are then given to the recognition system to identify the activities of the occupant.

Simple activity recognized using MLN obtains the time interval from the time instant of its atomic events. Later, composite activities are inferred from simple

activities using Allen's temporal rules modeled within MLN using Semantic Web Rule Language (SWRL) of ontology. The recognized simple and composite activity is given to the decision-making system for response activation. The response could be a simple alert or a call to caretaker or voice alert message, based on the smart home environmental setup.

2.4 Research Contributions to Model Activity Recognition and Dementia Care in Smart Home

1. This research employs statistical relational learning (SRL), a field of machine learning for the design of activity modeling and recognition framework for smart home. SRL is an expertise to integrate probabilistic machine learning and logical formalism within a single structure. The novel deployment of Markov Logic Network (MLN), a type of SRL within AR system, enables both data-driven and knowledge-driven modeling for recognition that enhances the recognition accuracy. MLN is a weighted first-order rule where soft rules enable probabilistic reasoning and hard rules enable context based reasoning.
2. As ADLs are characterized into simple and composite activities, hence AR system requires modeling these complex activity patterns. Most of the existing systems have focused on the recognition of simple activities; however, a few AR systems have modeled composite activities through knowledge engineering techniques. The limitation is that knowledge engineering strategies do not effectively address uncertainty reasoning. Therefore, it is mandatory for the AR system to recognize both simple and composite activities through uncertainty and context-based reasoning approach. This research deals with this issue, by utilizing MLN to model both simple and composite activities. Composite activities require to model temporal relations among simple activities, and the proposed system using MLN effectively models Allen's temporal relations. Hence, the second contribution to this research work is to propose an MLN-based activity recognition framework that models both simple and composite activities.
3. This research furthermore proposes an assistive healthcare framework through smart home that aims at recognizing abnormal occupant behavior. The proposed dementia care system employs MLN for its design, as the activity recognition system needs to reason on incomplete event sequences generated by occupant due to memory loss and model occupant-specific knowledge offered by the doctor/caretakers. As assistive care requires recognizing abnormality at faster pace, an MLN-based hierarchical framework is proposed for activity recognition. This framework models each contextual attribute separately at various hierarchies in a way that high-priority attributes are modeled at lower layers to enhance the response time in detecting abnormality on critical factors. The proposed dementia care system, in addition to abnormality detection, recognizes the context

attributes that caused abnormality so as to provide necessary decision support to the dement occupant that enhances their safety and comfort.

4. Intelligent decision support systems are critical in assistive healthcare system to provide timely responses in abnormal situations. Therefore, this research provides a framework to model an intelligent decision support system for dementia care through smart home. The novelty in the design of IDSS is to offer short-term and long-term decision making. Thus, the proposed IDSS provides quick alerts to handle abnormality situation through short-term decision making, and assessment of developmental stage of dementia is provided through long-term decision-making system.
5. This research proposes an Event Pattern Activity Modeling Framework (EPAM) to identify the occupant activity pattern from the sensor data by using an unsupervised machine learning approach, and further analysis is done with a knowledge-driven approach. Generally, occupant activities are highly discontinuous, and thus EPAM tackles this issue by the use of Jaro-Winkler similarity measure. The hierarchy of activity generated by the pattern clustering approach is used for activity modeling. Activity modeling should analyze the state of the occupant in the environment which demands a context-level reasoning, and it can be achieved through knowledge-driven activity recognition techniques. The activity patterns are represented as knowledge in the recognition system using ontology.
6. Activity recognition modeling research has been done with probabilistic approaches and ontology-based models individually. This research attempts to bring in a novelty in the AR system design by integrating probabilistic inference over the represented domain ontology. AR system is built up on well-defined domain ontology that describes complex relations among domain entities by means of description logic, thereby featuring reusability, adaptability, portability, scalability, and consistency. The proposed system integrates the Markov Logic Network to handle sensor data uncertainty. The constructed ontology which is based on description logic is converted to weighted first-order rules that will augment probabilistic inference over represented ontology.

Thus, the proposed activity modeling frameworks (MLN and probabilistic ontology) for smart home offer ambient assisted living environment to its occupant through the design of activity recognition and decision support system. Moreover, the framework proposed is scalable to design any smart healthcare system.

2.5 Conclusion

Smart home presented in this research offers ambient assisted living (AAL) to its occupants by modeling the activity recognition system. The activity modeling framework proposed in this research skillfully integrates ambient intelligence into the home environment by a collective process of activity recognition, abnormality

detection, and decision making. Moreover, the activity modeling strategy employed in this proposed framework efficiently models both the data and domain knowledge for activity recognition, and henceforth it is adaptable to develop a variety of smart home applications. The primary task in designing an activity recognition system involves the construction of activity model that represents occupant's activities of daily living (ADL). To perform activity recognition and abnormality detection competently, it is essential for the activity modeling strategy to consider the design challenges of uncertainty modeling, contextual modeling, composite modeling, activity diversity, and activity dynamics. The challenges of activity dynamics and data uncertainty are well addressed through data-driven approaches, whereas the challenges of activity granularity, contextual knowledge, and activity diversity are well addressed through knowledge-driven approaches.

Markov Logic Network, an approach of statistical relational learning, was utilized in the proposed activity recognition design to model both simple and composite activities. MLN is an appropriate approach as probabilistic and first-order logic is integrated within a particular structure. This research work also proposes an assistive dementia care environment through smart home that helps dementia people to live independently. The proposed dementia care framework includes both abnormality detection system and decision support system, to recognize the deviation of occupant from activities of daily living and to decide on appropriate alerts to handle the abnormality. Significant criterion to model dementia care is to handle incomplete event sequences (produced due to memory loss) and to model occupant-specific knowledge (provided by the caretaker/doctors). Markov Logic Network (MLN) models uncertain data and domain knowledge within a single framework, and thus the proposed MLN-based activity recognition is innovatively extended in this research to model the dementia care system. The compelling feature of the proposed abnormality detection system is the concept of hierarchical activity recognition where any abnormality in the occupant's activity is recognized and a decision is made at each layer. The factors that influence the abnormality detection include details regarding the objects that are used, time, location, and duration of activity. The system also identifies most relevant factors that would invoke emergency alerts and gives it high priority by modeling them in the lowest layer of the hierarchy.

The proposed hierarchical activity recognition and abnormality detection for dementia care are expanded with decision support system that provides assistance to the dement occupant during abnormal situations. The proposed decision support system for dementia care integrates short-term and long-term decision making in a single framework, where quick alerts to handle abnormal situation are presented by short-term decision making, while the assessment of progressive stage of dementia is presented by long-term decision making. The experimental evaluation shows the accuracy of the proposed framework in decision making. Thus, an absolute assistive dementia care system through smart home is presented through this research that models abnormality detection and decision support system appropriately.

The future work would be to extend the activity modeling recognition framework to address the challenges in modeling activities among multiple occupants within smart homes and to include other psychosomatic parameters in dementia for modeling the assisted healthcare system.

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Chapter 3

Role of Indian ICT Organisations in Realising Sustainable Development Goals Through Corporate Social Engagement



Parvathi Jayaprakash and R. Radhakrishna Pillai

Abstract UN Sustainable Development Goals (SDG) is an initiative of the United Nations to provide a technical and operational fit process for the achievement of sustainable development across the globe. Government and NGOs primarily cater to either of the aspects of sustainable development, but they lack infrastructure and capability. The public policies, though central for achieving these goals, are not adequate. The private sector should also be equally involved as they can drive innovation and growth in the nation. With the presence of the organisational and management expertise, the private sector can accelerate the attainment of these goals. This paper studies the role of businesses in attainment of SDG through corporate social responsibility (CSR) with ICT moderating this relationship. Since Information Communication Technologies (ICT) is considered to act as a catalyst for achieving these SDG, a mixed methodology is used in the study. The study identifies the firm size, profitability and industry sensitivity as factors influencing the CSR implementation in Indian ICT organisations and profitability, ICT and industry sensitivity to be influencing SDG. CSR need not be the only means for businesses to contribute to SDG. SDG can be considered as “corporate social opportunity” to obtain a competitive edge over other firms in the industry.

Keywords Sustainable development goals (SDG) · Corporate social responsibility (CSR) · ICT4SDG · Mixed methodology

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3.1 Introduction

UN Sustainable Development Goals (SDG) is an initiative of the United Nations to provide a technical and operational fit process for the achievement of sustainable development across the globe. It is a time-bound set of targets to bring social inclusion, environmental protection and economic prosperity irrespective of the status of countries. The sustainable development agenda 2030 consists of 17 goals with 169 targets and 230 indicators measuring them. A report from Global e-Sustainability Initiative on ICTs for sustainable development classifies the 17 SDG into the pillars of the Triple Bottom Line (TBL or 3BL) framework. Goals pertaining to removal of hunger, provision of good health and well-being, value education for all and promotion of lifelong learning and just, peaceful and inclusive societies, which “aims to empower poor and marginalized people to take advantage of burgeoning global opportunities” are considered as social inclusion (World Bank 2013). Goals that improve the nation’s economic, political and social well-being of its people are categorised as economic development. For example, eradication of poverty, gender equality, decent work and economic growth, infrastructure, promoting sustainable industrialisation, and fostering innovation promote equality. Environmental development is “the ability to maintain things or qualities that are valued in the physical environment” (Sutton 2004). Goals such as ensuring clean water and healthy sanitation facilities, access to sustainable energy sources, sustainable cities and communities, responsible consumption and production, climate action, life below water and life on land are categorised to protect the environment. For significant progress towards the achievement of these goals, a massive contribution of political will, government leadership with a diversified and productive private sector, is required (Nelson and Prescott 2003). The public policies, though central for achieving these goals, are not adequate. The private sector should also be equally involved as they can drive innovation and growth. The private sector can accelerate the attainment of these goals by using its organisational and management expertise.

Many organisations are often viewed as profit-making units, concerned about their economic performance and ignorant about the significant social and environmental challenges faced by societies. Since majority of these challenges are either contributed or caused by organisations, their legitimacy in society has fallen. Governments and NGOs primarily aim at addressing the societal challenges, but they lack capabilities and sufficient resources. The solution to this issue can be attributed to the concept of shared value which emphasises that companies can generate business opportunities by addressing societal problems and challenges, thereby creating value for the society. Organisations must relate the company’s success to societies’ progress (Kramer and Porter 2011). For example, Nestlé, restructured its coffee procurement process by working collectively with small-scale farmers. These farmers faced issues of poor quality, environmental degradation and low productivity; Nestlé provided guidance and helped farmers secure plant stock, fertilisers and pesticides. They ensured the farmers are incentivised directly by paying them a premium for better beans. The project resulted in higher yields, and quality increased

the growers' incomes, and the environmental impact of farms minimised. On the other hand, Nestlé received reliable supply of significantly higher-quality beans resulting in higher economic performance of the company. Here both the parties were benefitted; the organisation gained economically and also ensured economic, social and environmental development for the community. Such business model tends to be sustainable in the long run.

International Telecommunication Union (ITU) considers Information Communication Technologies (ICT) as a catalyst for achieving the UN SDG. The primary benefit of utilising ICT is its ability to rapidly diffuse into local masses and its global applicability. For example, not everyone has a bank account, but 81% of them have mobile phone connectivity. ICT can be a means for economic growth through digital financial services. Mobile banking can pave way for banking the unbanked, making way for sustainable economic growth. ICT can build a better inclusive society through equal access to information to all and empowering them. Improved medical and education facilities can ensure reduced inequalities within and across countries. Newer technologies can preserve ecosystems and thereby catering to environmental sustainability. The benefits of ICT can be accrued only if it is properly deployed and directed towards a social purpose. ICT can be levered to translate the digital transformation into developmental transformation. But this can be possible only if private enterprises can share their expertise towards social causes.

This paper is organised as follows: First, a discussion on the practical and academic literature to understand this paper is in three folds: (i) emphasising social responsibility of organisations through CSR, (ii) role of ICT in organisations becoming socially responsible and (iii) incentive for organisations to become socially responsible. Second, a conceptual model and hypothesis are formed with the concept of creating shared value. Third, the research method is explained under quantitative and qualitative subsections. Fourth, findings from the quantitative study and qualitative study are highlighted. Fifth, the discussion of the results is provided. Finally conclusions are drawn, limitations of the study are presented, and possibilities for future research are identified.

3.2 Conceptual Background

(i) *Emphasising social responsibility of organisations through CSR*

There is no consensus on a formal definition of CSR. One of the earliest of definitions of CSR is "Social responsibility is a commitment of entrepreneurs to seek strategies to make decisions or carry out such activities, which are desirable in terms of goals and values of our society" (Bowen 1953, p. 276). A more comprehensive definition was developed by Jones (1980, p. 59), "Corporate social responsibility is the notion that corporations have an obligation to constituent groups in society other than stockholders and beyond that prescribed by law and union contract. Two facets of this definition are critical. First, the obligation must be voluntarily adopted;

behaviour influenced by the coercive forces of law or union contract is not voluntary. Second, the obligation is a broad one, extending beyond the traditional duty to shareholders to other societal groups such as customers, employees, suppliers, and neighbouring communities". An operational definition for incorporation of social objectives into businesses was given by Wartick and Rude (1986, p. 124) as "the processes by which the corporation can identify, evaluate and respond to those social and political issues which may impact significantly upon it". CSR ensures that corporations do not just focus on their shareholders but all their stakeholders and meanwhile increase the positive impact and reduce the negative impacts on the society and environment while still retaining economic growth. Extant definitions of CSR is perceived from the triple bottom line lens (Elkington 1994); Hasnaoui and Freeman (2010) highlight the intersecting relationship of CSR with the triple bottom line (3BL) and emphasise the overlap does not place CSR into sustainable development but rather the corporate responsibilities within sustainable development. The World Business Council for Sustainable Development defines CSR as "the continuing commitment by business to contribute to economic development while improving the quality of life of the workforce and their families as well as of the community and society at large" (Watts and Holme 1998). Brusseau (2011) identifies a 3BL approach as a form of CSR. Either organisations should see each of these sustainability pillars in silos and work to achieve a certain level of attainment in each or consider project catering to all the pillars of 3BL and ensure sustaining results in them, thereby leading to sustainable development. CSR based on the 3BL ensures transparency and ethical behaviour within the initiatives (Capriotti and Moreno 2007; Schäfer 2005).

CSR is idealised with stressing on the responsibility of corporations to make money as well as to interact ethically to answer the broader questions of community welfare (Brusseau 2011). Porter and Kramer (2011) introduced "shared value" as a management strategy linking business opportunities with societal problems. "Creating Shared Value" (CSV) is "the concept of companies creating social value by addressing society's needs and challenges while simultaneously creating their own economic value". The processes for realising CSV are (i) creating new financial businesses to contribute to resolving social problems, (ii) reinforcing the corporate foundation by improving social compliance in everyday business activities and (iii) enhancing stakeholders' trust through active participation in social activities and strengthening the business base (Mitsui 2013). This study is concerned on creating business opportunities in social problems pertaining to SDG.

(ii) Role of ICT in organisations becoming socially responsible

ICT can be related with sustainable development in two ways: (i) directly, applications of ICT are used to attain economic, social and environmental development. (ii) It can be used to spread awareness with its immense global reach and dynamism. ICT organisations can leverage the application of ICT in both ways mentioned above, i.e. ICT organisations can develop projects to achieve sustainable development or use ICT for spreading awareness on the ways sustainable development can be achieved. Depending on the use of ICT in the organisation, the former or latter

methods can be applied. ICT can be utilised to communicate about CSR and can also connect people working for the same social cause for better management and application. With the wide penetration of technology in the lives of individuals, organisations, community and nations at large, it can be used to the benefit of society and bring in legitimacy to organisations in terms of their CSR initiatives. The connectivity among organisations also encourages the development of drivers for implementation and maintenance of CSR standards with incorporation of ICT to attain SDG (Hasnaoui and Freeman 2010).

(iii) Incentive for organisations to become socially responsible

According to the Ethical Corporation's State of Responsible Business 2016 report which surveyed 2045 sustainability professionals globally, lesser than half of the global companies plan to engage with the sustainable development goals. It indicates that businesses do not consider investing in SDGs as a business opportunity. Another survey indicated that in spite of 81% of consumers believing businesses have a role in the achievement of SDGs, the businesses fail to respond. It illustrates that end users value SDG and if businesses can leverage on the goals they can lead to competitive advantage for the organisation. The difference lies in the way businesses view sustainability, i.e. either as a primary goal or a secondary goal. Sustainability, CSR, corporate citizenship and social innovation are terms that broadly capture the essence of corporate engagement in society. Considering CSR in this study, CSR of a particular company can be defined as "any business activity contributing to the social, economic and environmental development of the society" (Dahlsrud 2008, p.4). The CSR rules under the Companies Act in India enforces the contribution of business organisations towards societal development. Thereby coercing companies to look into societal development apart from their economic performance. Organisations involve in various CSR initiatives, yet there is no consensus among business enterprises on the meaning of CSR (Sharma 2011). CSR initiatives are also evaluated using different indices that do not converge (Jankalova 2016). Since there is no solid mechanism for auditing the efficiency or quality of CSR initiatives, there exist diverse view points on implementation of CSR initiatives. Rangan et al. (2015) highlights the increasing pressure on companies to deliver business results in CSR initiatives. It would be easier for companies to align CSR initiatives in line with their main line of business, thereby generating credibility to the business operations, targeting a larger segment of population and harnessing better technologies leading to larger scope for their day-to-day operations.

In this paper, an attempt is made to find a possible solution to the two issues highlighted above, namely:

1. SDG not being seen lucrative for business to proactively target them
2. CSR being ineffective because of the absence of a common auditing criteria to measure its success

This paper investigates on merging the realisation of SDGs with CSR activities for the benefit of the ecosystem in large considering the role of ICT. Here, only Indian ICT organisations are considered as a number of evidence are highlighted

above to indicate the use of ICT to accomplish these SDGs. Moreover, a major portion of Indian GDP is from the ITES sector. This sector accounted a \$ 108 billion worth of services exports in 2015–2016, exporting primarily to the United States, the United Kingdom and Europe (Chakraborty 2016). These statistics provide evidence that the ICT sector is profitable and can boost the economic growth, so why not leverage it to social, economic and environmental development within India was the motivation behind this research. Moreover ICT service industries have wide access to infrastructure and can preferably cater to larger population with their demands. The ICT service sector can create new business models, thereby expanding their segment group and also be profitable. The research questions addressed in this paper:

RQ1: Can ICT be a means to achieve SDGs in business organisations?

RQ2: Are the factors influencing the implementation of CSR same for the implementation of SDGs?

RQ3: Is CSR the only mechanism to achieve SDGs by business organisations?

3.3 Research Model and Hypothesis

Figure 3.1 captures the conceptual understanding of this study where the continuous line indicating the relationships emerged from the quantitative analysis and the dotted line indicating the relationships emerged from the qualitative analysis. The hypothesis generation is explained in the later part of this section.

Firm size or company size is an influential factor in driving CSR expenditure (Rahman and Widayarsi 2008; Branco and Rodrigues 2008; Purushothaman et al. 2000).

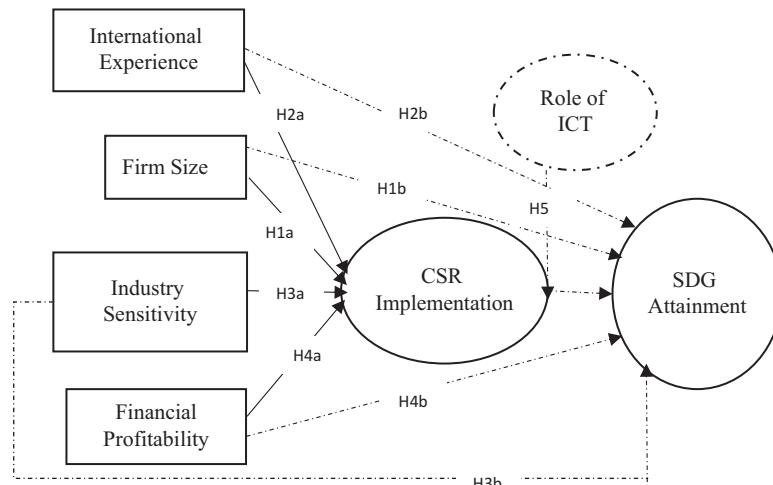


Fig. 3.1 Conceptual model of the study

It is used as a proxy for public visibility. Larger companies are susceptible to the scrutiny of the common public and thereby invest higher on CSR initiatives. Even according to the agency theory, larger companies may have sufficiently larger agents which may lead to higher expenditure on these agents. Research has shown a positive relationship between firm size and CSR (Bayoud et al. 2012). Larger the firm size, the companies can invest resources in more than one SDG, and with better resources at disposition, attainment of SDG is accelerated. Firm size is measured in terms of total assets of the company.

H1a: Firm size has a positive influence on CSR expenditure in Indian ICT companies.

H1b: Firm size has a positive influence on SDG attainment through Indian ICT companies.

Bansal (2005) measured international experience as corporations that operate in and depending upon foreign markets for their functioning. From a resource-based perspective, companies involved with many foreign stakeholders may have to cater to different needs of the customers and would be influenced by varied culture and customs of the country. This leads to higher social responsibility at an international frame, leading to proactive corporate initiatives with respect to the social responsibilities (Branco and Rodrigues 2008). International experience is captured using the average of export of services and export of goods.

H2a: International experience has a positive influence on CSR expenditure in Indian ICT companies.

H2b: International experience has a positive influence on SDG attainment through Indian ICT companies.

Profitability as an influential factor for CSR initiatives has been studied for a long time. Spicer (1978) examined that profitable companies have more affinity towards social responsibilities. Preston (1978) empirically tested the relationship between profitability and the extent of social responsibility and found a weak positive relationship. Cowen et al. (1987) emphasised the profitability of a firm provides higher resources with which the firm can cater a larger section of stakeholders thereby giving it legitimacy in the industry. Profitability is identified using profit after tax of the companies.

H3a: Profitability has a positive influence on CSR expenditure in Indian ICT companies.

H3b: Profitability has a positive influence on SDG attainment through Indian ICT companies.

Industrial sensitivity is a measure of industrial affiliation (Branco and Rodrigues 2008). More sensitive firms are those that get criticised in social matters because of its activities affecting the society. Thereby sensitive firms tend to be more socially

responsible for being legitimate in the industry. This study uses power, fuel and water charges as measures for industry sensitivity. Thereby lower these values the company is more sensitive to societal matters.

H4a: Industrial sensitivity has a negative influence on CSR expenditure in Indian ICT companies.

H4b: Industrial sensitivity has a negative influence on SDG attainment through Indian ICT companies.

The role of ICT in enhancing the attainment of SDG is explained in the previous section. Here we hypothesise the moderating effect of ICT on the relationship of CSR and SDG.

H5: The relationship between CSR implementation and SDG attainment is moderated by the role of ICT such that the relationship is stronger for companies with higher technology at their disposition.

3.4 Research Methodology

A mixed methodology is used in this study. According to Stange et al. (2006) “mixed method involves integrating quantitative and qualitative approaches to generating new knowledge and can involve either concurrent or sequential use of these two classes of methods to follow a line of inquiry”. Creswell and Plano Clark (2007) identified the sequence of the qualitative and quantitative analysis depending on the design of the study. Since we are attempting to explain the relationship of CSR and realisation of SDGs, we first use a quantitative analysis followed by a qualitative analysis.

3.4.1 Quantitative Analysis

The quantitative study is conducted with secondary data on 135 Information Technology and Communication services listed companies in India. The details of the companies are provided by the PROWESS database, which provides the financial performance of all Indian companies. Literature (Masud et al. 2012; Bolanle et al. 2012) has considered CSR expenditure as a proxy for CSR implementation. The sample reduced to 135 from 434 ICT companies as the CSR expenditure details were not present in most of the cases. Prior studies have not focussed on the CSR expenditure of the ICT services sector from a developing country context. A review of literature identifies firm size, international experience, profitability and industrial sensitivity as probable factors that have influence on CSR expenditure of an organisation. This secondary study is conducted to understand the factors that influence the CSR expenditure of ICT companies in India who have disclosed their recent expenditure on CSR activities.

The above-mentioned factors with industry type limited to information and communication services and country of origin being India regression analysis is conducted. To the best of our knowledge, factors influencing the CSR initiatives are not studied in the Indian ICT services sector context. It is important to study this context as the major portion of Indian GDP is from the ITES sector, i.e. accounts for \$ 108 billion worth of services exports in 2015–2016, exporting primarily to the United States, the United Kingdom and Europe (Chakraborty 2016). IT companies across India have operations running widely inside and outside the country. These IT and ITES companies can leverage their forte of applications in ICT towards sustainable development of the society. It is not only important to generate goods and services, but it has been a champion in signalling activities directed towards a social cause.

A multiple linear regression equation represented in Eq. 3.1 indicates a linear relationship of CSR expenditure as the response variable with the predictor variables such as international experience, industrial sensitivity, firm size and financial performance of the company.

$$CSRExpend = \beta_0 + \beta_1 * INTExp + \beta_2 * INDSense + \beta_3 * FIRMSize + \beta_4 * PROFIT + \mu \quad (3.1)$$

where

CSRExpend = CSR expenditure is a proxy for CSR implementation

INTExp = International experience of the organisation

INDSense = Industrial sensitivity within the organisation

FIRMSize = Firm size of the organisation

PROFIT = Financial performance of the organisation

3.4.2 Qualitative Analysis

Organisations can choose to respond to the SDG in three ways: (i) align with one or two of the sustainable development goals or maybe even a handful of them which do not require them to deviate from their main line of business, (ii) contribute to all the 17 SDGs directly or indirectly with the help of third-party institutions and (iii) leverage non-aligned goals (or their underlying business opportunities) to move into new markets or create new businesses. Whether a company is inventing new widgets, producing goods, selling products or delivering services, the SDGs provide a universal framework for all businesses to both play their part as global actors and create new opportunities for growth and competitiveness. Businesses can always partner with governments to enable them to better structure their critical investments and implementation approach in order to drive future prosperity and development. Leading companies can leverage on the SDG goals to create business value in the form of revenue generation, cost reduction, risk mitigation and brand enhancement.

In the second part of the study, we have identified one or more eligible employees from selected ICT organisations to understand if SDGs can be leveraged in their CSR agenda. The selected employees were given a brief idea of UN SDG and how ICT can be a means to achieve them; they were then asked to respond to a subjective questionnaire where they could align these goals with the CSR initiatives or business activities undertaken by their company. The responses were then content analysed, and points that emerged were individually coded, and the process was iterated until no further points needed to be coded. The points of differences in coding of a response between authors were resolved through discussion after each iteration, to improve inter-rater reliability with regard to coding.

Twenty-five employees with a minimum of 5 years of ICT industry experience from various ICT firms were contacted for the study. The response rate for the questionnaire was 84% which is roughly around 21 responses. Each of these responses was read individually by the authors to filter the responses depending on whether the employees responded aptly to the subjective questionnaire. This screening resulted in 19% of the responses which are four responses. These four responses were content analysed to understand the role of achieving SDG in the organisations. The four responses belonged to different companies, and thereby we use four companies for the qualitative analysis in this study.

Company A: "Company A is a leading global professional services company, providing a broad range of services and solutions in strategy, consulting, digital, technology and operations. Combining unmatched experience and specialized skills across more than 40 industries and all business functions underpinned by the world's largest delivery network. Company A works at the intersection of business and technology to help clients improve their performance and create sustainable value for their stakeholders. With approximately half a million people serving clients in more than 120 countries, my company drives innovation to improve the way the world works and lives".

Company B: "Company B is a \$6.7 billion leading global technology and IT enterprise. It is a pioneer of modern computing and a global transformational outsourcing company. Its range of offerings includes product engineering, custom & package applications, BPO, IT infrastructure services, IT hardware, systems integration, and distribution of information and communications technology (ICT) products across a wide range of focused industry verticals. The Company B consists of over 111,092 professionals of diverse nationalities, who operate from 32 countries including over 500 points of presence in India".

Company C: "Company C is a global IT consulting and outsourcing service provider, a leader in solutions and services that enable operational productivity for the global banking and financial services industry, insurance, telecommunications, technology and media, information & education industries. Using a combination of business consulting, cutting-edge technology capabilities, and best-of-breed domain and industry knowledge, Company C accelerates business outcomes for its clients. Company C helps clients accelerate business outcomes by consolidating, rationalizing, and modernizing their core customer-facing processes into one or more core systems".

Company D: “Company D is a distinctively diversified health and well-being and a leader worldwide in helping people live healthier lives and helping make the health system work better for everyone. Company D is committed to introducing innovative approaches, products and services that can improve personal health and promote healthier populations in local communities. Our core capabilities in clinical expertise, advanced technology and data and health information uniquely enable us to meet the evolving needs of a changing health care environment”.

The respondents were questioned on how they see or foresee the use of technology for each of the 17 SDG in their organisations. To handle the SDGs, we categorise them into the three pillars of TBL—social, economic and environmental. Defining the social development goals as no poverty, zero hunger, good health and well-being, quality education, gender equality and peace, justice and strong institutions; economic development goals as decent work and economic growth, industry, innovation and infrastructure and reduced inequalities; environmental development goals as clean water and sanitation, affordable and clean energy, sustainable cities and communities, responsible consumption and production, climate action, life below water and life on land. A summarised version of the responses is indicated in this paper to highlight the role of technology, the factors determining CSR and the role of CSR in achieving the SDG.

3.5 Findings

3.5.1 Quantitative Analysis

The descriptive analysis and correlation values of the variables are provided in Table 3.1. Since the values lie below 0.5, the results remain unaffected by the problem of multicollinearity. The results of the multiple regression are provided in Table 3.2. The regression output of indicates the explanatory variables explain CSR expenditure with a R^2 of 94.48 which is acceptable in literature, thereby indicating the chosen independent variables are able to sufficiently explain the dependent variable. Financial performance or profitability, industry sensitivity towards society and firm size are highly significant on explaining CSR expenditure. However, international experience of a country is not significant with CSR expenditure of the company. The results indicate that larger the firm size of the company the higher the

Table 3.1 Descriptive statistics with correlation matrix

Variables	Ob	Mean	Std. Dev	1	2	3	4	5
CSR expenditure (1)	135	48.32	214.23	1				
International experience(2)	135	0.4866	0.4203	0.01	1			
Industrial sensitivity (3)	135	452.60	3516.9	0.27	-0.08	1		
Firm size(4)	135	49,253	234,304	0.41	-0.10	0.49	1	
Profitability(5)	135	3784.2	16,558.	0.33	0.04	0.34	0.41	1

Table 3.2 Output of multiple regression

Dependent variable	CSR expenditure			
Independent variable	Coeff.	Std Error		
International experience	-5.765	11.0051	<i>R</i> ²	0.9448
Industrial sensitivity	-0.021***	0.0081	Adjusted <i>R</i> ²	0.943
Firm size	0.003***	0.0003	F test	542.92***
Profitability	0.0108***	0.0004	No. of observations	135
Constant	3.455	7.091	*** <i>p</i> < 0.001	

number of stakeholders, and thereby the company's CSR implementation can be targeted to a wide category of society. According to the new Companies Act 2013 of Ministry of Corporate Affairs, India, the higher financial performance of a company requires the company to share 2% of their profit in CSR initiatives. Finally industrial sensitivity of the company illustrates the socially responsible behaviour of the corporation, and thereby higher the sensitivity the better CSR implementation. However, international experience does not play a significant role might be due to the reason of each demography may have different social demands and by catering to business in different geographies may not help in generating better CSR initiatives. Thereby H1, H3 and H4 are not rejected in this context, and H2 remains rejected.

The first part of the study illustrated the significant factors that lead to CSR expenditure in Indian ICT companies. To understand the role of ICT industries in SDG, the significant factors from the quantitative analysis such as firm size, financial performance and industry sensitivity had to be related to SDGs. Since SDG targets are measured with the country as the level of analysis, we cannot directly use it to measure the effectiveness of the CSR initiatives of businesses. Therefore, for a better understanding, a qualitative study is undertaken.

3.6 Qualitative Analysis

3.6.1 *Role of Technology*

Company A "leverage technology and investments to minimize waste and use of virgin material. They develop modular products and circular business models to reduce ownership costs and create partnerships and linkages to enable collection mechanisms and recovery. They enable low cost production and connectivity to remote areas to spur the growth of developing countries and to create partnerships to leverage public sector funds and drive alternative business models using technology. They develop sustainable products and services and leverage technology to trace resource use and enhance connectivity. The need to sustainably support rapid urbanization is creating new market opportunities using technology".

Company B’s “skill development centres are equipped with modern mode of technology and communications like desktop and internet connectivity to impart skills and education. The company has adapted IT services to the demand of the virtual world—Cloud, Geographic Information system (GIS), Virtual Desktop Infrastructure (VDI), secure infrastructure such as Office 365, and Data Leakage Prevention as a means to responsible consumption. Integrated Smart Energy Analytics Dashboard offers a real-time, intelligent analytics solution that focuses on energy efficiency at the demand side of energy business spectrum. Green Logistics Terminal is a web-based tool that helps the organisation set goals on emissions control and measure progress on the same”.

Company C “utilises a social business platform to enhance the way the team members work, learn, share and connect with each other and thereby reduce inequalities. It also believes awareness is possible with the rapid growth in the technology and utilizing this technology can bring in significant improvement towards achievement of zero hunger. Organization is foreseeing to install sensors to detect any wastage happening in terms of resource usage and increase consumption of solar energy. The company is focused in using several other technologies in optimizing the usage of energy by configuring central monitoring systems which will automatically switch off the computer systems if they are not shut down end of the day by the employees”.

Company D “has contributed to environment conservation through paperless communications, posting sustainability tips and articles on the employee intranet, expanding teleconference capabilities to reduce business travel, following a shred-all policy to improve confidentiality and increase recycling, turning off monitors overnight to reduce energy use and supporting telecommuting”.

The above details of companies identify that ICT can be a means to achieve SDG. Though these companies have not used ICT as a means to achieve all the SDGs, the most prominent SDGs that ICT companies focus on are SDG 7, affordable and clean energy; SDG12, responsible consumption and production and SDG10, reduced inequalities. However, the report was compiled by a team from the Earth Institute at Columbia University in collaboration with Ericsson, the International Telecommunication Union (ITU) and the GSMA which contributed insights in order to gain a thorough and rich understanding of the impacts of information and communications technology (ICT) on achieving various sustainable development goals (SDGs).

3.6.2 The Factors Influencing SDG

The qualitative reports did not mention the firm size being a factor for achievement of SDG. The industry sensitivity and financial performance of the company plays a role in the achievement of SDG. All the four companies have been sensitive to the societal issues and have contributed or are continuing to contribute to the cause of

sustainable development. The companies' financial performance plays a significant role in achievement of these societal initiatives as the financial requirement to achieve these SDGs is high (Schmidt-Traub and Shah 2015).

3.6.3 CSR as a Means to SDG

Social Development Goals

Company A helped our client to roll out a Women Dairy Development Programme in a village in India to provide livelihood for women, improve the economic scenario and secure its supply chain in a fragmented dairy market.

Company B established after-school coaching centres in urban slums and in government-aided schools to enhance the quality of learning and development in children aged between 11 and 17 years which include after-school coaching program, counselling, bridge school, mentoring, sports and arts. In the company's Gurukul project achieve the goal of universal primary education, employability training programs are inclusive and gender sensitised.

Company C works with governments and agencies to support and respect human rights within their sphere of influence. The company will not tolerate human rights abuses; not engage or be complicit in any activity that solicits or encourages human rights abuse; not use or tolerate the use of forced, bonded or indentured labour, slavery, or human trafficking in their business or supply chain. Company C provides indirect economic benefits in two areas: Campus Reach programme, which collaborates with the academia to advance IT education in India and Sri Lanka and Tech Reach programme, which develops software applications for social good at zero cost to stakeholders.

Company D volunteers worked with professional athletes and local celebrities to help neighbourhood food banks prepare and deliver hundreds of thousands of meals to hungry seniors, the company's "Do Good. Live Well" initiative and the AARP Foundation's "Drive to End Hunger".

Economic Development Goals

Company A has engaged with clients to join forces to tackle the issue of financial inclusion by taking a savings-led, rather than credit-led, approach to microfinance through their initiative "Banking on Change".

Company B promotes empowering women, setting up homes and hostels for women and orphans and setting up old age homes, day care centres and such other facilities for senior citizens and measures for reducing inequalities faced by socially and economically backward groups. Inclusive and integrated development is prioritised in all their programs. The income augmentation vertical of Samuday Rural

aims at increasing the household level incomes in the project area by introducing various layers of income-generating activities in a household.

Company C being a signatory to the United Nations Global Compact is providing employment opportunities to many unemployed youth and thereby contributing towards the goal of reducing the global poverty.

Environmental Development Goals

Company A has enabled one of their clients to develop the world's first and largest commercial-scale CCS project with capabilities to lower SO₂ emissions by almost 100% and CO₂ by 90%.

Company D substantially reduced waste generation through prevention, reduction, recycling and reuse. It also has adopted Green IT practices and has moved the transnational part of the healthcare company, to adopt sustainable practices and to integrate sustainability information into their reporting cycle.

These responses emphasise the role of CSR as a means to achieve SDG. However, the attainment of SDG need not be only through CSR activities. Companies can consider newer target segments and develop new business models catering to the social demand. This could lead to a competitive advantage among business organisations as the United Nations have specified the urgent need for addressing these 17 issues. Companies can also work together to achieve efficient solutions to sustainable development goals. Moreover, a company is also profited by involving in SDG as it increases their scope of doing business.

3.7 Discussion

With Target Corporation, a discount store retailer in the United States, highlights in their 2016 CSR report—the progress made with regard to the sustainability goals and the company's new commitments are built around products, team, communities and the planet. The expansive nature of the companies' business and value chain enables it to directly and indirectly impact each of the UN SDGs. It supports the contention that SDGs can be used as CSR methods. The idea can be leveraged by Indian ICT companies to help the nation attain the SDG targets by actively involving in them as a CSR mechanism. However the major contribution of this paper highlights on the means of how SDG can be considered as a business opportunity. A concept of shared value as illustrated in this paper indicates the lucrative business opportunity which tends to be missed by companies. Indian ICT companies can utilise this opportunity to the fullest as their core resource—ICT—can be rampantly utilised in accelerating and attaining the SDG targets of a nation. A slight deviation or parallel attention by Indian ICT companies on SDG as a lucrative business opportunity can support policymakers, government and the society at large. The expertise and capability provided by private organisations with infrastructure and legal

support provided by public authorities can drive a nation to attain SDG at a faster pace.

3.8 Conclusion

This paper studies the role of businesses in attainment of SDG through corporate social responsibility (CSR) with ICT moderating this relationship. A mixed methodology is used in the study. The findings of this paper indicate that both the business enterprises and society are equally benefitted when SDGs are incorporated with CSR or business initiatives. Businesses can view investing on SDG as “corporate social opportunity” than just corporate social responsibility, thereby becoming more competitive, resilient and “future-proof” in an increasingly volatile, uncertain and complex world. Their role does not get narrowed to just providing financial investment, physical infrastructure or technology but rather capitalise on new business models for significant impact on business, the community and the environment. As a solution to the two issues listed in the beginning of this paper, we have identified that realising the SDGs can be lucrative for business to invest in them. Since the SDGs have a solid auditing mechanism, the efficiency and effectiveness can be well measured.

The study confines to the data from the Indian ICT services sector with the qualitative study confined to four companies. However future scope of study can be to leverage the same model to other industries as well as to do a comparative analysis if the model satisfies if the companies are from Indian ICT manufacturing industries. This paper contributes to the literature in terms of relationship between business organisations and achievement of sustainable development goals through CSR initiatives. It also gives factors that influence the attainment of SDG; the role of ICT in accelerating SDG is also highlighted. From a practical perspective, this paper serves as guiding light for utilising SDG as a competitive edge rather than a social responsibility.

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Chapter 4

Digital Capitalism and Surveillance on Social Networking Sites: A Study of Digital Labour, Security and Privacy for Social Media Users



Rianka Roy and Nilanjana Gupta

Abstract This paper addresses the political economy of social media and the restructured concepts of privacy and security. It also looks at the surveillance mechanism of social media and tries to determine the impact of surveillance on users, digital companies, State governance and on social media governance. This paper uses the theoretical framework of Michel Foucault's panopticon and governmentality to identify how the digital culture of social media has been constantly attributing new meanings to social relations in the ever-changing context of privacy, security and surveillance. The role of the State is also important in this matter, because State laws, community practices and governance also modify the pattern of access of its citizens to the networks. This paper looks at the way social media configures the political and digital citizenship of their individual users. The digital labour discourses are also instrumental in assessing individual users' mode of participation in digital communication.

Keywords Social media · Privacy · Security · Surveillance · Digital labour · Digital capitalism

4.1 Introduction

This paper is about the surveillance mechanism and privacy policies of social media. It looks at the policies in the context of digital capitalism and digital labour and examines the socio-political implications of digital privacy and surveillance. It also compares State and social media governance on the basis of Foucauldian

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governmentality. Amidst all this, it examines the role of individual users of social media, as citizens of digital networks. Users' participation in the structured digital communication on social media is marked by both conformity and dissent. This paper takes note of various forms of this conformity and dissent both within and without the networks. It looks at several instances of political protests and gatherings that have been enabled by social media connectivity. The research also involves a short case study on Indian IT employees as they deal with social media policies in their organizations and face organizational surveillance.

The global presence of digital networks has facilitated communication among individuals and communities. The participatory culture of Web 2.0 had apparently facilitated the growth of democracy and reinforced the pillars of development even in developing and underdeveloped nations. However, social media came with a series of complications and debates. Although the digital networks constituted virtual societies in which individual users can create multiple accounts and use fictitious names, yet their real-life moorings are cannot be overlooked. The reciprocity of real and virtual societies is a discourse by itself. What emerges from this is that networking sites were never free from real political engagements. The digital divide debate is all about the impact of economic and political policies of real nation states on citizens' access to the networks. China's rejection of sites like Facebook and favour for its home-grown networks like REN REN give hints about its diplomatic preferences and political insularity. Occasional censorship of social media at the time of political uprisings is also common. This shows how the State looks upon citizens' unregulated access to social media as a threat to sovereign security. At this juncture, it is important to understand how real and virtual societies influence each other and look upon each other.

The State also has a complicity in the digital surveillance on users as discovered in programmes like Prism and Tempora. At times, it is not even complicity but the laws of the State like the Foreign Intelligence Surveillance Act (FISA) and the Patriotic Act in America, the Section 66 A in the Indian Constitution that legitimize the surveillance. Security policies of nation states that are crucial in combating regular and cyber terror threats essentially infringe on the privacy of citizens. It is now imperative to study the relation between State governance and social media governance. Social networking sites have their own privacy policies and security measures. At the same time, they depend on the laws of the State to take action against aberrant users who flout their regulations.

The growth and expansion of neoliberal economy based on the digital organizations in present times makes it essential to study the political economy of social media. Also, at the time when the Government of India has rolled out the Digital India campaign and Aadhaar became a standard biometric identification system in the largest democracy of India, as a citizen of this country and as a researcher, I feel obligated to investigate the pros and cons of a digitally connected society.

4.2 Literature Review

The theoretical premise of my research is founded on various works that discuss the political economy of digital networks. Many of these authors identify the present global economic system dominated by digital organizations as a new form of capitalism. Dan Schiller (1999) in *Digital Capitalism* writes rather prophetically about the emergence of a new form of capitalism, which is extensively dependent on digital networks. Schiller provides a pessimistic picture of exploitation, labour and alienation within digital networks. In contrast, Manuel Castells's theorization of the "network society" (2004) is a rather positive understanding of the networks. Castells calls the new economy based on information "informationalism", and he is optimistic about the possibilities of mass empowerment embedded in it. He even eulogizes the networks for enabling big social movements (2012).

However, Christian Fuchs and Sebastian Sevignani in their Marxist reading of digital media discuss the exploitation and alienation of digital labour (2013). Fuchs also provides a reading of Marx recontextualized in the digital era (2014a, b). Trebor Scholz (2013) analyses digital labour discourses along the same line. Chris Rojek (2009) analyses labour from the perspective of leisure. I have referred to Raymond Williams's seminal idea that the means of communication becomes the means of production, (1978) to understand the concept of digital labour on social media.

Lawrence Lessig (1999) identifies the strict pattern of governance on the digital networks that allow limited freedom to their users. The websites are structured by rigid technical codes, which Lessig interprets as strict norms of conduct for users. His aphorism, "Code is law, law is code" is explanatory. In this regard, I have used Michel Foucault's theory of "governmentality" to examine if the networks constitute digital governmentality (1977–1978).

Benedict Anderson's concept of "imagined communities" (2006) in the context of globalization is also relevant in understanding how online communities are formed on social media, bringing together individuals from across the world on the digital networks. Howard Rheingold (1993) finds that online interaction reinforces real social ties. In his extensive writings on WELL, a previous-generation social network, he recounts how the members interacted even in real life and helped each other. However, the social research carried out in Netville, Canada, by Keith Hampton and Barry Wellman (2003) indicates otherwise.

As a theoretical premise to understand the significance of public and private spaces, I have referred to Jürgen Habermas (1991). I have also referred to Warren and Brandeis (1890) for their classic definition of privacy as a right to be alone, with case studies and legal insights. Christian Fuchs (2014a, b) examines how social media have transformed privacy into a commodity. Helen Nissenbaum (2010), in her analysis of privacy, identifies it as a context-oriented phenomenon. [d]anah boyd (2011) discusses the role of the imaginary invisible audience present on digital networks which influences users to modify their online behaviour.

Michel Foucault's discourses on panopticon, as a surveillance model, have been important in understanding the power structures in the network society (1977). Additionally, the works on omniopticon by Emmanuel Pimenta (2008) and by L. Mitrou et al. (2014) are significant in conceptualizing the social media surveillance mechanism beyond the Foucauldian structure.

The workplace inquiry by the German libertarian Communist group Kolinko (2002) on call centre employees has also been insightful in understanding the surveillance mechanism within digitally connected organizations.

The documentary film by Laura Poitras, *Citizen Four* (2014), on Edward Snowden has provided important insights into the life of a whistleblower. I also have to depend extensively on newspaper reports and academic journals for this research, because a major part of my focus deals with policies that are constantly updated. Social media studies are relatively a new area of research. Hence, academic materials on the same are scarce. Other than this, I have also had to consult the rules and policies of social networking sites and the social media policies of various companies that are constantly updated. I have also had to look at cyber laws and privacy laws of various countries and case studies on various related litigations.

4.3 The Research Question

The following is the research question of this paper:

What is the status of individual users of social media in the digital governmentality of digital capitalism, and what happens to their privacy and security as a result of constant surveillance in which State and corporate machineries apparently have a stake?

4.4 Research Methodology and Constraints

This paper uses the theoretical framework of Foucauldian panopticon to study the pattern of digital surveillance and governmentality to analyse the pattern of social media governance in the context of digital capitalism. The largely analytical thesis involved both qualitative and quantitative methods to arrive at its findings.

The research involves visits to various IT companies and interviews of IT employees. The qualitative tools were structured interviews of these employees. I also conducted two questionnaire-based surveys as quantitative instruments—one survey is on IT employees' experience of workplace surveillance, and another is common social media users' perception of online privacy, security and surveillance.

I have also conducted a focus group discussion with IT employees who have been expelled from their organizations for violating their communication policies. The group of former IT employees, who claim to have been unfairly terminated, has formed the Forum for IT Employees (FITE). I have got in touch with their representatives, who have agreed to respond to my queries.

In this analytical research, I have not yet faced any scientific and technical challenge. However, my knowledge of programming could have enabled me to analyse the social media algorithms better to understand the scope of sentiment analysis.

I have faced the social constraint of employees' fear while interviewing them. Most of the IT employees were reluctant to respond to my queries, citing their non-disclosure agreement.

Constant and quick changes in the digital networks, in their policies and pattern of communication and collaboration, necessitate constant revision of this paper.

4.5 Analysis and Results

The following is the research analysis that seeks to answer the research question and assesses the status of individual users on digital networks. The analysis is topically divided.

4.5.1 *The Politics of Digital Labour and Digital Capitalism on Social Media*

In this paper, I am looking at the digital labour discourses according to which individual users of social media act as "prosumers" (producer and consumer). Their voluntary and unpaid labour, which is not even recognized as labour by the sites and often by themselves, is crucial in maintaining the profit-oriented information business of social media. These users upload information for the sake of online communication, and this keeps the networks running. The sites mostly offer their access free of cost to these users and make money by selling users' data to third party advertisers. The use of cookies and other digital tools gather users' data. In a way, this process also turns users into products that are sold to another set of consumers, i.e. advertisers, on the basis of the networking sites' popularity. The perpetuation of voluntary labour and exploitation of labour, especially in the Marxist concept of alienation has been investigated.

I have been theoretically analysing the mechanism of online surveillance and its implications. The usual surveillance discourses try to fit the pattern of online surveillance either in the Foucauldian panopticon model or the omniopticon model of participatory digital culture of Web 2.0. In my research, I have been trying to establish that the surveillance on social media goes beyond these two models by

combining both of them strategically. The synthesis of both panopticon and omnivoxicon ensures that users are monitored in the stringent way possible. This complex mechanism of surveillance is automatized and naturalized. The use of cookies is such a normal and legitimate practice on social media that few users actually question it or feel threatened by it. In this paper, I am analysing how this model of surveillance modifies the online behaviour of users and determines the pattern of digital labour. I have been arguing that only such a complex mechanism of surveillance can automatize the cycle of digital labour keeping most of the users oblivious of their exploitation and alienation.

I have been looking at the discourses of “playbour” (the conflation play and labour—identifying labour in the form of leisure) and how leisure and labour are increasingly becoming inseparable on social media. My research shows that earlier casual approach towards social communication as seen in the prolific use of fake and fancy names on MySpace and Friendster has been replaced by the serious use of social media with real identities being used and real issues being addressed. The semblance of leisure is no longer necessary to keep users oblivious of their status as prosumers because access to social media is a necessity for them now, irrespective of the exploitation and alienation of digital labour. My research looks at the role of surveillance in enabling this transformation.

One of the ways in which surveillance is incorporated in the networks is by encouraging users to monitor their peers for possible breach of privacy. The networks isolate users by individualizing the method of access, and thus the networks enforce disunity among them. I am reading this practice as an attempt of digital capitalists to prevent virtual congregation of users against their exploitation (much like the way industrial capitalists tried to prevent trade unionism) and to prevent the growth of alternative networks of communication rendering them redundant. Surveillance also enables network authorities to perpetuate their power over users. Users are turned into agents of surveillance as they monitor each other and report against each other for anomalous behaviour. The networks appear to be the custodian of users’ information—even passwords are saved in their databases. This sense of oneness with each and every user that the networks forge is maintained by the mechanism of surveillance. And the involvement of users in maintaining surveillance on behalf of network administrators is a part of their digital labour. Hence, they produce their condition of labour and exploitation as a commodity. Surveillance on social media becomes a commodity, like information, privacy and security.

4.5.2 *Privacy, Security and Surveillance on Social Media*

This paper looks at the way social media have been redefining privacy, security and surveillance. On social media, it is a prerequisite for users to expose themselves to public view. Although each social networking site allows users to manage their privacy with the help of a few digital tools, some parameters like the Facebook profile picture are mandatorily visible to the digital public. This seems to be a compromise

on users' privacy. While trying to define the dynamic concept of digital privacy, I have been looking at various discourses and debates of privacy in real society. It is culture specific, sometimes it is individual, and at times it can also be collective. This paper also traces the association of privacy with capitalism and how digital capitalism (in which information is a commodity, and network users have multiple roles like producer, consumer and product) has affected the established notion of privacy. It is also important to observe who has the ultimate control over information on the digital networks—users, network administrators or the State.

The control over privacy is important because privacy is an important tool of governance. It implies the control over disclosure and concealment of information. Since the realm of social media is all about the monetization of information, privacy is significant to understand who controls the digital universe.

The State provides certain behavioural guidelines to citizens regarding access to information, its use and dissemination. If citizens fail to follow those guidelines, they are subjected to disciplinary measures by the State. On social networking sites, users have to abide by the rules and methods of sharing information predetermined by the network administrators. Every user has to share some information mandatorily with the sites. And unlike as in the State, on the digital networks, the method of sharing information with peers is determined by the network authorities. Hence, on social media, there is perhaps limited requirement for discipline to address interpersonal behavioural anomalies among users. Users have less chance of violating these guidelines on social media, because the entire system of communication is designed and monopolized by network authorities.

The governmentality of network authorities is reinforced by the monopolistic control of the sites over their technical resources. On social media privacy, too, is part of this governmentality scheme. Within the structured landscape of communication, who should conceal or reveal what information and from whom is also a part of the network design. Although users are provided with various digital tools for privacy control, yet those tools cannot fetch users the power to have control over their information while dealing with the network authorities. Users can, to some extent, choose what information they can keep private from other users, but they cannot keep any of their information private from network authorities.

The sites state in their declarations that they gather information about various online activities of the users, using tools like cookies and pixel tags. Hence, the privacy of users seems to be compromised in some sense. However, why the sites project it as a necessary action to protect "security" is not clearly defined, but it is clear enough that this does not refer to security from potential threats from other users; rather, it means security for the products of the sites. At the same time, the sites also seem to discourage users from unrestricted sharing of information with other users. Privacy or control of information on social media is projected as a technically achieved advantage. It also, therefore, involves the issue of individual choice to maintain privacy on social media.

All in all, the privacy configurations that users are allowed to manipulate help the sites to create an illusion for users that, after all, they themselves are in control of their information on the networks. To some extent this dispels the fabricated paranoia

regarding the vulnerability of users' privacy in front of a huge body of unknown audience lurking in the digital universe. This notion moulds privacy into a fetishized commodity that the network authorities offer their users. Privacy policies in all networking sites iterate how users need to guard themselves against data misuse by other users, but users, individually, are prompted to share all their data with the networking sites.

The conspicuous suppression of users' exclusive control on their information, or rather the discrepancy between the configurations of users' privacy and the privacy of networks, makes way for surveillance. Surveillance gets projected as a method of maintaining a particular kind of users' privacy that the networks endorse, i.e. privacy from other users, because only this type of privacy can reinforce their hegemonic control over users' information. It seems as if the practice of surveillance fills in the void created by the lack of users' privacy from the networks. In other words, surveillance becomes a substitute for the control that users are not allowed to have on their own information. While promoting surveillance, the networks forge a sense of oneness with users, since they project users' privacy from other users as the only type of privacy, preempting or negating the need for users' privacy from the networks.

The negation of users' privacy from the networks and the concomitant emphasis on users' privacy from other users creates a binary between these two types of privacy. Since the latter depends on surveillance, on social media surveillance is in a binary relationship to privacy. Although users are asked to share information with others, yet they have to monitor others' activities, just as others can monitor theirs. And this surveillance perpetuates the data churning mechanism on the networks.

Surveillance is shown as a method to safeguard user information and to reinforce security. And this surveillance means both surveillance of individual users by the networks and surveillance on other users by an individual. However, this model of surveillance on social media hardly allows users to monitor how the sites, the self-professed custodians of their information, deal with the huge corpus of information; how they sell the information to advertisers; and how much profit the information fetches the networks.

The mechanism of control on social media makes the distinction between security and discipline quite stark. And also this makes way for a difference between State surveillance and surveillance on social media. There are apparent similarities between them. Both as citizens of the State and as users of social media, individuals seem to accept various regulations of their respective governmentality schema. In both spheres the justification of surveillance is hinged upon security; hence, citizens/users accept surveillance in spite of knowing that their various activities and communication are monitored. Such breaches of privacy, for the sake of surveillance, are perhaps acceptable to them as long as it reinforces their security. For what can be termed as the post-9/11 paranoia all over the world, security perhaps seems to be preferred over privacy. And for this security, citizens apparently are less antagonistic to being monitored than before, even though the State hardly provides any transparency on its surveillance mechanism to them.

4.5.3 *The Digital Fourth Estate: Counter-Surveillance and Resistance to State and Corporate Hegemonies*

In this paper, I am looking at various instances of resistance to the hegemony of digital capitalists on social media. Often this resistance targets both social media administrators and State authorities together. Especially after Edward Snowden's disclosures in 2013, the extent of State surveillance on citizens and the complicity of network companies in it has ascertained the association between State and corporate surveillance.

Ordinary users of the internet are not able to comprehend the extent of exploitation, deprivation and surveillance they face. Lack of digital literacy among citizens makes it easy for network corporations and the State to assert their hegemonies. But there are individuals and organizations who/which are capable of subverting the power structures with their highly specialized technical knowledge and skills. This paper reviews some of these organizations and individuals and their method of subversion. This type of counter-surveillance practice is indicative of the emergence of a new form of fourth estate in the digital world.

The participatory culture of Web 2.0 had been hailed for its democratic potential. But gradually it was perceived that this participation hardly allowed much freedom of choice to individual users of the internet. Rather, the participation had a predetermined form. Users could not break the mould of online communication on social media. Users are not given a chance to alter the website structures. Corporations running the networks, with or without State intervention, determine the structure of networks and pattern of participation. In my research, I have been looking at this as a form of digital governmentality. The monopolistic control over digital resources and specialized digital knowledge allow network corporations to sustain this hegemony. However, the resistance to this power structure has been quite frequent and has been crucial in raising awareness of the vulnerable status of the digital public.

The three specific forms of dissent or resistance that I have been exploring in this paper are dissent of whistleblowers (Bradley Manning, Edward Snowden), dissent of individual and group of hackers (Anonymous and LulzSec) and dissent of digitally connected organizations which provide a platform to individual whistleblowers (WikiLeaks and Privacy International). For each type of dissent, I have chosen two most universally significant examples from recent times. My paper analyses the impact of this resistance on the digital public, on network companies and on the policies of State governance.

Whistleblowers like Bradley Manning and Edward Snowden challenged the governance of the State. Manning leaked sensitive information about US military actions in Iraq with the help of WikiLeaks. Edward Snowden disclosed information about clandestine surveillance operations, conducted by the US Government (PRISM) and the UK Government (TEMPORA), on citizens' telephonic and online communication. Snowden entrusted documentary filmmaker Laura Poitras and Glenn Greenwald from *The Guardian* to make his narrative public. Both whistleblowers faced litigation. However, their contribution to the study of State and

corporate surveillance is significant. In this regard, this paper looks at the relation between State and corporate surveillance and the role of digital networks in it.

As networks providing a platform to individual whistleblowers, WikiLeaks and Privacy International have contributed to the exposure of State and corporate mal-practices. These disclosures are not necessarily about digital networks and digital surveillance, but they provide meaningful insight into the possible relationship between and structure of State and corporate governance in the digital society. In this paper, I am also trying to see how these organizations are engaging the common citizens in a new kind of journalism, truly exemplify the participatory culture, which should ideally have been a part of Web 2.0. Their websites with disclosed resources build a new knowledge-based hegemony that destabilizes the State and corporate monopolies over governance.

In my analytical reading of hackers, I also have been looking upon their disruptive activities as a subversion of State and corporate governance. Hackers have highly specialized knowledge of digital networks, and they use their skills to undo the monopolistic control of the State and corporations over digital resources. Hackers may or may not express any concern about the privacy and security of individual citizens. In fact, their actions often put individual privacy and security at stake. However, the core ideology of anonymous denounces State and corporate hegemonies, but not at the cost of citizens' security. Many of these groups are often loosely organized, with partially committed members. Often they are built around cult personalities like Sabu and Weevil.

An important outcome of this kind of digital subversion is the restructuring of the media. All these examples of dissent in the digital age show the involvement of individual citizens, with or without the help of established media houses. In this connection, it is also important to analyse that while social media have facilitated several important movements like Occupy Wall Street and Arab Spring, which even led to the fall of a regime, the sites themselves are fraught with the ideology of control and homogenization.

4.5.4 Individual Identity and Online Communities on Social Media

Individual users of social media fulfil multiple roles assigned to them. They are the products, consumers and producers of digital capitalism. As subjects of digital governmentality, these social media users are homogenized. However, they also act as important voices that bring down the networks with the help of hacking skills. In this paper, I am evaluating the role of individual users of social media. I am placing them in the context of digital citizenship and real-life political citizenship.

Social media is also a place to form online communities. Based on common interests, users get together on social media and form networks within networks. Just as there are specific social networking sites for community-oriented activities,

in the same way, within a mainstream networking site, users may form these communities. I am studying the pattern the communication pattern within these communities and how these virtual communities relate to real communities.

The communities reflect individual and collective tendencies and interests of their members. Unlike real-life communities, communication in virtual communities technically does not depend on geographical proximity. There is a dualism in the formation of virtual communities in social media. On the one hand, the communities abide by the technical rules of networking sites and remain homogeneous; on the other hand, the communities may become breeding ground for dissent. Forums on 4chan and Reddit have often accommodated hackers. And the discussion on irrelevant topics within the topical confines of a virtual community is indicative of the dissolution of homogeneity that digital capitalists seek to achieve for better control of individual users.

Virtual communities encourage censorship and surveillance. Fanatic members of various communities often are intolerant towards opposing voices. It is easy to join these communities, but nonconformity to their opinion may result in expulsion. Members of online communities monitor their peers and that helps in reinforcing the automatized surveillance mechanism of social media. This is also important in studying the relationship between individuals and communities in the virtual territory.

This paper includes comments on the relationship between real and virtual identities of individuals and communities. Often network companies exploit the link between reality and virtuality, by strategically claiming that either the relationship is tenuous or it is firm. This paper looks at specific examples when networking sites emphasize that their network is more real and therefore more secure than others. There are also examples of the networks distancing themselves from reality and hence free from the concerns of real society. By this strategic toggle between the real and the virtual, the network companies try to engage their users in digital labour. Reality and virtuality no longer remain two specific types of condition, but both are fabrications and commodities that are offered to prosumers.

4.5.5 The Challenges of Corporate Social Media Policy: Workplace Enquiry at Indian IT Companies

In this paper, I have been examining the relationship between real and virtual surveillance in a controlled and digitally connected environment. I have chosen the Indian information technology (IT) industry, because of its extensive use of and dependence on the digital networks. I am specifically focusing on the surveillance carried out inside and outside the workplace on employees on the basis of their use of social media. This paper is largely dependent on the quantitative data gathered from questionnaires that I had circulated among employees of Amdocs, TCS, Cognizant, Covidien and Ericsson. So far I have completed my fieldwork in Pune,

Hyderabad and Kolkata. I am yet to carry out the fieldwork in Bangalore, the IT hub of India.

Many companies allow users to access social media even at workplace. I am examining the politics behind this apparent leniency. Many of these companies also have their own online social network. Employees are encouraged to use them, but in ways that would enhance their productivity and bring profit to the companies.

These organizations have their specific guidelines and social media policies for employees' use of general and organizational social media. Employees are trained on their ideal online behaviour. They often get mails from the HR personnel on online communication policies. I have been trying to understand this process of using the social media for the best interest of the organization from the perspectives of ordinary employees as well as of network administrators in these companies. Strangely, many employees are aware of the existence of such communication policies and the practice of organization surveillance online, but they are not able recall the exact rules. Mostly, it is the fear of surveillance that makes these employees control their behaviour online.

I am also comparing employees' behaviour on common social networks and organizational social networks. In my survey, I have found that IT employees earlier considered the organizational social network a restrictive place, but common social networks a haven for freedom, where they could rant about their work and criticize their bosses. But following a number of exemplary terminations owing to unregulated behaviour on social media, IT employees are now quite cautious. Hence, in spite of the so-called liberal atmosphere at workplace, and even amidst the freedom of access to various social networking sites and download facilities, these employees practice self-restraint. Thus surveillance is automatized at workplace. The invisible audience on social media and the possibility of being watched by anyone drive the fear and consequent self-censorship.

Besides, online surveillance is also complemented by real surveillance. At workplace, even if employees are entitled to use networking facilities and even if they complete their assignments, their access to social media is not favoured by their supervisors and colleagues. Office politics complicates the matter. This also propels individuals to enforce self-regulation in access to social media. Incidentally, the use of social media for purpose other than business is also discouraged. This is not just infringement of privacy but also of liberty of employees to use social media for personal communication. This workplace enquiry of online surveillance seems to represent a microcosm of the power structures in virtual and real network societies.

While conducting the survey, I encountered employees' reluctance to respond, in fear of organizational surveillance. Although my questions were adequately camouflaged, they were sceptical. However, they accepted the fear as normal. The naturalized status of this fear of surveillance is proof that online surveillance is successfully automatized.

4.6 Conclusion

The tripartite role of users in the discourse of digital labour as producer, consumer and product ensures that users are engaged all the time in online social networking. Their digital labour turns privacy, security and surveillance into commodities of digital capitalism, just like information commodity.

The predominance of surveillance is counteractive to the notion of social media users' privacy. Hence, privacy quite justifiably has minimal scope in social media, which is dominated by surveillance. Almost all networking sites have meticulously drafted privacy policies, but their rhetoric harks back to the overarching priority of surveillance in the sites.

Privacy for users of social media no longer means keeping data private to oneself; rather, it means sharing personal data with the sites. Digital privacy is being redefined in adherence to the terms of surveillance. On social media, privacy no longer means concealing oneself from the public; it means opening up to a digital public while monitoring the potential violators of rules that are inscribed by none but the digital bodies running the sites. In fact, people's desire for privacy is magnified by projecting the prevalence of surveillance. This encourages users to use the privacy control tools that are owned, controlled and provided by the sites, and this makes way for further integration of the users in the digital governmentality.

The sites seem to have a double standard regarding users' privacy. Rather, privacy is being defined in two different ways for users and for the networks. For users, it means complete submission to the technical standards set by the networks, while the networks have no obligation to share their technical detail with users. Even though privacy policies in all networking sites iterate how users need to guard themselves against possible data misuse by other users, yet users, individually, are prompted to share all their data with social networking sites.

The relationship between the State and the digital capitalists seems to be symbiotic in nature. The organizations depend on the State for discipline in governance, and the State depends on digital surveillance of these sites for governance. The State often gathers information from the sites as well as from network authorities.

The State appears to be a formidable institution that maintains the governance through various disciplinary actions., according to Foucault (2009). Security is an essential part of State governance, but compared to the minimal disciplinary actions of social media, the rigors of discipline in State governance are stronger. Social networking sites have their own scheme of control, independent of State interventions. The sites rely on the disciplinary power of the State from time to time, but otherwise distance themselves from the discipline and seem to prioritize security.

Surveillance and the concomitant decline of the traditional notion of privacy are pervasive in the network society. Even in a digitally connected real environment, e.g. a workplace, surveillance is an accepted norm. In such an environment, virtual and real surveillance complement each other. The model of surveillance followed in that environment is similar to that of online surveillance—isolation of users, compulsory monitoring of peers and palpable fear of privacy violation by peers.

4.7 Future Research Directions

In the future, this research may be expanded for further investigation into the relationship between State and corporate surveillance. The digital networks are constantly evolving, with new paradigms replacing old norms every day. Changes in the pattern of communication on social media, merge of companies, new laws are common phenomena in this area of research. Maybe in the future, the dynamics of State and corporate surveillance will change, requiring a renewed analysis of the same. This paper can also look into the development and sustainability of the biometric identification system, Aadhaar, in India. Although it is challenging to keep pace with the ever-evolving pattern of digital networks, researchers may even examine the trajectory and conditions of such changes.

This paper on workplace enquiry in the digitally connected Indian IT industry can be expanded to an insight into other industries like education, hospitality, management and sports. Comparative studies can be conducted on the use and impact of digital networks across these industries. The research can also be important in understanding the dynamics of recent developments in the field of digital networking like cryptocurrency, sentiment analysis, opinion mining and so on.

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Chapter 5

Significance of Social Networking Media for Influencing the Investor Behaviour in Stock Market



Muskan Kaur, Taruna Kalra, Sakshi Malik, and Anuj Kapoor

Abstract

The new source of power is not money in the hands of few but information in the hands of many.

— John Naisbitt

Digital technology and businesses are becoming inextricably interwoven. Digital literacy is the ability to use the innovative technology to navigate, evaluate and create information. This paper aims to highlight the prominence and significance of social networking media like Twitter, Google Trends, Yahoo Finance, etc., for enhancing the investor knowledge and influencing the investor behaviour in Indian financial market, i.e. the National Stock Exchange (NSE) and the Bombay Stock Exchange (BSE). Previous literature and many research works were analysed which depicted the adoption of these innovative methodologies for market prediction and making future investments by developed nations like the United States, China, etc. The analysis of such past time studies glorified the existence of correlation amongst the posts on Twitter, StockTwits, Google Trends, etc., with price prediction of stocks listed on the Dow Jones, NASDAQ and S&P 500 in US financial market by influencing the sentiments of the investors proposing scope for Indian investors. Thus, in this research work, we elaborated the importance of adoption for these innovative social networking media by current and prospective Indian investors for understanding stock volatility and increased price prediction capabilities.

Keywords Social media · Stock market · Digitalization · Twitter · Facebook

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Information is a source of influence and power!

5.1 Introduction

The manner in which actions in the financial markets are contagious, emotions in social media are contagious too. Therefore, it is agreeable that tweets and posts about stocks are a natural harbinger to real financial market actions. With this learning the following research paper explores the life of Indian stock market in the current world of uprising social media. The Indian financial market has spotted spectacular modifications in the modern decades, and the market has also encountered big reforms in the previous years. The upcoming worldwide trends in financial markets have contributed their influence on the Indian stock market volatility as well. The linkage of Indian stock market with social networking media is an upcoming area of interest amongst investors and policy-makers throughout the global and national context. Digital technologies such as mobile, social media, smartphones, predictive analytics and cloud, amongst others, are the fundamental sources that touch the users directly these days, and such interactions are creating a source of digital difference which adds to the value and revenue of the business world. We call that source a “digital edge”.

Digital technology and businesses are becoming inextricably interlacing. Digital literacy is the ability of using this digital innovative technology to navigate, appraise and create information. With these innovations emerging in the society, our study investigates the extent to which sentiments revealed by traditional media and social networking media differ in affecting the Indian financial market like it does in many developed financial markets.

In traditional times the boisterous traders at the Indian stock exchange used to yell out demands to each other, creating a raucous din. The stock trading used to happen on the strength of news and story in the market; traders used to gather in the trading area of stocks and started shouting numbers and matches that blared like brawls. In the present day, high-tech trading continues without any shouting and even offers the investors with effective and efficient ways to research and buy stocks. This all has been realistic with the advent and acceptance of technology in Indian financial market.

The commencement of Web 2.0 era of cyberspace, social media has metamorphosed the pattern by which nation communicate. The utilization of web-based machineries has contributed a powerful effect on the ISM (Indian stock market) also. Application of the web-based technologies has wiped out the impediments of dealers and topographical locations as with advent of Internet facilities; the investors can purchase or/and sell-off their stakes by learning the updates of stock market from anyplace at any point of time. Now, investors have unprecedented access to information about companies and their stocks. The Internet facilitates current situation of financial market, current stock prices, company's reports, upcoming or breaking news about stocks and the companies announcing those particular shares.

Financial advisers can reckon prevailing and recent developments to their investors, and the companies can record the achievements of their stock in real time. The benefit of such quick information is better-informed investors, clients and advisers. Accurate, trustworthy and prompt news and details are vivacious for an effective decision-making in financial markets (Piñeiro-Chousa et al. 2017).

Nowadays, different upcoming ways of spreading knowledge and communicating with masses have aroused due to the spread of digital technologies and increased application of the Internet. The web users share any news or thoughts through social media, which encompasses many different social networks like Twitter tweets, Facebook posts, Internet-based blogs or other websites such as Yahoo! Finance message boards, news sites like The Wall Street Journal and many others. Based on this pattern, various investors, companies, institutions and, at a more basic level, communities as a whole approach social media to gather and spread any news or information. In today's time, social media is an element of regular routine that demands the consideration of how social media influences society with the power to revolutionize consumers' or investors' behaviour, concluding in consequences that will surely spread markets at various levels. Many aspects of the social networks and their users can be valuable in envisioning the financial market performance.

The analysis of few past time studies glorified the existence of correlation amongst the posts on Twitter, Facebook, StockTwits, Google Trends, etc., with price prediction of stocks listed on the Dow Jones, NASDAQ and S&P 500 in US financial market by influencing the sentiments of the investors. This path attracted us and led us to honour the gap for such kind of study for Indian investors too. With the rapid advancement of a developing country like ours, we need to learn and absorb many diverse technologies and habits from the developed ones. The initiation of "Digital India" concept brings in numerous opportunities for us to think digital and go digital!

Thus, our target for the research began with understanding the prosperity, uses and advantages of social networking media being used by investors, speculators, traders and businessmen in many developed nations and understanding its relevance for Indian stock market. This focus of research channelled us to compare the traditional media being used by Indian investors in and the upcoming social media with the advent of digitalization in our nation. Many research works were carried in similar studies in various nations but not much of work was cited for the Indian economy. This initiated us to find whether 280 characters really make much noise.

The study proceeded with an aim to highlight the prominence and significance of social networking media like Twitter, Facebook, Google Trends, Yahoo Finance, etc., for enhancing the investor knowledge and influencing the investor behaviour in two prominent market indices that operate within the Indian stock market, i.e. the National Stock Exchange (NSE) and the Bombay Stock Exchange (BSE). There is a high level of risk associated for all the investors due to the complexity of the Indian stock market. Specifically, the BSE comprises of 30 companies for Sensex, and NSE includes 50 companies for Nifty. Thus, this tends to be the requirement to predict the stock market position for investors by adopting the two significant indicators, i.e. Sensex and Nifty (Guo et al. 2017) and.

This paper is organized as follows. In Sect. 5.2, the literature review and theoretical background are discussed. In Sect. 5.3, the objectives of the study are comprehended. In Sects. 5.4 and 5.5, research methodology and the data analysis and findings of this paper are presented. Section 5.6 presents the conclusion, and Sect. 5.7 briefly describes the limitations of the study.

5.2 Literature Review

Structuring our research on previous studies and works published, we aimed to conduct a similar study for our economy highlighting the significance, limitations and future scope of social networking media in Indian financial markets and businesses.

The basic premise of many studies published targeted to look for a relationship between the tweet volume, hashtags, Facebook posts, StockTwits posts, etc., on the share price performance or dependence of investors on such media for analysis of stock volatility. From the analysis of previous work established for many developed nations like the United States, China, etc., the conclusion led to the facts that there existed some predictive value on tweet and many other social media activity on the share price performance. The conclusions derived from such studies glorified that there endured predictive value on tweets and posts and the share price performance. Dominantly, all such researches stated that firms with high level of fluctuating financial performances significantly had a higher correlation of tweets and posts.

5.2.1 *Correlation Between Social Media Sentiments and Stock Returns*

Few such domains and studies that lead us to frame the current research paper targeting Indian stock market volatility are discussed further. In 2017, Ho C.S. et al. published a work announced as the time-varying nature of social networking media sentiments in modelling stock returns wherein a comprehensive empirical study built a conjunction amongst social media sentiments and time-varying stock returns with the symbiosis of Bayesian dynamic linear models and seemingly unrelated regressions methodology. By deploying dataset from the Dow Jones Industrial Average stock data and Yahoo! Finance stock message boards, authors concluded existence of significant correlation between stocks between -0.8 and 0.6 . Zhang Y. et al. in a research paper titled *The Interaction of Financial News Between Mass Media and New Media: Evidence from News on Chinese Stock Market* (2017) studied contemporaneous and lead-lag relationships amongst the mass media news and the new media news of the financial news on the constitute stocks of the CSI 300. The empirical findings displayed existence of strong correlation between the two

types of news. Similarly, Li B. et al. in 2017 constructed an article: *Discovering Public sentiment in Social Media for Predicting Stock Movement of Publicly Listed Companies* wherein methodology developed named SMeDA-SA terminated with a result displaying correlation between public emotions shown through Twitter and the Dow Jones Industrial Average. Lin et al. (2016) came up with a research work titled *Network Interdependency Between Social Media and Stock Trading Activities: Evidence from China* where they contributed that the advent of social media hastens the research on information diffusion and its corresponding influence on trading tendency.

5.2.2 *Influence of Sentiments and Text Mining on the Volatility Pattern of Stock Market*

An article published under the title *The Impact Technical and Non-technical Investors Have on the Stock Market: Evidence from the Sentiment Extracted from Social Networks*, by López-Cabarcos et al. (2017), assessed the gaps between the activity shown by technical and non-technical investors by means of social media and its influence on measurement of market risk with the VIX index using a logit model. The work concluded influence of social networking activities on stock market movements and its dependence on the type of investor collected from Stocktwits.com.

In the research work constructed under the title “A Social Media-Based Approach to Predict Stock Co-Movement” published in the year 2015 by Liu L. et al., the authors proposed an innovative model for identifying homogeneous stock groups and predict stock co-movement with respect to firm-specific social metrics. The scrutiny of samples from the NYSE and NASDAQ stock exchanges by the authors led them to a conclusion stating that firms with official Twitter accounts had a much higher co-movements than those without such account. On the similar grounds, in 2011, Bollen J. et al. published a paper under the title *Twitter Mood Predicts the Stock Market* wherein they took up an agenda of exploring correlation between public mood and the Dow Jones stock market indices using mood-tracking tools such as OpinionFinder and Google profile of mood states. The text content of daily Twitter feeds was analysed concluding public mood state could be traced from the content of large-scale Twitter feeds by text processing techniques.

In the year 2016, Sun A. et al. in the research paper named *Trade the Tweet: Social Media Text Mining and Sparse Matrix Factorization for Stock Market Prediction* applied text mining on information sources which became a focal point for researchers in the present time. And a paper produced in 2011 by Loughran and McDonald aimed to identify specific words that contain information relevant to financial markets and link them with returns, trading volumes and other market metrics. Lastly, in a research paper titled *Predicting Stock Market Indicators through Twitter* “I hope it is not as bad as I fear” in the year 2011 by Zhang X. et al., it was

concluded that when people express a lot of hope, fear and worry, it affects the Dow Jones volatility index in a similar way. The researcher stated that when the emotions on twitter fly high, the Dow goes down the next day and when people have less hope, fear and worry, the Dow goes up.

On the whole, the authors explored stronger correlation of Twitter actions and the stock price performance for all the companies with lower levels of debt, stocks with higher betas or a low float. Usually, the research works stated that the companies with the financial performances fluctuating significantly, displayed a high correlation of Twitter mentions and trading volume, which came up to designate the opportunity to trade on volatility and either invest in a stock or go short to profit from a fall in the stock price.

With the analysis of many research papers and articles like these, we could come up with a framework for a study on Indian stock market and its deal with Social media in recent times. From the scrutiny of past literature, we concluded the deep and clear correlation of posts and tweets about stock market on social media on financial markets of many developed nations, which motivated us to explore Indian scenario.

5.2.3 Theoretical Background

The term stock analysis attributes to the assessment of a specific trading stock, any investment opportunity or the stock market on the whole. Stock analysts pursuit to resolve the future action of any stock, sector or market (Nguyen et al. 2015).

Our research study is attempted in reference with previous literature and many other works that were initiated in developed nations like the United States, China, etc., which analysed and depicted the adoption of innovative methodologies for market prediction and making future investments. For instance, in a paper presented by Bollen et al. (2011) in the United States, correlation was found between public mood and stock market indices using mood-tracking tools such as OpinionFinder and Google profile of mood states by analysing the text content of daily Twitter feeds. Similarly, from a study conducted in China by Lin et al. (2016), it was concluded that the advent of social media hastens the research on information diffusion and its corresponding influence on trading tendency. But the question still haunts the minds of the past and prospective investors that “Can Tweets and Facebook posts predict stock behaviour?” In support of such queries, there have been many past incidences which show how Twitter and Facebook have proven to be faster and efficient in news dissemination vis-à-vis the other channels. For instance, news leak from a Canadian newspaper about Blackberry’s \$4.7 billion buyout collapse by Investment clients at Dataminr (a New York City-based data analytics firm) went viral in such a way that within few seconds, the hedge fund clients used this news to short the stock ahead whereas the rest of the investment community got the news on Blackberry after many actions had already occurred and even before Wall Street could figure out how and what happened. In similar fashion, Social Market Analytics

used its coverage of 400,000 Twitter accounts to disseminate information to its clients about the positive chatter percolating on Apple even before the tweet of Carl Icahn stating about his purchase of big chunk of Apple stock. These few examples of early bird alerts showcased the reach and power of social media to bring about faster impacting news affecting behaviour of investors, stock prices and market volatility, highlighting the fact that social networking media is not just a theory but a reality.

On the contrary, some analysts and researchers highlight the Twitter stock recommendations to be problematic for investors. They hold the fact that the brevity of the medium restricts its use to only disseminating a tip and no further grounded suggestion. They add that the people who tweet on stocks do not give a detailed rationale supporting their recommendations which can be misleading. In the similar way, StockTwits also renders an entry level Twitter investment news tracking system, but that is also favoured by astute investors and amateurs alike, so the analysts suggest “Buyer needs to Beware!”

Traditional Media

Traditionally, the stock analysts had to be dependent on two basic deterministic categories which were available for evaluation of stocks and the market are as follows:

- Fundamental analysis
- Technical analysis

The fundamental analysis advanced with a goal to determine whether if a company's future value was being accurately reflected in its current stock price or not. For the projection of a company's value and/or capacity for expansion in the future based on its stocks and instruments, fundamental analysis suits the best. It assesses all the financial reports for determining the stock value. When a fundamental review and scanning used to complete, the analysts then decided the stock to be an attractive opportunity or not based on its future prospects. The analyst also ascertained the stock to be a “hold” or a “sell” as per the value being fully reflected in the price (Drakopoulou 2015).

The technical analysis gauged trading movements and trends for resolving what should be the next for a company's stock price. Majorly, technical analysts pay less attention to the fundamentals underlying the stock price. In technical analysis, the prediction of future financial price development was grounded on the scrutiny of previous price fluctuations. It was applicable to all the kinds of shares, stocks, indices, commodities, futures or any tradable instrument where the price was swayed by the momentum of supply and demand. Technical analysts trust on stock charts for their assessment of a company's stock price (Drakopoulou 2015).

The Relative Strength Index (RSI), stock trends, moving averages and Fibonacci retracement are few tools amongst many others extensively used for assessing

stocks. In the application of traditional evaluation methods, stocks are analysed in different time frames like:

- The long-term time frame is used to evaluate the value of the company together with the position of the overall market, called the fundamental analysis.
- The mid-term time frame monitors and detects trend changes. This is typically done using standard technical analysis tools such as the MACD, RSI, EMA and others.
- The objective of the short-term time frame analysis is to select good entry/exit timing. This majorly indulges the candlestick patterns and also the short-term technical assessments.

Time frame	Purpose	Traditional methods
Short term	Quick profits	Candle stick analysis
Medium term	Trend changes	Moving average, relative strength index, moving average convergence divergence
Long term	Evaluation of value	Fundamental analysis: Cash flow, price earning, price/earnings to growth

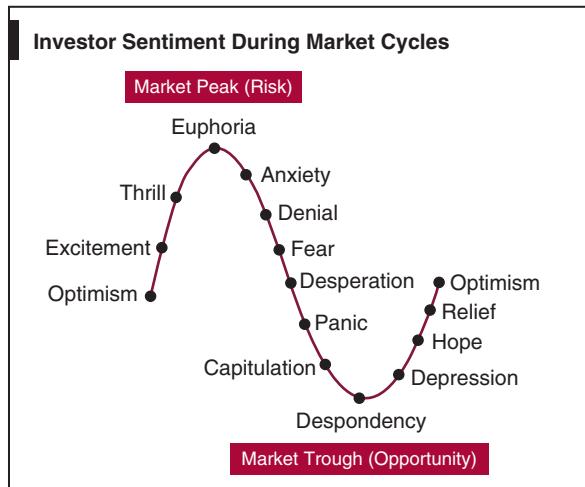
Current Scenario

In the current time, the advancement of science and technology gifts us all a platform of a wide range of tools and facilities in all arenas to begin, develop and grow. The compilation of finance with IT sectors is bringing up wonders in the economy. With onset of newer methods of analysis, sentiment analysis has come up after fundamental and technical analysis for the assessment of impact of sentiments displayed in various forms at different platforms on stock markets. In various literatures and articles available, employing social networking media for the prediction of stock market, while in its infancy, has already confirmed high levels of accuracy as compared with many different methods of anticipations.

5.2.4 *Sentiment Analysis*

After the emanation of social media application for stock market analysis, sentiment analysis jumped into the current scenario. It is designed to extricate various opinions, thoughts and remarks of users by categorizing them into positive, negative and natural sentiments. Besides various definitions of sentiment analysis in the literature, the sentiment analysis can be described as method put up to excerpt intelligent information established on the user's sentiment/opinion about any object or issue from basic data accessible on the Internet (Bhardwaj et al. 2015 and Devika et al. 2016).

The traditional theoretical model of behavioural finance cannot completely elaborate the investor sentiment effect on stock market in social networking surrounding. However, many of the past studies depicted that the investor sentiments which were presented by traditional exchange indicators, investigation data and Internet data may take an important role in stock market investment. In the present study, we aim to analyse the significance of Stocktwits.com, Twitter and Facebook posts on Indian stock market volatility.



*Published by Scott Blair on Oct 09, 2015

Twitter

Twitter is a free of cost, simple online available social network microblogging assistance which permits all authorized individuals or members to announce short posts called “tweets”. Twitter, is a website and also provides a mobile application wherein any member can post a 140 character thought (called tweet) representing one of the newer social networking media resources in the market. Within a small span of time frame, the individuals have started using it to develop stock and market trading strategies as well.

Twitter application is an assemblage of social media activities, with 645 million active users and 135,000 brand new users every day across the globe (Mittal and Goel 2012). According to Heckyl Technologies (a social media data analytics firm), there has been a 72–125% rise in the “mentions” about Nifty, Sensex, etc., over the past 1 year in these social networking sites. According to a study from Markit, a financial data services provider, from December 2011 to November 2013, positive social media sentiment stocks have shown cumulative returns of 76% compared to -14% from negative sentiment stocks. Johan Bollen, a business professor at Indiana University, reported that Twitter data could predict the Dow Jones industrial average

with 87.6% accuracy. Considering these facts that Twitter and Facebook are powerful tools in modern days and are being used by both punters and people who want to disseminate useful information, analysis of their tweets and posts has become crucial. The Facebook offers some data mining opportunities, whereas the Twitter hosts as the real hotspot for social indicator analytics. The number of stock market players logging into Twitter accounts, Facebook accounts and other networking sites is escalating for sharing information and extracting cues for their next big bet.

A 2012 study by researchers at UC Riverside and Yahoo! Research Barcelona concluded that analysing tweets about the rates of member companies could enhance stock trading strategies. The study with a title *Correlating Financial Time Series with Micro-Blogging Activity* published in 2012 by E.J. Ruiz appraised twitter the outstanding microblogging authority and developed sets of filter to estimate tweets about companies and whether this facilitated the betterment in trading returns.

Facebook

Facebook application is a social networking media that concedes its users to build an online profile and create an interconnected web of known contacts who can access and post on each other's Facebook profiles. Nowadays it relished the status of being privileged as the biggest online portal for social networking; it enjoys more than one billion active users all over the world. Its statuses and posts permit information to be collected about the subjective well-being of a larger sample of individuals over a relatively longer time period. Furthermore, the status updates are majorly not focused to any specific target audience, unlike wall posts on Facebook or Twitter messages, neither of which necessarily have any informational content about the subjective well-being of individuals. With the given base on the background of many text-based online social networks, Facebook's post updates emerge as the most relevant type of text to adopt in building up a sentiment calculator.

StockTwits

StockTwits is a social networking media arena designated for spreading and sharing opinions and ideas between investors, traders and entrepreneurs. It is a social media network very similar to Twitter, wherein all the users share posts about stocks, indexes and financial markets. The relationships amongst users take place through subscriptions to accounts as followers.

One characteristic of StockTwits is that users share their opinions with their followers and with other users in real time; the sharing of information is quick, allowing faster reactions to stock market events. Another characteristic of StockTwits is the use of keywords that allow the classification of conversations by tickers (e.g. a tweet with a \$SPX will be related to news about the S&P 500). Additionally, users' profile shows relevant information such as their experience as investors, their holding period or the type of analysis they use to decide their

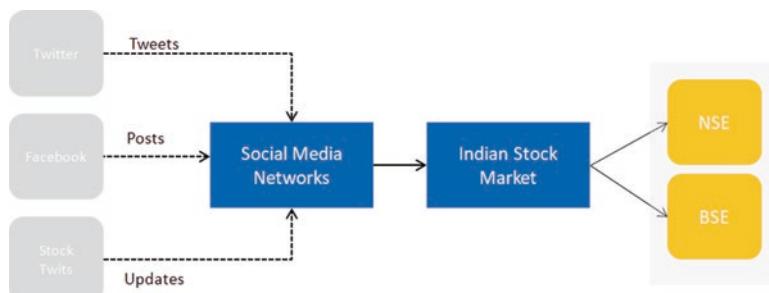
investments. Considering all these features and given that all messages users post are about financial issues, StockTwits is one of the most suitable social networks for analysing influence of social media activity over the stock market. Oh and Sheng in the year 2011 mentioned in their study that it is the most used sources which provides accurate data in order to predict market performance.

5.3 Objectives of the Study

The study initiated with an aim to highlight the prominence and significance of social networking media like Twitter, Facebook and StockTwits for enhancing the investor knowledge and influencing the investor behaviour in Indian financial market, i.e. the National Stock Exchange and the Bombay Stock Exchange. Following all the scientific literature available and systematically reviewing various empirical studies, we targeted to propose a conceptual framework based on such past studies supporting the social networking media influence on investors and businessmen decisions in Indian financial market like it does in many developed economies like the United States, China, etc (Renault 2017 and Rao and Srivastava 2012).

5.4 Research Methodology

In many research works that are produced for developed economies, assessing, scrutinizing and understanding the blogs, posts and tweets on social networking media are conducted using social media analytics. These methods of analysis are making big waves in stock markets globally, as many studies pour in proving such social sentiment indicators really does give investors the advantage over all the investors who have still not adopted the newer technology. Until 2012, no technology existed to splice, dice and slice Twitter feeds and Facebook posts to discern fresh trading data. Once social sentiment indicator analysts began understanding method to quantify all that streaming available social media data and offered the results to professional investors, they began with earning higher profits.



There are two kinds of theories for the analysis, namely, the Informational theory and the Sentimental theory. One kind deals with the conceptual framework, and the other tends to deal with empirical framework. In an Informational theory, the information is published on Twitter is recent, meaning that it has not yet been absorbed by the stock prices. This information can therefore be expected to impact the value one could rationally expect for the future cash flows of an asset. On the other hand, in a Sentimental theory, the price of an asset diverges from its fundamental value banking on waves of optimism or pessimism, and Twitter facilitates the appraisal of this particular investor sentiment.

In our study, we intended to produce a conceptual framework which could clearly define the importance and advantages of social networking media over earlier used traditional media in our economy. We targeted to analyse whether if these networking sites add value and profit to Indian investors if they also adopt such innovative and newest technologies over the traditional ones. For fulfilment of this agenda, we proffered primary data collection which was attained by the employment of interview method. We planned, initiated and conducted focused interviews with investors and businessmen of our subject group for sharing their inputs and experiences with us. The interview methods are of various kinds, namely, unstructured interviews, semi-structured interviews, structured interviews, etc. The first-hand information collection was planned to be carried out with the help of semi-structured interviews. Semi-structured interviews are interviews which operate with a protocol to guide the conversation between the interviewer and participant throughout the entire process of interaction. There are conversational aspects incorporated, and it is majorly a guided conversation with some structure. The beauty of this kind of interview lies in the fact that it allows the researcher with great deal of flexibility and the ability to probe the participant for additional details. The interviews were carried out in two different ways, telephonic chats and direct face-to-face conversation with the interviewees. Open-ended questions were put up to selected investors who have been investing in Indian stock market over a long time now. All the interviews conducted were assessed and scrutinized for analysis of the results and reaching to the conclusions.

5.5 Data Analysis and Findings

5.5.1 Data Analysis

The analysis of the data collected gave us a lead to an interesting horizon of findings and results. The interviews conducted amongst investors from diverse backgrounds displayed interesting outcomes. The dataset that was gathered was a primary data based on the interviews we conducted with investors from manifold palette of arenas. The semi-structured interviews were planned and executed with 20 subject matter experts working within Delhi and NCR regions, and the interviewees were of age group from 25 years of age up till 70 years. The experience of all these interviewees in stock market helped us gather information and fulfil our purpose. The experience

of our participants ranged from 2 years to 25 years. They all hold eminent positions in their fields and have been investing in Indian stock market from long now.

5.5.2 *Findings*

In the area of investments, there are majorly three different phases of investments, i.e. short term, medium term and long term. The short-term investments are below 1 year, medium term range between 1 year up till 3 years, and the long term are 3 years and above. The analysis of interviews held produced interesting results. The investors were diversified in the terms of their investment patterns. This diversification was in correlation with the age of the investor and the experience earned in investment arena. It was explored that the young investors or people with less experience preferred investing for shorter time period. On the other hand, as the age and experience of investor grew, the pattern of investment shifted from short term to medium and long term. The age, experience and time of investment were in direct and positive correlation with each other.

The responses that were enumerated with us also revealed the sectors that were of interest to the investors. All the participants came up with their preference of equity sectors, which also very interestingly led us to the path of various sectors for investments. Majorly, the equity investment categories or sectors that were revealed by people were the banking companies, gas and oil industry, telecom and IT sector, pharmaceuticals industry and the infrastructural sectors. Out of many responses, many fields and options were pointed out, but the aforesaid were the most invested and preferred ones.

After this came up the task of enquiring about the ways and methods involved for the scrutiny and analysis of stocks and sectors chosen. When enquired about the selection patterns for analysis of investment decisions, the participants' revealed one major platform used, assessed and relied on newspapers and news channels. Irrespective of the age or time of investment, this is the most widely used method of taking decisions. With further talks and questions and enquires, brokers' advice, NSE and BSE website, few online available websites like [Moneycontrol.com](#), [Stockmarketindia.com](#), etc., were mentioned by the respondents. Few others mentioned about trading consoles like IIFL and some fundamental measures of stock volatility analysis like ladders approach, candle stick approach, etc.

Further, in our collection and analysis procedure, we enquired about the knowledge, usage and reliance of social media networking sites for the analysis of any stock or sector or company by the set of investors. To our amazement and shock, majority of the respondents answered zero reliance and trust on such sites for investment guidance. As per the investors, Facebook, Twitter, StockTwits, etc., are more for the purpose of marketing and fun rather than being used as a platform for taking some serious decisions. Some of the analysts from the list of our respondents mentioned that mature investors will certainly not accept such sites for this purpose wherein speculators or "newborn" investors may look up for such options. The elder

generation was found having no single account on any of such media, so the question of relying on such arenas died. Wherein in the case of young investors, though they had accounts on many of such sites, their vote did not go for such media for such assessment.

As per the interviews taken and after the scrutiny of the data collected, the results led us to the path which stated meagre popularity of all such sites in India currently. The investors also mentioned that the Twitter and Facebook posts do not reflect true information, or the sentiments revealed are too instant to be relied on. They believed that the posts are more of rumours rather than information. The prices may or may not reflect such information but any day for understanding the volatility patterns, understanding fundamentals, company reports, market pattern and news were more trustworthy. The upcoming investors showed interest in such posts and hashtags but were sceptical about the same for the long-run decisions. Also, after the inquiry, investigation and scrutiny of past research work carried across boundaries, and interviews conducted with specific investors and businessmen of our subject group, we established that the usage of social media networks was not yet accepted, used or preferred by Indian investors.

The analysis of past works revealed strong association of social media sentiments with contemporaneous and subsequent stock returns in developed countries, but it is yet to get popular in Indian stock market. The studies from developed nations showed us that social media sentiments are strongly associated with contemporaneous and subsequent stock returns. This lead led to frame this research paper for Indian investors wherein it was concluded from the analysis of interviews taken that the young blood showed more keen interest in blogs, posts and tweets over the experienced players. The experienced investors and analysts revealed their interests and intentions of trusting and preferring the traditional technologies and methodologies over the newer ones, i.e. the social media networks.

5.6 Conclusion

While reading and framing, we encountered many articles and research works highlighting the partnerships and deals which facilitate association of Indian financial market with social media aiding in fulfilling the mission of Digital India. Thus, in this research work, we elaborated the current situation of Indian investors and also the significance of adoption for these innovative social networking media by current and prospective Indian investors for understanding stock volatility and increased price prediction capabilities.

The data mining of social networking sites and tracking select sectors or companies on such media for assessment of stock movements and volatility can add understanding, clarity and higher prediction power to the investors. To our interest, a partnership pact between Twitter and BSE stated that it is a move towards democratizing financial information by enabling millions of Indian investors to easily access stock market and stock-related information through a digital platform.

This justifies our research and may even promote the significance of social networking media in predicting Indian stock market prices and stock volatility.

The bottom line: Undoubtedly, social media investment analysis is an ascending, but being very much nascent, technology; so far it is a winning one for early birds and yet to spread to the mass.

5.7 Limitations

In the above comprehensively written research paper, we read many previous works and analysed different literature available and understood that this is a vast topic. Only one single paper is not justification to this topic. We have come up with a conceptual framework producing a qualitative study whereas on the similar topic, we can also conduct empirical research with the application of sentiment analysis. This brings us with a gap and motivation to come up with more papers on the similar grounds.

The sentiment analysis has its own limitations wherein the challenges like type of opinion (positive or negative), too short statements or frequent changing opinions also deviate or produce wrong results. For instance, the tweets and trades study highlighted that many times, picking the right tweets also remains as difficult as making the right trades.

Thus, post this research work, we aim to expand our working paper to an empirical paper with the application of all these aforesaid innovative technologies and usage of data mining tools for deeper and better analysis.

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Chapter 6

Bitcoin and Portfolio Diversification: Evidence from India



Shivani Aggarwal, Mayank Santosh, and Prateek Bedi

Abstract Achievement of diversification gains is one of the most important objectives of portfolio optimization. We aim to ascertain the magnitude and robustness of diversification gains for an already diversified portfolio due to inclusion of Bitcoin from the standpoint of an Indian investor. We use eight indices to build a portfolio spread across six asset classes, namely, equity, fixed income, commodities, real estate, gold and alternative investments. All asset classes except alternative investments are represented by indices which track performance of respective assets in India. We employ three investment strategies, namely, ‘long only’, ‘constrained’ and ‘equally weighted’ to construct optimal portfolios. Instead of the traditional mean-variance optimization methodology, we apply mean-CVaR approach for optimal allocation of weights to assets. Our findings suggest that portfolios containing Bitcoin have superior risk-adjusted returns as compared to portfolios without Bitcoin for two strategies, ‘long only’ and ‘equally weighted’. Results suggest relatively stable weights across the investment horizon for Bitcoin in ‘long only’ strategy as compared to ‘constrained’ framework. The findings are relevant for institutional and retail investors looking to earn higher risk-adjusted returns for a portfolio denominated in Indian rupee. The study highlights the immense potential of Bitcoin as an investment alternative and also adds fresh evidence to the scarce literature on Bitcoin from a financial perspective.

Keywords Bitcoin · Modified CVaR · Portfolio optimization · Modified Sharpe ratio · Portfolio diversification · Risk-adjusted returns · Indian investor

JEL Classification Codes: G11, G15, C61

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6.1 Introduction

One of the most significant developments during the financial crisis of 2008–2009 is the emergence of a decentralized peer-to-peer payment system, Bitcoin. Nakamoto (2008) introduced Bitcoin as the first open-source digital currency which uses the principles of cryptography for its creation and circulation. With the help of the Internet, the transactions pertaining to the digital currency are recorded and verified by an open-source algorithm. The limitation on the quantity of Bitcoin in circulation distinguishes it from other fiat currencies. The supply of Bitcoins is determined by a process called ‘mining’ in which network participants provide computing power to record transactions in a public ledger, i.e. ‘blockchain’. As fresh Bitcoins are mined at a decreasing rate, the units in circulation of the cryptocurrency are bound to hit the maximum limit of 21 million in 2140.

The implications of Bitcoin from an economic and financial perspective are important for governments, regulators, corporates, financial institutions, academicians and investors. With its growing popularity across multiple types of users such as traders, brokers, speculators and unfortunately criminals, fraudsters, terrorists, etc., the digital currency has delivered phenomenal returns in recent times. From August 2016 to August 2017, Bitcoin’s value grew approximately eight times, and from March 2017 to August 2017, Bitcoin’s price quadrupled. On the one hand, there are countries such as the USA, Japan, Canada, Australia, etc., which have recognized and regulated the use of Bitcoin, and on the other hand, nations like Saudi Arabia, Bolivia, Bangladesh, etc., have declared usage of Bitcoin as illegal. Moreover, national agencies in many countries like India, South Africa, South Korea, Vietnam, etc., have still not adapted a clear framework with regard to usage of Bitcoin for different purposes.

At the beginning of 2015, more than 1,00,000 merchants were reported to accept Bitcoin in exchange for goods and services.¹ As more and more companies accept Bitcoin for payments, Bitcoin’s value is bound to grow, and the cryptocurrency is expected to be of prime interest to institutional and retail investors. The growing interest for the biggest and the earliest virtual currency has led to the establishment of many Bitcoin startups in India such as Zebpay, Unocoin and Coinsecure.² Major Bitcoin exchanges in India recorded a spike in transaction volumes after demonetization in India.³ In the Financial Stability Report (December 2015), the importance

¹ Anthony Cuthbertson. (2015) Bitcoin now accepted by 100,000 merchants worldwide. Available from: <http://www.ibtimes.co.uk/bitcoin-now-accepted-by-100000-merchants-worldwide-1486613>. [Accessed 15th August 2017].

² Shweta Modgil. (2017) Indian Government Mulling Legalising Bitcoin Cryptocurrency In India. Available from: <https://inc42.com/buzz/bitcoin-cryptocurrency-india-government/>. [Accessed 15th August 2017].

³ Shailesh Menon & Saikat Das. (2016) Demonetisation effect: Why cryptocurrency is gaining currency in cashless times. Available from: <https://economictimes.indiatimes.com/news/economy/finance/demonetisation-effect-why-cryptocurrency-is-gaining-currency-in-cashless-times/article.show/55861664.cms> [Accessed 15th August 2017].

of the blockchain technology to disrupt financial markets, collateral identification and payment systems was recognized by RBI. The bank asserted that there is a need for regulators and authorities to keep pace with the developments in the blockchain technology because it possesses the ability to transform back office operations of banks and improve the speed and cost efficiency in payment systems and trade finance. Moreover, the bank invited suggestions from the public on the existing framework of virtual currencies. The Department of Economic Affairs and Ministry of Finance decided to constitute an Interdisciplinary Committee in March 2017 to provide measures for dealing with virtual currencies. The private Bitcoin companies have also formed an association called 'Digital Assets and Blockchain Foundation India (DABFI)' to educate masses about cryptocurrencies and propagate best industry practices.²

Most of the existing academic literature has focused on the legal and information technology aspects of Bitcoin. In this study, we attempt to ascertain the diversification gains that accrue to an already well-diversified portfolio from the perspective of an Indian investor. Considering the thin body of literature on Bitcoin from a financial economics' point of view, we believe this paper adds value to our understanding on the benefits of investments in the virtual currency.

The remainder of this paper is organized as follows: Sect. 6.2 discusses the existing related literature, Sect. 6.3 lists the objectives, Sect. 6.4 provides the data and methodology used in this paper, Sect. 6.5 highlights the results of the analysis and Sect. 6.6 concludes the study.

6.2 Literature Review

Blockchain is a distributed database solution that maintains a continuously growing list of data records that are confirmed by the nodes participating in it. The first and most popular application of blockchain technology is Bitcoin. Witte (2016) and Dwyer (2016) provide a basic introduction to blockchain and discuss its applications and also show how the technology works. Pierro (2017) reviews the basic ideas of this technology and provides a sample minimalist implementation in Python. Yli-Huumo et al. (2016) provide an extensive account of the research on blockchain technology and challenges currently associated with its application and scalability. The study systematically reviews and classifies key research topics on blockchain addressed in the literature and identifies potential challenges for blockchain and its applications. Lipton (2017) discusses potential applications of blockchain and distributed ledgers to money, trading, clearing and settlement, payments and banking. The paper also highlights the role of digital currencies in modern society and compares different forms of digital cash such as bank money, Bitcoin, P2P money and electronic cash. McLean and Deane-Johns (2016) present an overview of the ways in which the blockchain technology can transform different business segments including financial services, music and entertainment, intellectual property, smart contracts, etc. The authors also list key impediments along with

technical, legal, security and regulatory challenges in the adaption of distributed ledgers. Kshetri (2017) provides evidence linking the use of blockchain in overcom-ing some economic, social and political challenges and demonstrates how block-chain can help promote transparency, build trust and reputation and enhance efficiency in transactions.

Bitcoin has intrigued researchers from different areas since its inception. The use of ‘blockchain’ technology for payment systems has caught attention of academi-cians in the field of computer science whereas the decentralized and private nature of transactions on the Bitcoin network has become a matter of interest for research-ers in the area of law and compliance. Studies concerning the economic and finan-cial implications of Bitcoin picked up pace from 2013 when the currency touched \$1000 mark. Weber (2015) and Böhme et al. (2015) present an elaborative view of the governance and technological issues of Bitcoin and discuss the feasibility of Bitcoin as a potential medium of exchange vis-à-vis fiat currencies. Luther and White (2014) argue that the highly volatile nature of Bitcoin’s value renders it unsuitable to become a popular means of exchange. Lo and Wang (2014) also find Bitcoin to be a poor replacement for fiat currencies due to the economies of scale possessed by the latter. Glaser et al. (2014) conclude that digital currencies are more popular amongst users as an investment alternative than a payment mechanism.

With regard to the determinants of Bitcoin’s price, Ciaian et al. (2016) find mar-ket forces of demand and supply to be a major driver of changes in value of the cryptocurrency. Garcia et al. (2014) attribute movements in Bitcoin’s price to grow-ing public attention and conclude that major price downfalls are preceded by rise in information search for Bitcoin. Similarly, Kristoufek (2013) suggests that changes in Bitcoin’s price are closely associated with searches on Google and Wikipedia. Cheah and Fry (2015) conclude that fundamental value of Bitcoin is zero, and it experiences speculative bubbles like other assets. Exploring the hedging capabili-ties of Bitcoin, Dyrhberg (2016) finds Bitcoin to be a potential hedge against stocks in FTSE as well as US dollar. Bouri et al. (2017a) use wavelet analysis to show that Bitcoin provides hedge against global uncertainty.

Being one of the first studies to evaluate the diversification benefits of Bitcoin, Brière et al. (2015) show that inclusion of even a small proportion of the virtual cur-rency may dramatically improve the risk-return characteristics of a portfolio. They show BTC-inclusive mean variance efficient frontier to be much steeper than its BTC-free counterpart. Eisl et al. (2015) test the relevance of addition of Bitcoin to an already well-diversified portfolio comprising of 12 indices to represent different asset classes. With a perspective of a US investor, they calculate risk-return ratio similar to Campbell et al. (2001) to find the optimal combination of assets on a roll-ing basis for each month from July 2011 to April 2015. They conclude that average monthly returns and CVaRs are higher for a portfolio with Bitcoin and report su-perior risk-adjusted performance of portfolios containing Bitcoin.

Chowdhury (2016) assesses Bitcoin’s role in financial markets. As one of the initial attempts to evaluate inclusion of Bitcoin in a portfolio, it follows a more gen-eral approach than the traditional mean-variance in-sample setting. Results suggest Bitcoin offers diversification benefits to investors regardless of the performance

measure used. Moore and Stephen (2016) assess the potential benefits and costs of holding Bitcoins as a part of portfolio of international reserves by considering the case of Barbados. The study finds that if Bitcoin were included in the portfolio, it would have generated significant returns, but the volatility of the reserves would also increase. Bouri et al. (2017b) find that Bitcoin may serve as a safe haven against severe declines in Asian stocks, and such properties of Bitcoin may vary across different horizons.

6.3 Objective

The meteoric rise in value of Bitcoin has been a matter of discussion and astonishment for the investor community. The research on determinants of price of Bitcoin has yielded varied results. Some studies find market forces of demand and supply as a major driving force behind changes in Bitcoin's price whereas others report macroeconomic events to affect value of Bitcoin. Since the beginning of 2017, Bitcoin has delivered an exceptional return of 358% till August 31, 2017. A major reason behind this price rally is the infamous 'WannaCry ransomware attack' in May 2017 which persuaded the owners of the victim computer systems to pay ransom payments in Bitcoin. Additionally, global macroeconomic events such as devaluation of Chinese Yuan, hyperinflation in Venezuela, Brexit, results of US presidential elections, India's demonetization drive, etc., have also contributed to global uncertainty and Bitcoin's price rise.

Keeping in view the growing popularity of Bitcoin as an investment vehicle, we aim to find out the extent and robustness of diversification benefits of Bitcoin for an already diversified portfolio from the view of an Indian investor. We consider eight indices to represent fund allocation across equity, fixed income, real estate, alternative assets, real estate and gold. The low correlations shared by Bitcoin with other asset classes make it a suitable alternative to achieve enhanced portfolio diversification. Our research questions are summarized as follows:

1. Does the risk-return ratio of an already diversified portfolio improve upon inclusion of Bitcoin?
2. Is Bitcoin's weight in a diversified portfolio robust across different investment strategies?
3. How does weight of Bitcoin change across time in an already well-diversified portfolio?

We believe this study to be a novel attempt for exploring diversification gains of Bitcoin to a portfolio comprising of investments across different asset classes from the perspective of an Indian investor. Moreover, the results also add fresh evidence to the limited literature available on the financial aspects of Bitcoin.

6.4 Data and Research Methodology

The price data for Bitcoin has been taken from CoinDesk which reports a simple average of global Bitcoin/USD prices from different exchanges. Our sample period covers 77 months from July 18, 2010, to December 30, 2016. We have chosen at least one leading liquid index as a proxy for each noted asset class. The data for all the indices are taken from Bloomberg. The Indian indices used to represent investments in equity, fixed income, gold, commodities and real estate are already denominated in INR, and we convert USD denominated indices, namely, Morningstar Diversified Alternatives Index, Global Hedge Fund Index and Bitcoin values to INR by using USD/INR exchange rate data, taken from Bloomberg as well.

Table 6.1 lists the assets considered to create a well-diversified portfolio with the perspective of an Indian Investor.

We provide the descriptive statistics for all assets in Table 6.2. It can be easily observed that Bitcoin has exceptionally high skewness, standard deviation and kurtosis as compared to other assets.

Keeping in view the non-normal return distribution of Bitcoin, CRISIL Composite Bond Fund Index, CRISIL Gilt Index, Global Hedge Fund Index, RBI's House Price Index and Morningstar Diversified Alternatives Index, we follow Rockafellar and Uryasev (2000) and use Conditional Value-at-Risk as the proxy for risk. Following these notations, we define Conditional Value-at-Risk (CVaR _{α}) as the average of the losses that exceed Value-at-Risk.

Value-at-Risk for a predetermined confidence level α is defined as

$$\zeta_{\alpha}(\omega) = \min \{ \zeta | \Psi(\omega, \zeta) \geq \alpha \}$$

where, ω = vector of portfolio weights,

ζ = specific loss.

Table 6.1 List of assets considered for portfolio construction

S. no.	Asset class	Indices	Mnemonics
1.	Equity	S&P BSE 500	SPB
2.	Fixed income	CRISIL Composite Bond Fund Index	CCBF
3.	Fixed income	CRISIL Gilt Index	CGI
4.	Real estate	RBI's House Price Index	HPI
5.	Alternative investments	Morningstar Diversified Alternatives Index	MDAI
6.	Alternative investments	Global Hedge Fund Index	GHFI
7.	Commodities	MCX Comdex	MCX
8.	Commodities	Gold prices	GLD
9.		CoinDesk Bitcoin Price Index	BTC

Notes: The table lists the assets considered in the study to construct a diversified portfolio. Data for all indices has been taken from Bloomberg database. Data for Bitcoin has been taken from CoinDesk Bitcoin Price Index. All values are quoted in INR in the study. The sample period starts on July 18, 2010, and ends on December 30, 2016

Table 6.2 Descriptive statistics of asset returns

	SPB	CCBF	CGI	HPI	MDAI	GHFI	MCX	GLD	BTC
Mean	0.67%	0.72%	0.74%	0.24%	0.79%	0.57%	0.34%	0.60%	24.93%
Median	0.57%	0.73%	0.86%	1.14%	0.63%	0.57%	0.02%	-0.03%	8.36%
Maximum	13.34%	3.06%	4.02%	2.64%	8.37%	9.03%	16.22%	16.96%	454.03%
Minimum	-10.46%	-4.17%	-5.56%	-30.10%	-5.62%	-5.31%	-10.25%	-9.97%	-37.12%
Std. dev.	4.91%	0.92%	1.33%	5.06%	2.31%	2.43%	4.46%	5.38%	72.74%
Skewness	0.12	-1.76	-1.31	-4.85	0.23	0.41	0.32	0.61	3.69
Kurtosis	2.91	12.44	8.48	26.04	4.36	4.63	3.67	3.30	19.18
Jarque-Bera	0.22	325.47	118.22	2006.06	6.62	10.70	2.73	5.07	1014.67
<i>P</i> -value	0.89	0.00	0.00	0.00	0.04	0.00	0.26	0.08	0.00
Count	77	77	77	77	77	77	77	77	77

Notes: The table reports the descriptive statistics for log returns of assets considered in the study to construct a diversified portfolio. The statistics have been calculated using monthly returns for 77 months in the sample period, i.e. from August 2010 to December 2016. The *p*-value of the Jarque-Bera statistic shows that six out of nine assets including Bitcoin have non-normal return distribution

The Conditional Value-at-Risk (CVaR $_{\alpha}$) is the average of the losses that exceed VaR, $\zeta_{-\alpha}(\omega)$:

$$\text{CVaR}_{\alpha}(\omega) = \frac{1}{1-\alpha} \int_{f(\omega,y) \geq \zeta_{\alpha}(\omega)} f(\omega,y) p(y) dy$$

where, y = uncertainties that affect loss.

In order to form optimal portfolios, we minimize CVaR:

$$\min \text{ CVaR}(\omega); \text{subject to}$$

$$\omega^T \hat{\mu} = \bar{r}$$

$$\omega^T 1 = 1$$

where $\hat{\omega}$ = vector of expected asset returns.

\bar{r} = expected total return of the portfolio.

We follow Eisl et al. (2015) to construct optimal portfolios based on the asset returns of the previous 1 year. Hence, for the period July 2010 to July 2011, we do not calculate any weights. Keeping the size of our rolling window as 12 months, we calculate optimal portfolio weights for a total of 65 months as we move the window forward by 1 month each time. Using the optimal weights obtained by mean-CVaR optimization for a particular month, we calculate out-of-sample monthly return and CVaR. We perform this procedure for three portfolio construction strategies, namely, long only, constrained and equally weighted. For each strategy, we form two portfolios: one with Bitcoin and other without Bitcoin. In this way, we calculate 65 risk-return ratios similar to Campbell et al. (2001) for each investment strategy, i.e. a total of six different combinations (two for each strategy). It is important to note that the ratio is valid for comparison only when portfolio return and risk values are positive numbers. Since CVaR is a loss, by definition, it is reported as a positive figure in R. On the other hand, portfolio return may be negative or positive. Hence, to make meaningful comparison of portfolios with and without Bitcoin, we consider only those risk-return ratios for which both numerator (portfolio return) and denominator (portfolio CVaR) are positive. This ensures that only positive risk-return ratios are used to calculate mean monthly risk-return ratio for each combination. We then make a comparison of the risk-return ratios of portfolios with and without Bitcoin for each investment strategy to ascertain if Bitcoin offers any diversification benefits.

6.4.1 Modified Sharpe Ratio

The modified Sharpe ratio is an extension of the original Sharpe ratio given by Sharpe (1966) amended to use CVaR as a proxy for risk instead of standard deviation. It is calculated by dividing the excess returns by CVaR (popularly known as expected shortfall). CVaR focuses on the left tail of the return distribution and has

better properties than standard deviation, especially when the returns are not distributed normally. The study by Rockafellar and Uryasev (2000) shows that CVaR can be used for portfolio optimization of financial instruments, and they argue that CVaR is a coherent risk measure that is able to quantify dangers beyond VaR. We fix the confidence level at 95% in our analysis for calculation of CVaR. An optimal portfolio is achieved when the risk-return ratio is maximized.

6.4.2 Portfolio Construction Strategies

We initially obtain a log return series of monthly data for all the assets from August 2010 to December 2016. The first 12 months' observations of the returns are used as an input to get the initial weights for each of the assets by maximizing the risk-return ratio. We use the DEoptim solver of programming language R, developed by Peterson and Carl (2015) for portfolio optimization. We compare the risk-return ratios of the portfolios with and without Bitcoin to determine whether the addition of Bitcoin offers any diversification benefits or not. The weight optimization process is dependent on many parameters and constraints that are defined in the following three frameworks.

Strategy 1: Constrained Portfolio ($w_i \in R : -1 \leq w_i \leq 1$)

For a constrained portfolio, the asset weights can vary between -100% and $+100\%$. As there is a limit on weights at both the ends, we expect to get a smooth vector of the asset weights. Thus, need for rebalancing the portfolio decreases. The initial 12 months' returns are used to find the first set of the portfolio weights; thus, the actual investment period is 12 months less than the total sample period of 77 months.

Strategy 2: Long Only Portfolio ($w_i \in \mathbb{R}_0^+$)

In this strategy, a constraint related to short selling is imposed on the asset weights. It restricts the short selling of assets due to lack of appropriate financial instruments. The investment horizon has a total of 65 months due to usage of initial 12 months' returns in computation of initial weights, similar to the previous strategy.

Strategy 3: Equally-Weighted Portfolio ($w_i = \frac{1}{N} \forall i$)

In the equally-weighted strategy, the asset weights remain fixed across the investment horizon. The weight assigned to each asset is $1/N$ (here N is number of assets available for investment); thus there is no need for portfolio optimization as the weights remain constant. Demiguel et al. (2007) depicted that this strategy performs

equally well or sometimes even better than other portfolio techniques. The investment horizon considered for this strategy is same as that of above two strategies in order to maintain consistency.

6.5 Results and Findings

As we can see in Fig. 6.1, the price of Bitcoin remained largely steady for the initial 3 years. The spike around October 2013 was the first significant increase in the price of Bitcoin. The growth story of Bitcoin eventually started from the end of 2015, and it picked up unparalleled pace from August 2016. The return delivered by Bitcoin in the past 2 years is higher than any other class by leaps and bounds. This period also consists of spikes as a result of cyber ransomware attack in May 2017.

In Table 6.3, we provide the correlation matrix of asset returns. Bitcoin has a strikingly low correlation with other assets which renders Bitcoin an edge as a diversifier. Specifically, Bitcoin has a negative linear relationship with four out of eight assets. In fact, the highest positive correlation for Bitcoin is reported at 0.069 with Morningstar Diversified Alternatives Index. However, these correlation coefficients are not significant at standard confidence levels.

In Table 6.4 we present the key results of our study. For the three portfolio strategies – equally weighted, long only and constrained – we compare mean monthly return, mean monthly CVaR and mean monthly risk-return ratio for a portfolio with and without Bitcoin. We observe that for all three strategies, the mean monthly return and the mean monthly CVaR of the portfolio with Bitcoin are higher than that

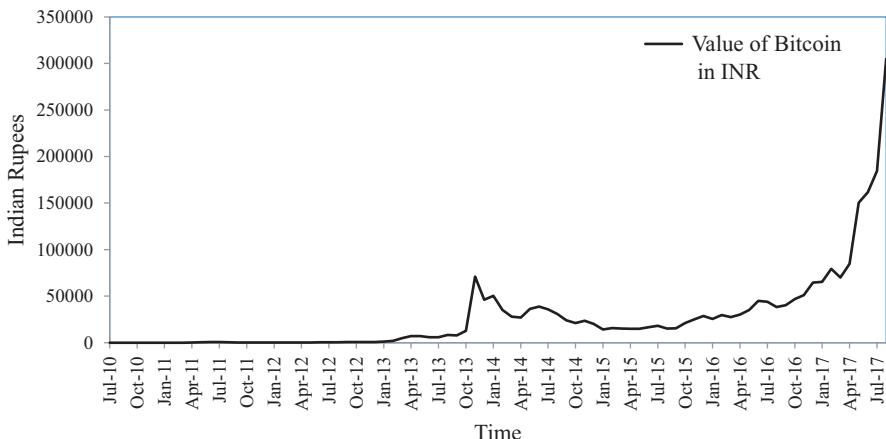


Fig. 6.1 Bitcoin price trend from July 2010 to August 2017. *Notes:* The graph shows Bitcoin's price development in INR since its inception in July 2010 till August 2017. Data for prices of Bitcoin have been gathered from CoinDesk Bitcoin Price Index and USD/INR exchange rate values have been taken from Bloomberg. Bitcoin has witnessed a continuous spike in value from March 2017 to August 2017 with a discrete return of ~335%

Table 6.3 Correlation matrix of asset returns

	SPB	CCBF	CGI	HPI	MDAI	GHFI	MCX	GLD	BTC
SPB	1								
CCBF	0.332**	1							
CGI	0.256*	0.923**	1						
HPI	0.051	-0.052	-0.066	1					
MDAI	-0.563**	-0.322**	-0.297**	-0.198	1				
GHFI	-0.589**	-0.250**	-0.225**	-0.228*	0.909**	1			
MCX	-0.197	-0.307**	-0.338**	0.024	0.412**	0.379**	1		
GLD	-0.267*	-0.289*	-0.285*	0.219	0.252*	0.239*	0.605**	1	
BTC	-0.104	-0.148	-0.172	0.064	0.069	0.007	0.029	-0.053	1

Notes: The table shows correlation amongst returns of nine assets used for portfolio construction in the study for the period between July 2010 and August 2017. Bitcoin has remarkably low correlation with other assets. *denotes correlation is significant at the 0.05 level (two-tailed), and ** denotes correlation is significant at the 0.01 level (two-tailed)

Table 6.4 Results of the three portfolio construction strategies

Portfolio optimization framework	Mean monthly Bitcoin weight	Mean monthly return	Mean monthly CVaR	Mean monthly risk- return ratio
Long only with Bitcoin	2.92%	2.67%	0.36%	185.90
Long only without Bitcoin	–	1.52%	0.27%	79.88
Constrained with Bitcoin	12.01%	15.86%	4.23%	2.72
Constrained without Bitcoin	–	3.21%	1.20%	7.56
Equally weighted with Bitcoin	11.11%	4.20%	12.10%	1.57
Equally weighted without Bitcoin	–	1.22%	2.11%	0.70

Notes: The table depicts final empirical results of the study in the form of mean monthly return, mean monthly CVaR, mean monthly risk-return ratio and mean monthly Bitcoin weights for all three optimization techniques considered in the study

of the portfolio without Bitcoin. This clearly shows that Bitcoin offers an upside in the return to an already well-diversified portfolio but at the cost of additional risk. Our findings reveal that the highest increase in mean return is reported for the constrained portfolio with Bitcoin, i.e. 12.65% points higher than the portfolio without Bitcoin. The greatest spike in CVaR due to inclusion of Bitcoin occurs in equally weighted portfolio at 9.99% points.

We compute the risk-return ratio to see if Bitcoin improves the risk-return trade-off of the portfolios. For long only and equally-weighted strategies, the portfolio with Bitcoin has a higher risk-return ratio. This clearly indicates better risk-adjusted returns for these two investment strategies with Bitcoin than without it. However,

for constrained strategy, the portfolio without Bitcoin offered better risk-adjusted returns as it is reported to have a higher risk-return than portfolio with Bitcoin.

The risk-return ratio of two portfolio strategies – equally weighted and long only – increases by 130% and 124%, respectively, due to inclusion of Bitcoin. These results depict the potential of Bitcoin to increase the risk-return ratio of the portfolio dramatically.

We consider the trend of weights of Bitcoin across the portfolio strategies over the 65 months long period in Table 6.2. With regard to the mean monthly weight of Bitcoin in the three strategies, we compute an average weight of 2.92% and 12.01% for long only and constrained strategies, respectively. The average weight is 11.11% for the equally-weighted strategy, as we consider eight other assets other than Bitcoin. These results depict a considerable variation in the weight of Bitcoin across three strategies. Hence, an investor who does not consistently follow a single strategy may have to rebalance his portfolio frequently, and this in turn may lead to higher transaction costs. The standard deviation of the Bitcoin weights for the long only strategy is just 3.81%, and the Bitcoin weight crosses the 10% mark only five times in 65 months (Fig. 6.2).

The constrained strategy shows a wide variation in the weight of Bitcoin across the investment horizon. The standard deviation of Bitcoin's weight is 22.12%. This shows that constant rebalancing is required to include Bitcoin in the portfolio. An investor who invests according to this strategy might have to pay high transaction costs to buy/sell/short sell the assets on a regular basis. The weights hover in the range – 15% to 15% for 37 out of 65 months. Hence, in two out of the three strate-

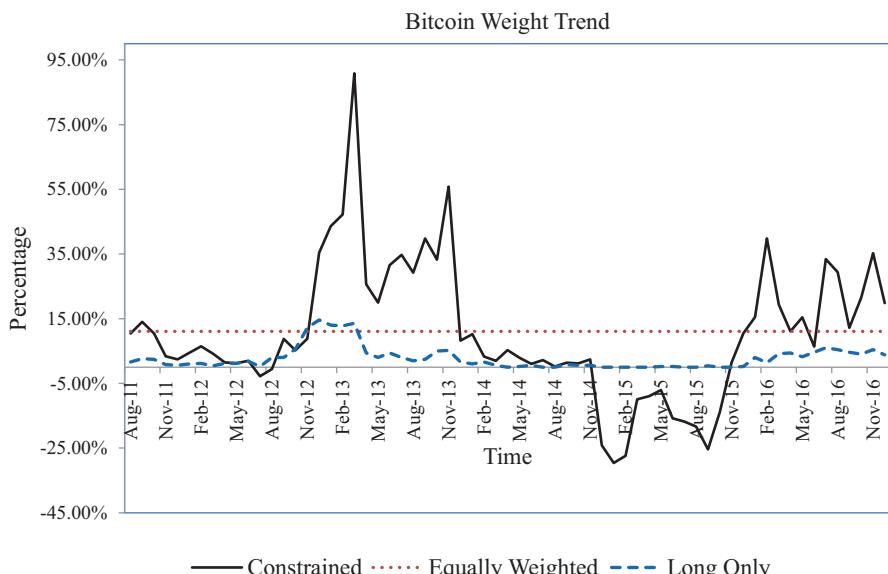


Fig. 6.2 Bitcoin weight trend from August 2011 to December 2016. *Notes:* The figure displays the optimal Bitcoin weights for three portfolio strategies, namely, constrained, long only and equally weighted, over the investment horizon starting from August 2011 to December 2016

gies considered, Bitcoin's weight remains relatively stable, and it makes Bitcoin a suitable investment alternative for institutional and retail investors.

The most realistic and replicative strategy considered in the study is 'long only' as there are no short positions required on any asset which anyway may not be possible for some assets including Bitcoin. We now have a detailed look at the results of this strategy. Figure 6.3 compares the returns of long only strategy for portfolios with and without Bitcoin.

Since inception in August 2010 till December 2012, the portfolio without Bitcoin has higher cumulative returns than the portfolio with Bitcoin. From January 2013, Bitcoin pulls up the return of the portfolio consistently and maintains its superiority over portfolio without Bitcoin. In December 2016 the difference between the cumulative returns generated by the two portfolios is close to 76%. Bitcoin portfolio delivers higher returns for 35 out of 65 months than the portfolio without Bitcoin.

The comparison of monthly CVaR of portfolio with and without Bitcoin for the long only strategy is shown in Fig. 6.4. It is clearly evident that the CVaR of the portfolio with Bitcoin is mostly greater than the portfolio without Bitcoin. In the 65 months investment period, from August 2011 to December 2016, the portfolio with Bitcoin is reported to be riskier in 40 months.

To summarize, Bitcoin offers enhanced diversification gains in two out of the three portfolio strategies considered in the study. These results should be viewed by an investor in consideration with a few limitations of the study. Firstly, due to the extremely large volatility of Bitcoin returns, it may not be a suitable investment alternative for investors with lower risk tolerance. Secondly, it might not be possible to short sell certain assets like Bitcoin, i.e. it is difficult to replicate the constrained

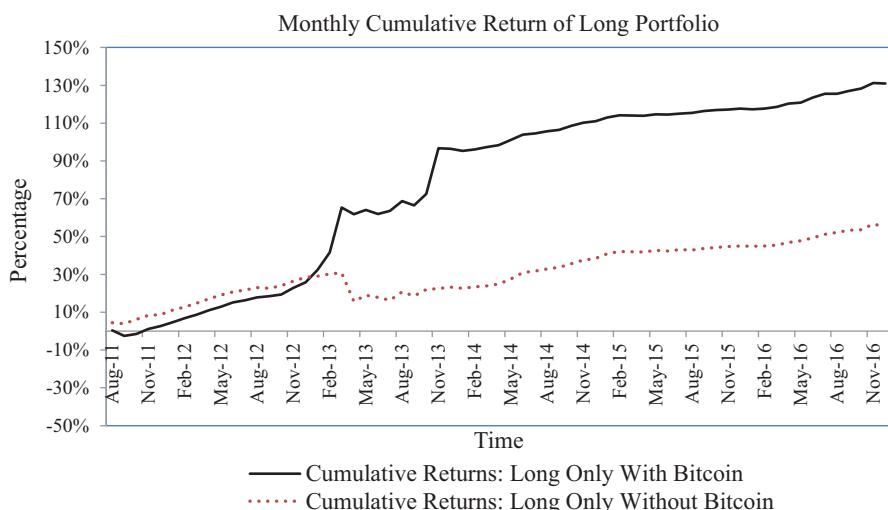


Fig. 6.3 Monthly cumulative returns of long only portfolio strategy. *Notes:* The figure displays the development of cumulative monthly returns of two long only portfolios: bitcoin portfolio and without bitcoin portfolio. The monthly returns span over the investment horizon starting from August 2011 to December 2016

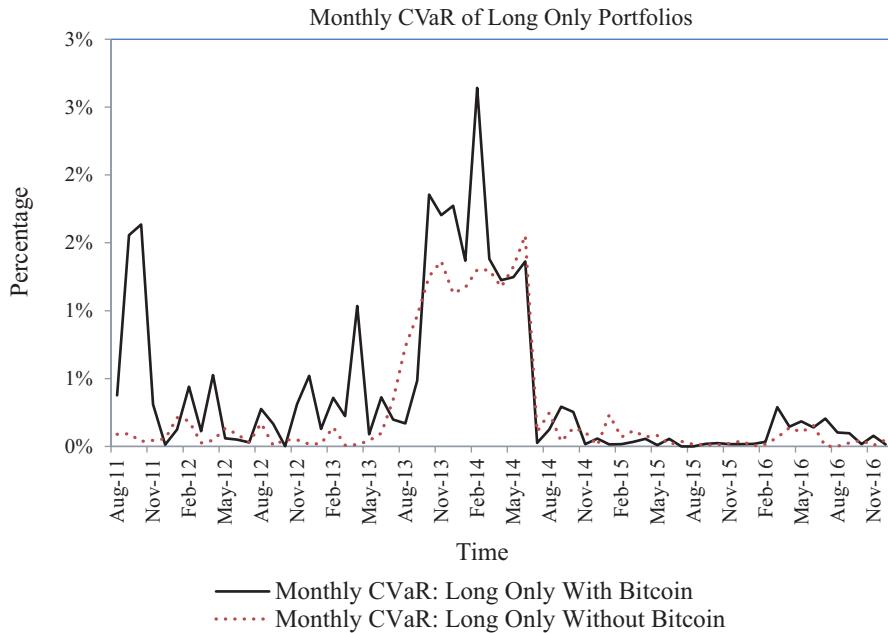


Fig. 6.4 Monthly CVaR for long only portfolio strategy. *Notes:* The figure displays the development of monthly CVaR of two long only portfolios: bitcoin portfolio and without bitcoin portfolio. The monthly CVaR spans over the investment horizon starting from August 2011 to December 2016

strategy. Thirdly, the choice of assets that form a well-diversified portfolio is arbitrary. The selection of different assets for constructing a diversified portfolio may change the results. Lastly, measures to evaluate risk other than the CVaR can also be used to compute the benefit of diversification of portfolios, and this choice of risk measure may affect the findings decisively.

6.6 Discussion

According to the mean-variance framework suggested by Markowitz (1952), assets with lower correlation can be combined to form portfolios to generate higher risk-adjusted returns vis-à-vis standalone investments in assets. It is therefore pertinent for investors to find assets which share a low correlation with traditional asset classes. Burniske and White (2017) view the emergence of Bitcoin, as an asset class, is an imperative development for the investor community. This study extends the relatively thin extant literature on financial attributes of Bitcoin by providing

support to Bitcoin's credentials as an investment alternative. The study shows that Bitcoin offers diversification gains for long only and equally-weighted portfolios and improves return-risk ratios by a huge margin. These findings are in line with those provided by Eisl et al. (2015) and Brière et al. (2015) who assess the diversification capability of Bitcoin from the standpoint of a US investor. This is a maiden study to apply mean-CVaR optimization to test the impact of Bitcoin on return-risk attributes of an already diversified portfolio for an Indian investor. However, results do not indicate an absolute dominance of Bitcoin as the return-risk ratio in a constrained portfolio falls upon inclusion of Bitcoin. Moreover, the exceptionally high volatility of Bitcoin suggests that it may not be a suitable choice for risk-averse investors. The contribution of the study lies in the quantitative evaluation of Bitcoin as an asset for investment and the extent of fund allocation for the same in the context of portfolio construction.

6.7 Conclusion and Implications

We examine the extent and significance of diversification gains that accrue to an already diversified portfolio due to inclusion of Bitcoin from the standpoint of an Indian investor. We use global indices to build a portfolio spread across six asset classes, namely, equity, fixed income, commodities, real estate, gold and alternative investments for adequate representation of existing investment choices. We use Indian indices for all asset classes except alternative investments to ensure that investment perspective for an Indian investor is captured adequately. To construct optimal portfolios, we employ three investment strategies, namely, long only, constrained and equally weighted. Instead of the traditional mean-variance optimization methodology, we apply mean-CVaR framework for optimal allocation of weights to assets.

Our findings suggest that portfolios containing Bitcoin have superior risk-adjusted returns as compared to portfolios without Bitcoin for two strategies, namely, 'long only' and 'equally weighted'. The substantial difference in the risk-return ratios across time in these strategies indicates robust and considerable diversification benefits of the cryptocurrency for a portfolio denominated in Indian rupee. We report relatively stable weights across the investment horizon for Bitcoin in long only strategy as compared to constrained framework. The study is relevant for individual and institutional investors as it highlights the importance of inclusion of Bitcoin in optimal portfolios. The study also adds fresh evidence to the scarce literature on Bitcoin from an investment perspective.

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Chapter 7

Analyzing Whether CEOs Can Act as Influencers for Sustainable Development Goals



Purva Grover, Arpan Kumar Kar, and P. Vigneswara Ilavarasan

Abstract The objective of this paper is to provide directions to governments and corporates for supporting the 2030 agenda for sustainable development across the world. This study proposes an approach for analyzing the inclination of leading CEOs (as social influencers) toward SDGs by analyzing the CEOs' conversation on social media platforms. The study also tries to investigate the usage pattern of Twitter among the CEOs and themes of the tweets posted by CEOs. The results of the study show, through social media platforms (such as Twitter), CEOs are expressing their opinions for various events happening across the world and motivating Twitter users for building their career and improving their living standards. The outcome of the study suggests, if some organization (such as United Nations or governments) pushes these CEOs on SDGs themes, then these CEOs can act as the great influencers on SDGs' theme on social media platforms.

Keywords Sustainability · Twitter analytics · Social media analytics, Text analytics

7.1 Introduction

The Sustainable Development Goals (SDGs) given by United Nations (UN) provide guidelines for the member countries to move toward sustainable and equitable society and have long-term implications for the business corporations. Multinational enterprises can use the SDGs as a guideline to invest in sustainable development while pursuing their own business interests (Chakravorti 2017). The framework for achieving SDGs is kept robust enough to include complexities and dimensions of sustainable development so that nations could adopt the goals with implementation strategies based on scope and context. These SDGs are still comprehensive with 17 goals defined with 169 targets along with 230 indicators (Jerven 2017).

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These 17 goals are no poverty (NOPO); zero hunger (ZERO); good health and well-being (GOOD); quality education (QUAL); gender equality (GEND); Clearwater and sanitation (CLEA); affordable and clean energy (AFFO); decent work and economic growth (DECE); industry, innovation, and infrastructure (INDU); reduced inequalities (REDU); sustainable cities and communities (SUST); responsible consumption and production (RESP); climate action (CLIM); life below water (LIFW); life on land (LIFL); peace justice and strong institutions (PEAC); and partnership for the goals (PART). The SDG guidelines cannot bind any private organizations through regulatory means directly. The member countries are signatories to the SDGs which in turn would set guidelines and practices to be adopted by the business organizations.

Due to the commitment to the UN, governments and firms are either contemplating new processes or aligning the old ones to support the SDGs. In this study, we explore how Twitter is being used by chief executive officers (CEOs) and whether they are discussing the SDGs on the social media platform. The outcome of the study will help the United Nations and various governments across the world to decide whether CEOs can act as influencers for disseminating the information regarding SDGs.

7.2 Theoretical Background

Sustainable development strategies help the public to meet the current needs without compromising on future generation's need (Campbell 2017). Literature highlights sustainable development can be achieved through education (Bell et al. 2017), competitive international markets (World Business Council for Sustainable Development 2002), economic development (Ye et al. 2017), and through local authorities emphasizing on sustainability (Tessema 2017). The largest barrier of the sustainability is poverty, which can be reduced by applying the sound business thinking (World Business Council for Sustainable Development 2002). However, the potential benefits for pursuing SDGs are not direct and tangible. Literature highlights investing in the environmental measures would improve the quality and cost performances of the firms (Pullman et al. 2009). However, there is not a significant indication in existing literature on the degree to which firms are attempting to address the needs of these SDGs.

Social media is increasingly becoming important across the globe for sharing information (Xiang and Gretzel 2010), public relations (Eyrich et al. 2008), and opinion propagation (Valenzuela 2013). In this era of digital economy, all business leaders are utilizing social media for marketing (Thackeray et al. 2008), brand management (Kim and Ko 2012), product or service promotions (Neiger et al. 2012), customer engagement (Heller Baird and Parasnis 2011), and recruitment (Henderson and Bowley 2010). For these functional benefits, organizations are focusing on building a significant

presence in social media platforms like Facebook and Twitter (Kietzmann et al. 2011) through which they are attempting to engage with all the relevant stakeholders.

While there are many social media platforms, the current study mines social discussions from Twitter. Twitter is a microblogging service, started in 2010, to enable users to share content within a limit of 140 characters. Discussions in Twitter are often oriented toward reporting news and information to followers by influencers. The discussions are normally available in the public domain unless protected. Every day, around 500 million tweets are sent or received by people (Internet live stats 2016). Twitter helps in sharing information and gathering advice from large groups of stakeholders with minimal effort. Twitter discussions also influence the users following popular profiles (e.g., politicians, actors, thought leaders, etc.).

The implementation of SDGs faces various challenges in terms of successful adoption. A major challenge is identifying champions who will uptake the goals in various parts of the world in the localized environment. The UN and governments require actors to uptake the goals in context-specific application and influence the localized crowd to follow the goals (Klopp and Petretta 2017). The offers related to SDGs should be attractive so that public can willingly accept the offers (Wagner et al. 2016). There is the need for raising the awareness among the people for the sustainability and climate change (Duxbury et al. 2017). Education can contribute to sustainability, socially and technically on both global as well as on local scale (Bell et al. 2017). The regional inequality can be reduced by economic development (Ye et al. 2017).

Literature highlights, the key stakeholders in governance, should be involved in sustainable development (Zhu 2017). On a global scale, big firms and organizations can play a big role in achieving the SDGs (Hahn 2009; Pless and Appel 2012; Rahdari et al. 2016). Corporate social responsibility initiatives within the firms can also boost up social entrepreneurship (Rahdari et al. 2016). In management literature, it is indicated that for any project to get successful, top management support is required (Young and Jordan 2008). Similarly for SDGs to be adopted in firms, the role of leadership is of paramount importance (Daily and Huang 2001). This is a key motivation for us in conducting our study. Further to quantify through various social media analytics, whether CEOs can play a key role as influencers to impact the thinking process of the practitioner communities.

7.3 Research Question and Hypothesis

Twitter is a microblogging service, started in 2010, to enable users to share content within a limit of 140 characters. Discussions in Twitter are often oriented toward reporting news and information to followers by influencers. The discussions are normally available in the public domain unless protected. A tweet is an informal unstructured content consisting of the text, images, hyperlinks, hashtags, and much more.

Research Question 1 *Investigating how Twitter and its features such as hashtags, @mention, retweets, likes, and URL being used by CEOs for disseminating information? What types of word being used by CEOs for showcasing their emotions and polarity?*

Hashtags are user-generated keywords preceded by the # symbol. It allows users to cluster their tweets around the hashtags included in the tweets (Borondo et al. 2014). Using @mention one user can directly communicate with the other users on Twitter (Shuai et al. 2012). Retweets help the users to express their opinions on the tweets posted by other users (Bode et al. 2015). If user wants to attach more information to a tweet beyond 140 characters, it can be done by adding a URL to the tweet (Stieglitz and Dang-Xuan 2013).

Sentiment analysis is also known as the opinion mining (Pang and Lee 2008) and has two parts, emotion analysis and polarity analysis. It extracts the subjective information from the tweets. The polarity analysis classifies the tweets into three categories such as positive, negative, and neutral. The emotion analysis classifies the tweets into eight emotions such as anger, anticipation, disgust, fear, joy, sadness, surprise, and trust.

Research Question 2 *Are CEO's tweeting about the concerns and issues raised by the Sustainable Development Goals (SDGs) introduced by United Nations (UN) in 2015? What is the nature of such discussion in the public forum?*

Topic modeling classifies the sets of the documents into themes. To identify the popular topics among CEO's, topic modeling is the beneficial tools. For the identification of the themes through topic modeling, latent Dirichlet allocation (LDA) (Blei et al. 2003) was used to identify the themes (popular topics) for each CEO and mapped the topics to SDGs and its indicators. This has been adopted in lines with the approaches of content analysis which is often used in social science literature (Kassarjian 1977). Content analysis (Kassarjian 1977) is the way by which the qualitative data can be converted into the quantitative data based on the inherent semantics (meaning) of the content.

7.4 Research Methodology

A list of top 100 CEOs on social media was identified from the [Hootsuite.com](https://hootsuite.com) database of leading social influencers among CEOs (Hootsuite Blog 2016). Hootsuite offers solutions in social media management of various accounts available on different dominant social networking sites such as Twitter, Facebook, LinkedIn, Instagram, YouTube, Google+, and much more from a single dashboard. Hootsuite has published a list of top 100 CEOs on Twitter by examining the impact and engagement made by these CEOs with their followers.

CEOs who are actively participating in social discussions and holds industry leadership qualities are ranked higher in the list. Richard Branson, chairman and



Fig. 7.1 Methodology adopted for the study

founder of Virgin Group, ranked first in the list, followed by Bill Gates, technology advisor of Microsoft and co-chair of Bill and Melinda Gates Foundation. Arianna Huffington had been given the third position on the list, the first woman CEO on the list. Arianna Huffington is a cofounder, president, and editor in chief of AOL Huffington post media group. The 100th rank on the list is occupied by John Chen, CEO and executive chairman of Blackberry. Out of 100 CEOs, the data for 96 CEOs were extracted from the Twitter timelines and stored in a spreadsheet.

The Twitter data analysis can have three broad approaches (Chae 2015), descriptive analysis, content analysis, and network analysis. For this study, mostly descriptive analysis and content analysis method were applied to recognize salient elements of the CEO's views regarding SDGs on Twitter. Research question one had been investigated using the descriptive analysis whereas second research question is being investigated using the content analysis of the tweets.

Recent literature groups SDGs into categories like people, planet, policy, and human conditions for prioritizing sustainability focused efforts (Chakravorti 2017). We have also adopted this classification in illustrating some of our results surrounding the preferences and priorities among SDGs. Figure 7.1 shows the methodology followed for the study.

7.5 Analysis and Results

This section had been divided into the two sections. The first section highlights how Twitter had been used by CEOs, and the second section quantifies the conversations by CEOs on SDGs.

7.5.1 CEOs Twitter Usage

Research Question 1 *Investigating how Twitter features such as hashtags, @mention, retweets, likes and URL being used by CEOs for disseminating information? What types of word being used by CEOs for showcasing their emotions and polarity?*

Figure 7.2 gives the overview of Twitter usage by CEOs, in terms of number tweets posted by CEOs (till August 2016), followers following CEOs on Twitter, pages followed by CEOs on Twitter for news and updates, and number of times impression of like shared by CEOs on Twitter. The CEOs are extensively using the

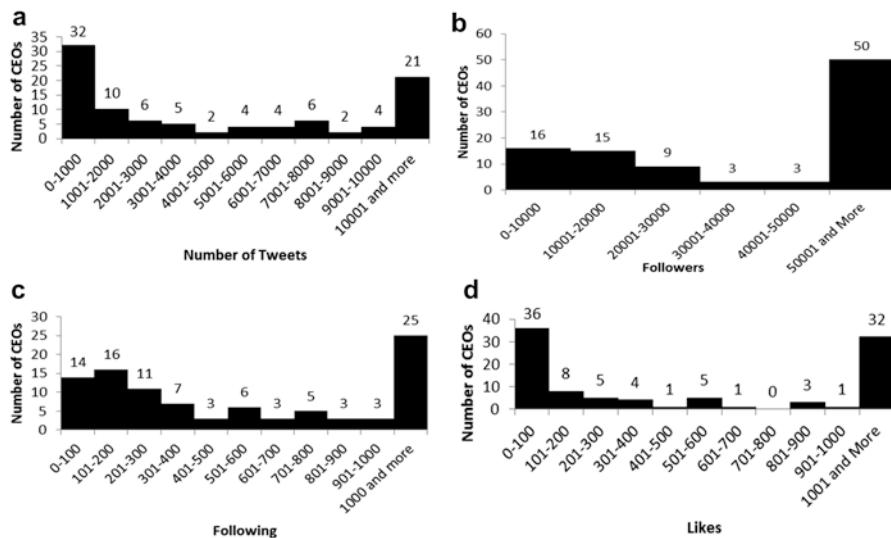


Fig. 7.2 (a) Illustrates tweeting frequency of CEOs; (b) followers following CEOs on Twitter; (c) number of following followed by CEOs on Twitter for news and updates; (d) number of times like impression shared by CEOs on Twitter

like feature offered by Twitter to express themselves. In our database, mean like expressed by CEOs was 3630 (round off to nearest whole number) with a standard deviation of 11142.28 and median, 286.

Figure 7.3 shows the word cloud of all the 1440 topics (extracted from 96 CEOs, each contributing 15 topics). The dominant topics derived from the figure are related to people, great, thanks, will, new, time, the world, and many more. The social networking sites such as Twitter and LinkedIn are popular among the CEOs and feature in these topics. A deeper investigation into the topics highlight that CEOs are concerned about topics like gender equality, jobs, start-ups, leadership, partnership, and entrepreneurship. Using Twitter CEOs are sharing their experiences with public and inspiring them to learn. CEOs through these topic discussions are trying to make an effective personal connection with their stakeholders.

Around one-third of the tweets posted by CEOs contains the hashtags. Figure 7.4 shows the top hashtags being used by CEOs such as artofpeople, leadership, smallbiz, sleeprevolution, yourrule, and many more. Using these hashtags, it seems CEOs are encouraging the public through their opinions and stories. Figure 7.5 shows the top @mention used by CEOs in their tweets, it can be derived Twitter is being used by CEOs for the communication among themselves.

There are around 40% of tweets are retweets from CEOs. The hyperlinks being used by CEOs extensively in their Tweets for disseminating information. There were around 129,786 times URLs encountered in the 193,022 tweets. The URLs were touching the topics like trust, leadership, skills, live and lead better, commitment, health care, recruitment, and job posting.



Fig. 7.3 Word cloud of the topics discussed within the tweets of CEOs

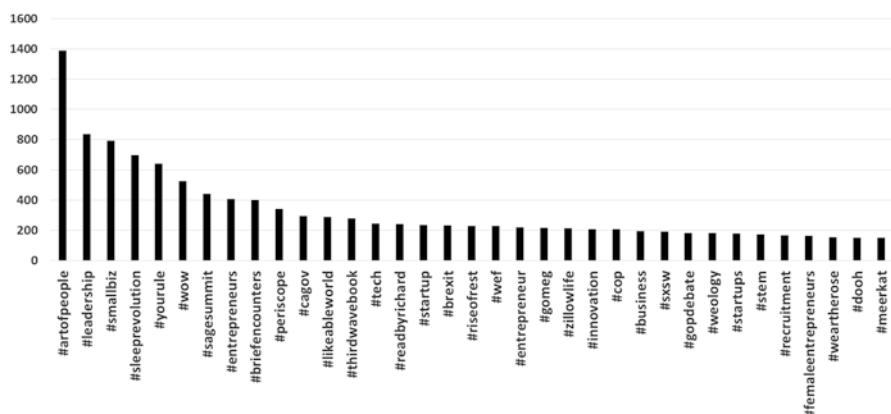


Fig. 7.4 Top 35 hashtags used by CEOs in their tweets

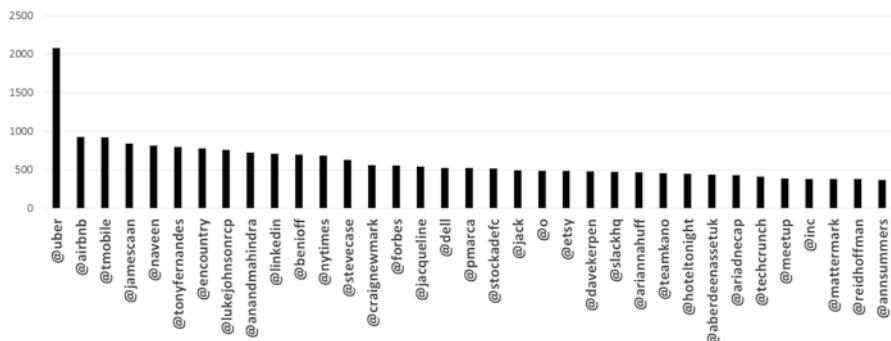


Fig. 7.5 Top 35 @mention used by CEOs in their tweets

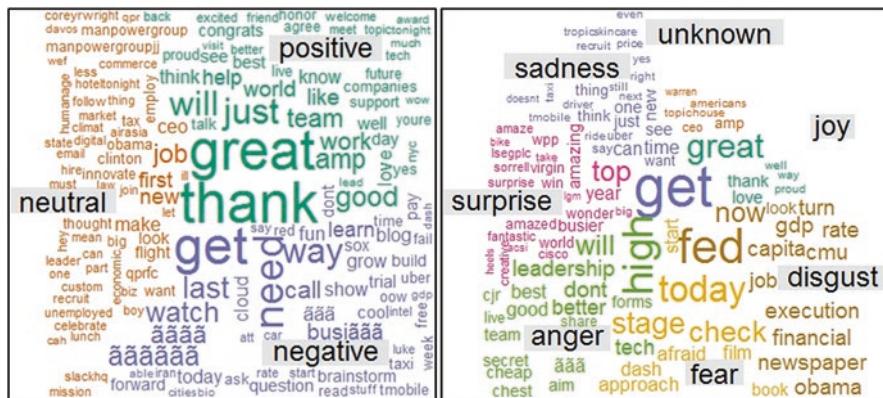


Fig. 7.6 *Left image* – classifies the words used by CEOs into positive, negative, and neutral; *Right image* – showcases the words used by CEOs for expressing their emotions

The sentiment analysis of the tweets for each CEO was done. Among 96 CEOs, 83 CEOs are posting 60% or more of the positive tweets on Twitter. Figure 7.4 shows the distribution of the CEO to positive tweets percentage. On an average, 77.35% of the tweets posted by CEOs are positive. Thus from this, it can be derived CEOs are highly optimistic and hold a positive outlook toward the world and for handling crises. Literature indicates, content can influence the emotion of followers (Kramer et al. 2014).

Twitter has been used by CEOs to express their emotions. If CEOs are unhappy toward any public event (e.g., budget/finance policies), they may express their opinions toward it, which may be indicated by a negative sentiment post analysis. Around 12.86% of the tweets posted by CEOs are containing angry words and 13.26% of the tweets showing the sadness of CEOs on various events. On an average, 47.98% of the tweets posted by CEOs contains trustworthy words which help them in increasing the trust of the people in them and their organization. CEOs are also sharing their joyful moments with the public through Twitter. On average around 35.42% of CEOs, tweets are classified as containing joyful emotions. Figure 7.6 illustrates the words being used by CEOs for showcasing their sentiments on Twitter.

7.5.2 SDGs Awareness and Relationship Between CEOs and Followers

Research Question 2 Whether CEO's are tweeting about the concerns and issues raised by the Sustainable Development Goals (SDGs) introduced by United Nations (UN) in 2015?

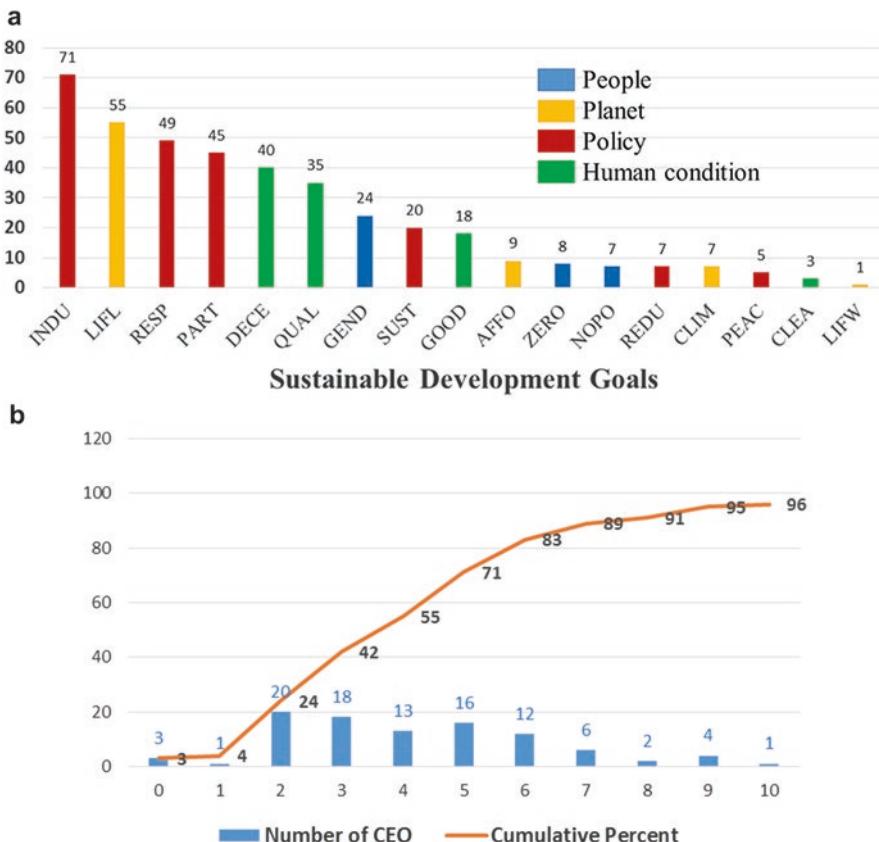


Fig. 7.7 (a) Number of CEOs concern about each SDGs and (b) number of SDGs followed by CEOs. Note: INDU industry, innovation, and infrastructure, LIFL life on land, RESP responsible consumption and production, PART partnerships for the goals, DECE decent work and economic growth, QUAL quality education, GEND gender equality, SUST sustainable cities and communities, GOOD good health and well-being, AFFO affordable and clean energy, ZERO zero hunger, NOPO no poverty, REDU reduced inequalities, CLIM climate action, PEAC peace justice and strong institutions, CLEA Clearwater and sanitation, LIFW life below water

Figure 7.7a shows the inclination of the CEOs toward SDGs and also mapped the SDGs and their frequency to SDG categorization presented by Chakravorti (2017). The inclination of the CEOs toward the SDGs was found by mapping the CEOs topics to SDGs. If any of the CEOs' topics match to SDGs themes then CEOs were awarded the score. The most popular SDG among CEOs is “industry, innovation, and infrastructure” with around 73.96% of CEOs are following it. Around 18 out of 96 CEOs are concern about “good health and well-being” and motivating their followers to take care of their health by discussing vaccination, alcohol, and tobacco control. From Fig. 7.7b, it can be derived 57.7% of the CEOs talk only about less than or equal to four SDGs. Based on the content analysis of tweets after topic

modeling, it appears that none of the CEOs are concerned about more than ten SDGs, based on their social discussions.

Table 7.1 illustrates the percentage of the awareness of SDGs among CEOs on the basis of their demographics such as gender, size of the company, location, and industry. In the table after the category, the total number of instances occurred in the sample are written within the brackets. For gender category the lowest percentage is indicated by red and highest by green. For location the lowest percentage is indicated by white and highest by green for other categories; more the amount of the color in the cell more the category is inclined toward the SDGs.

Figure 7.8 shows the connection among the CEOs on the basis of SDGs followed. Different industries have different takes on the SDGs. The SDGs followed within industries depend on whether the organization is an SME or MNC. Figure 7.8a provides the three-dimensional view of the SDGs followed (represented by the size of the node) by SMEs and MNCs (represented by the shape of the node) among various industries (represented by color of the node). The SDGs followed within industries depend on the headquarter location of the organization as well. Figure 7.8b provides the three-dimensional view of the SDGs followed (represented by the size of the node) by male and female CEOs (represented by the shape of the node) across the global (location represented by color of the node).

Table 7.1 Percentage of the awareness of SDGs among CEOs on the basis of their demographics

Sustainable Development Goals	Gender		Company size		Country			Industry					
	Female (9)	Male (87)	MNC (72)	SME (24)	UK (12)	US (70)	Other (14)	Manu (13)	Fin (16)	Serv (54)	Reta (2)	Tran (11)	
No poverty	0	8.05	6.94	8.33	0	5.71	21.43	7.69	6.25	9.26	0	0	
Zero Hunger	0	9.2	8.33	8.33	0	5.71	28.57	15.38	6.25	9.26	0	0	
Good Health and well-being	22.22	18.39	22.22	8.33	16.67	18.6	21.43	30.77	18.75	13	50	27.3	
Quality education	22.22	37.93	38.89	29.17	25	40	28.57	46.15	31.25	35.2	0	45.5	
Gender Equality	66.67	20.69	29.17	12.5	33.33	24.3	21.43	46.15	31.25	16.7	50	27.3	
Clearwater and sanitation	0	3.45	1.39	8.33	0	4.29	0	7.69	6.25	1.85	0	0	
Affordable and clean energy	0	10.34	12.5	0	0	11.4	7.14	7.69	6.25	11.1	0	9.09	
Decent work and economic growth	33.33	42.53	43.06	37.5	41.67	37.1	64.29	53.85	56.25	35.2	0	45.5	
Industry, innovation and infrastructure	88.89	72.41	76.39	66.67	83.33	67.1	100	76.92	81.25	70.4	50	81.8	
Reduced Inequalities	11.11	6.9	8.33	4.17	0	10	0	15.38	6.25	5.56	0	9.09	
Sustainable Cities and Communities	33.33	19.54	18.06	29.17	33.33	17.1	28.57	53.85	6.25	14.8	0	36.4	
Responsible Consumption and production	55.56	50.57	55.56	37.5	83.33	44.3	57.14	69.23	50	44.4	50	63.6	
Climate Action	0	8.05	8.33	4.17	8.33	4.29	21.43	15.38	6.25	5.56	0	9.09	
Life below water	0	1.15	1.39	0	0	1.43	0	0	0	1.85	0	0	
Life on land	33.33	59.77	55.56	62.5	41.67	61.4	50	69.23	62.5	55.6	0	54.6	
Peace justice and strong institutions	0	5.75	4.17	8.33	0	7.14	0	7.69	0	7.41	0	0	
Partnerships for the goals	11.11	50.57	52.78	29.17	25	47.1	64.29	46.15	43.75	46.3	50	54.6	

MNC multinational corporation, *SME* small-/medium-sized enterprise, *Manu* manufacturing, *Fin* finance, insurance, and real estate, *Serv* services, *Reta* retail trade, *Tran* transportation, communications, electric, gas, and sanitary service

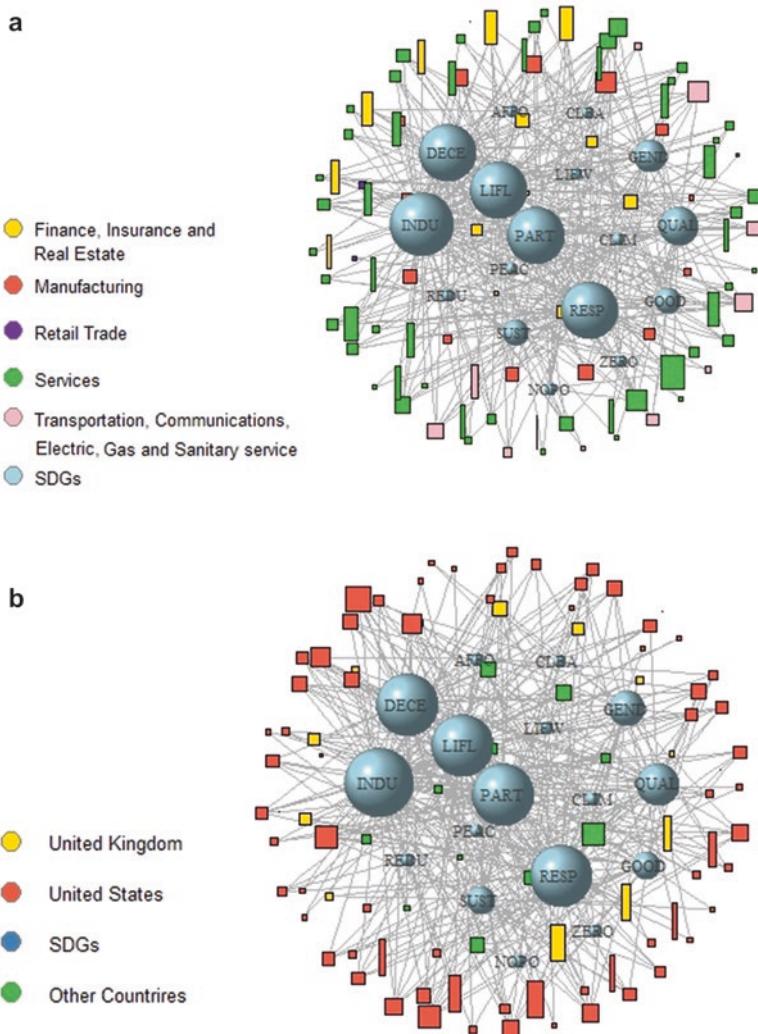


Fig. 7.8 (a) Depicts the following of SDGs by SME-CEOs as rectangle and MNC-CEOs as square across various industries represented using the color of the node; (b) depicts the following of SDGs by female CEO as rectangle and male CEO as square across various countries represented using the color of the node

7.6 Discussion

Descriptive analysis of the sample extracted from Twitter shows among 96 CEOs; 21 CEOs has more than 10,000 tweets, which implies Twitter had been used by CEOs extensively for communication and public relations purposes. The large fan base is following CEOs on Twitter, and CEOs are following many pages of Twitter

for news and updates as depicted from Fig. 7.2c. Around 25 CEOs are following more than 1000 pages on Twitter. Thus from the descriptive analysis, it can be said, Twitter is being used by CEOs for sharing their opinions, likes, and dislikes.

CEOs are talking about improving people's life through empowerment, startup, leadership, and entrepreneurship. CEOs are tagging #artofpeople, #leadership, #entrepreneur, #innovation, and many more hashtags relating to skills and empowerment in their tweets. It seems like CEOs are motivating the public for their career opportunities. Thus from descriptive analysis, it can be said, CEOs are mostly tweeting about the positive themes and centered around organizational campaigns.

Using content analysis, CEOs tweets were mapped to SDGs. The mapping was used for getting the overview of the tweets posted by CEOs relating to SDGs themes. The popular SDGs among the CEOs are industry, innovation, and infrastructure, life on land, responsible consumption and production, and partnerships for the goals whereas the SDGs relating to environment and nature are less popular among the CEOs. Around 41 CEOs are talking about more than five SDGs on Twitter.

CEOs are driving forces behind industries and take an important role in shaping the role of a firm in the society and its perception within social communities (Lin et al. 2016; Kashmiri and Mahajan 2017). Now, these CEOs are directly interacting with the different stakeholders of the organization, such as customers, employees, and investors, over social media platforms. Therefore they could become influencers for the propagation of policies and guidelines targeted for the betterment of the society. Through social media platforms such as Twitter, CEOs are expressing their feelings for various events happening across the world. So a strong possibility emerges that if leading CEOs start discussing SDGs in social media, they will act as influencers and assist in improving awareness about these SDGs in the socioeconomic ecosystem in which their firm operates (Carmeli and Paulus 2015).

7.7 Conclusion

The research paper focuses on the information dissemination by the CEOs about United Nations' SDGs through one of the leading social media platforms, Twitter, which is having 313 million active users (Statista 2016). There are around 193 member states which had signed the agreement with United Nations for implementing the SDGs at the national level. Our research indicates the CEOs of MNCs and SMEs can help the government in implementing the SDGs at the government level. The research outcome can help the government and policy makers in deciding to collaborate with industries on the group of the SDGs which are famous among the CEOs, and both can be benefited by following SDGs. The research paper also gives the overview of how Twitter handles being used by CEOs. By analyzing these it can be suggested, if some organization pushes these CEOs on SDGs themes, then these CEOs can act as the great influencers of SDGs theme on Twitter.

7.8 Limitations and Future Research Directions

The current research is somewhat limited from bias which may occur due to topics which may not be identified if any of the discussion was not following the English dictionary. Shortened and vernacular language modeling would have also posed a limitation to the outcome of the study. Further, the unavailability of any detailed database, which had a list of the Twitter profiles of all the CEOs across industries, poses some sampling challenges.

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Chapter 8

Assessing E-Government Project Outcome: A Service Provider's Perspective



Harjit Singh, P. Vigneswara Ilavarasan, and Arpan Kumar Kar

Abstract The main purpose of this research study is to conceptualise a comprehensive framework for assessing the overall outcome of e-government projects in context multi-stakeholders with focus on service provider. There is a growing need especially in developing countries to know whether the e-government projects are comprehensively achieving their desired objectives and if each stakeholder of the initiative is performing its role as expected, especially the service provider under public-private partnership. We need tools and models to know and understand this domain more holistically. Most of the studies in the area of e-government performance assessment have been done considering citizens as stakeholder. The perspectives of other stakeholders are hardly part of literature available on e-government. A comprehensive framework for assessing the performance of e-government projects has been conceptualised as part of this research and would be empirically validated as part of the future scope of the research. This framework will have the competence to evaluate an e-government initiative from the perspective of service providers. The practical assistance we can get from framework would be to evaluate the impact of an e-government initiative by comparing with the earlier proposed objectives for it, so that the results can contribute to the subsequent decision-making related to the concerned projects and also to assist the government in making decisions for the future e-government initiatives.

Keywords Assessment · E-government · Framework · Performance · Service provider

8.1 Introduction

Information and communication technology (ICT) worldwide is spreading very fast in all spheres of society. Government tasks contain collaboration and interaction with citizens, own backend office and with other government agencies. Governments

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worldwide are developing various capabilities to deliver public services using ICT to their stakeholders. The businesses and citizens are now using the ICT very predominantly, especially the Internet, and are getting rewarding experience from electronic services from the private sector (e-commerce). Same service standards are being expected from the government agencies now. Digital services at all levels in government can be a prominent tool for improving the quality of life of citizens. The focus of governments is to shift maximum public services as e-services to the citizens and use it as a channel to promote economic development and effective as well as efficient governance. The government has to ensure that there is an end-to-end enablement of the government business processes and citizen services as e-services.

The public-private partnership (PPP) implementation in e-government involves (Sharma 2007) the acceptance and involvement of some crucial successful practices and inclusion lessons learned from previous practices and assignments. This model has come up as a sustainable and successfully workable business model for implementation of e-government across. This model is particularly recommended for emerging economies and developing countries, where there is already a scarcity of resources like finances and technical skills with the governments. This PPP model for managed services (Chakrabarty 2008) enables governments to concentrate on core and crucial activities and shifting the technology-related requirements to IT professionals (ICT partner).

Heavy investment from the governments goes into e-government projects. The gestation period of large projects is also quite long. Multiple stakeholders strive together to achieve the objectives of the projects. A system has to be effective and efficient for the highest utility to the user of the system. However, with governments running on tight budgets, especially in case of developing countries like India, there is an increasing demand to know the performance of the e-government initiatives. So, the question arises, "Is there a possibility of having a good framework that can assess the performance of a large e-government project from the perspective of different stakeholders in a comprehensive manner?"

This paper is a part of the ongoing research wherein a holistic framework is being developed from the perspective of multiple stakeholders to evaluate and assess the performance of e-government projects. The focus of this paper is in context of the service providers.

This paper consists of six sections. The first section provides the introduction, background, definitions and context of different terms used. The second section covers the literature review done for this research plan. The third section gives details about the identified research gaps in respect to the studied aspects and the research objectives. The fourth section covers the conceptualised frameworks of performance assessment and detailing with the perspective of service providers. The last section provides the concluding discussions and future research.

8.2 Literature Review

E-government research touches many other research domains, such as information systems (IS), public administration, management and political science. In the literature review, it is observed that in every e-government study or research, some of the literature cited is definitely from information systems or e-business concepts modified in some way to fit into a public administration perspective (Heeks and Bailur 2007). In literature we come across various definitions of e-government, however, all stress for the use of information technology, for electronic delivery of public services to citizens, businesses and other government agencies (Palvia and Sharma 2007). Besides citizens, the other stakeholders of e-government initiative are government, businesses, employees, intermediaries and the service providers (Singh et al. 2017). Each of these stakeholders has a specific role in the execution of any e-government project that influences the performance of the project.

It is seen in developing countries that a lot of e-government project got dumped just after implementation or major proposed objectives were not achieved for those initiatives (Dada 2006). Also, while conceiving any e-government project, one should consider both the negative and the positive aspects that influence the acceptance and adoption of any ICT system (Rowley 2011). The development and integration (coupling) of strong back-office systems (upstream and downstream) to support is an essential factor in achieving the best of the front-end portal of an e-government initiative. A weak or no backend support generally leads to failure of any e-government initiative (Klievink and Janssen 2009; Theocharis and Tsirhrintzis 2013; Goldkuhl and Röstlinger 2014).

There are many technological developments in the IS domain, yet the fundamental role of IT has not changed (DeLone and McLean 2004), which can be inferred that the IS success and its underlying components are still the same, and with inclusion of new metrics, the modified version of the model was successfully applied to e-commerce success measurement. The enhanced DeLone and McLean IS success model (DeLone and McLean 2003) with the exclusion of some links was proposed and validated in e-government domain in context of citizens (Wang and Liao 2008), however, on a single case study. This was further modified and validated in context of trust of stakeholders in government and its influence on IS quality determinants (Chen et al. 2015).

There are a number of proven theories and models relating to adoption of IS available in literature which in some form or the other are being very frequently referenced in research and studies of e-government domain (Alryalat et al. 2011). In literature, technology acceptance model in some form (Davis 1989; Venkatesh and Davis 2000) is one of the most frequently used models for research and studies into new information technology acceptance. It submits that when users are offered any new technology, two factors, the perceived usability and utility and the perceived ease of use for the system, determine the attitudes to adopt new technologies.

However, instead of original TAM, most of the studies used modified or enhanced versions of TAM (Turner et al. 2010), and the results were affected by the new variables that were inducted in the modified versions of TAM. An important model in this area is the UTAUT model (Venkatesh et al. 2003), the unified theory of acceptance and use of technology, which is an enhancement from TAM and is an integration of predictability capabilities from different existing models of technology acceptance to cover prediction of behavioural intention towards the acceptance of information technology through performance expectancy, effort expectancy and social influence. Assessment of performance of e-government projects is an important matter (Esteves and Joseph 2008), and the lack of formal methods for monitoring and assessing comprehensive e-government assessment has led to a significant slowdown of e-government development and needs to be further improved in order to give policymakers better evaluation criteria for their decisions. The assessing and appraising of electronic government are multifarious and multidimensional tasks (Luna-Reyes et al. 2012).

The development of e-government is an evolutionary process. E-government initiatives grow over time to include a variety of features, functions and services. Most used maturity model for e-government initiatives, the model given by Layne and Lee. It comprises of four stages (Layne and Lee 2001). E-government projects progress through these four stages of development, with increase in their combination, technological and organisational construction intricacies.

The search on SCOPUS database was done with restriction to publications for 10 years (year 2005 to 2016). A total of 922 studies were shortlisted in this phase. A more detailed review was then conducted by applying the inclusion/exclusion criteria based on the studies that focus on performance of e-governance projects. Finally, 64 studies were filtered out for the thorough and comprehensive study of each one of them.

Most of the research in e-government assessment has focused on citizens (Singh et al. 2017). It explains the importance of citizens for any e-government assessment. The focus on other stakeholders is insignificant.

8.3 Research Gap and Research Objective

In literature review exercise, it was clearly evident that the researches and studies of performance evaluation of e-government (including frameworks and models) are focusing on citizens as stakeholder of e-government. The perspective of other stakeholders, although crucial, has not been the focus of the research literature on egovernment assessment.” A detailed literature review exercise using the systematic literature review process identified a list of constructs which are being used in e-government research. Some are dominating and have been used across studies. However there are some constructs which the literature says are important but are not being much used in existing research on performance assessment frameworks. Evidence of research on e-government performance frameworks in the perspective of the maturity stages of the e-government system is also not available in the existing literature.

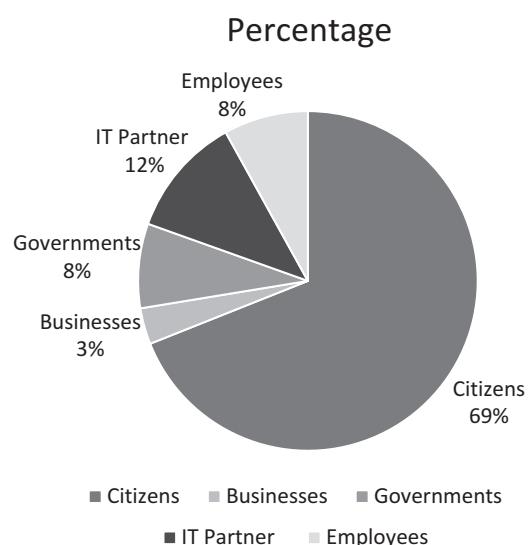
The above research gaps led us to derive objectives of this research. An effective measurement of performance of e-government initiative would direct to better investments and, therefore, clear and larger benefits for stakeholders and the society in general. Keeping these points in focus, following research objectives have been identified:

- To examine the frameworks and models from research literature which are being used or referred for assessment or evaluation of performance of e-government projects and identify the various factors, components, dimensions and constructs
- To develop a framework to evaluate the performance of e-government projects with multi-stakeholders' prospective providing special focus on service provider as key stakeholder

8.4 Conceptualised Framework

This framework has been conceptualised using the results of our literature review exercise. The review identified a total of 126 unique constructs from 64 studies. Most of the constructs and factors of the examined e-government models and frameworks are from the well-known models and theories from the literature of information systems like service quality, system quality, information quality, use, user satisfaction and net benefits (DeLone and McLean 2003). Others factors are from different versions of TAM like perceived usefulness and perceived ease of use and usability. An e-government adoption model based on the theory of planned behaviour (TPB) was developed and is an important contribution to literature (Ozkan and Kanat 2011).

Fig. 8.1 Stakeholders focused in research literature



The framework put forward in this study (explained in Fig. 8.1) comprises a conceptualised framework which could support to find areas of opportunity for expansions and will make it possible to fulfil the e-government goals and objectives proposed at the organisation level. Assessment of e-government initiatives is connected to sustainable resourcing and progress of the organisation. This framework can also be used as a template for assessment by policymakers before, during and after the completion of any e-government project.

The scope of assessment in e-government initiatives focuses on characterising the key stakeholders of the e-government projects. Recognising the context of all the key stakeholders in e-government projects creates the foundation for comprehensive evaluation and assessments process. This will lead to an important decision for the optimum usage of the framework. This stress of the framework is on evaluating the importance of the project for each of the stakeholders. The constituents of the framework are the constructs in different context of key stakeholders. New dimensions have been added on the enhanced version of information systems success model (DeLone and McLean 2003). With this inclusion, the new enhanced version can be applied for success of e-government assessment and measurement in context of multi-stakeholders of the initiative. These constructs are not to be considered in isolation instead to be considered as group or cluster. In this case, the meaning and context of each construct would be based on the context and the cluster being considered. For evaluation and assessment of the project to be effective and valuable, the perspective of the stakeholder and maturity level e-government (Layne and Lee 2001), of the concerned project, must be judged, evaluated and measured together. The importance of each dimension, factor and the construct, is to be classified in perceptive of the project being studied. Most of the time, for each of the stakeholders, a subgroup of the construct/factors termed in the proposed framework would be significant and relevant. This will also depend on the maturity level of that concerned e-government project, the nature and class of the concerned e-government project and also the type of the implementation or executor government agency. As part of this framework, for each stakeholder, the value of each identified and applicable construct is to be measured to lead to the total value delivered by the project with respect to stakeholders.

8.4.1 Service Providers Centric Performance Assessment Framework (SPCPAF)

The conceptualised framework with the perspective of service providers (ICT partners) has been illuminated in Fig. 8.2. Figure 8.3 shows the relationship among different relevant constructs as part of framework including in the context of impact of maturity stage (Layne and Lee 2001) of the e-government project on these relationships (Fig. 8.3).

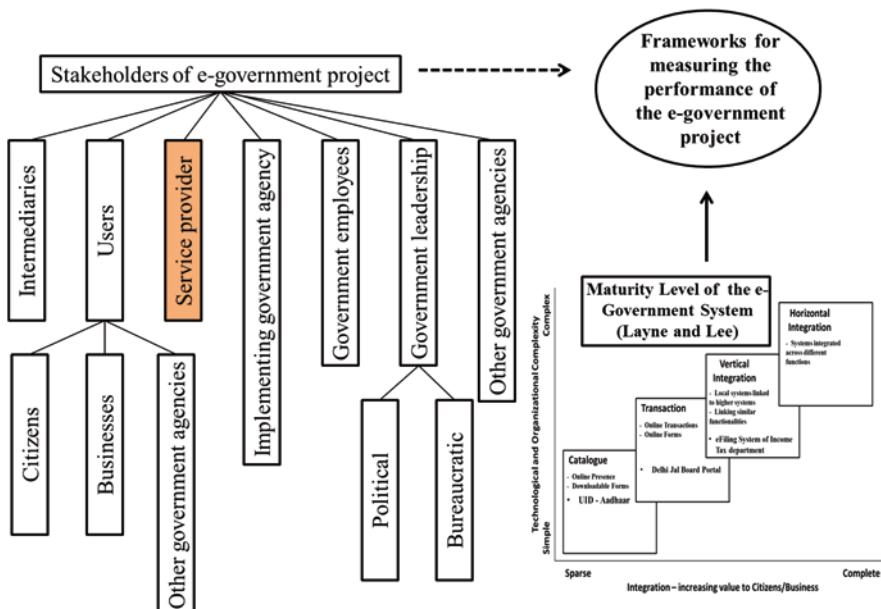


Fig. 8.2 Proposed approach for measuring the performance of e-government project

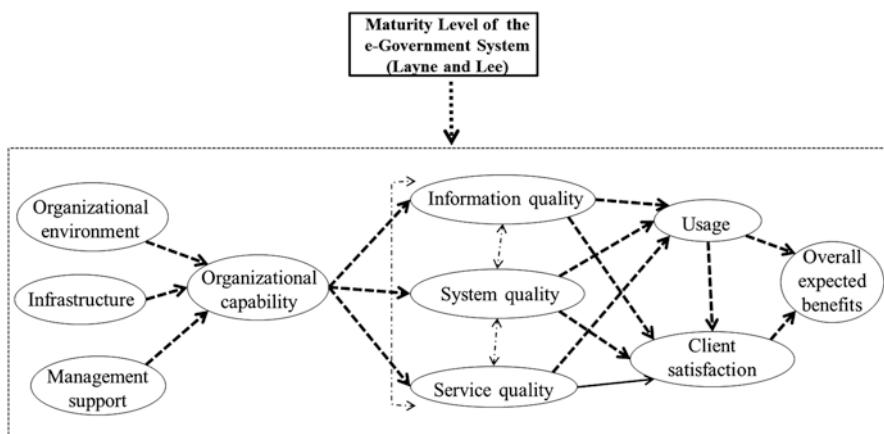


Fig. 8.3 Framework for evaluation of performance with the perspective of ICT service providers (SPCPAF)

Construct Relations: In Context of Service Providers (the ICT Partners)

The following are the details of the framework in context of service providers (the ICT partners) of the e-government system.

Management Support Positively Affects Organisational Capability

In the first step, we explore the relationship between management support and organisational capability. In existing literature, indications are presented that management support in organisations facilitate achievement of tacit and explicit objectives of the organisation, which may be embedded within the organisation's vision and mission statements. In the process of trying to achieve these objectives, organisational capabilities are enhanced with due support from senior management. Thereby we envision that management support should positively impact organisation capability.

Infrastructure Positively Affects Organisational Capability

The relationship between the organisational infrastructure and organisational capability is studied. Inter- and intra-organisational systems like knowledge management and learning management systems, use of technology in decision-making, human resources and other organisations support activities like finance, planning and technology development.

Organisational Environment Affects Organisational Capability

The relationship between the organisational environment and organisational capability is explored. The finding of the literature shows that organisational work culture, policies of the organisation (Yusof and Yusuf 2013), collaboration among stakeholders of the organisation, usage of organisational systems and power distance affect the development of organisational capabilities.

Organisational Capability Positively Affects Information Quality

Organisational capability for ICT services organisation is an outcome of technical knowledge as well as domain knowledge of the organisation across spectrum of technology platforms and business domains. Organisational capability is the inherent capacity, generally built over the time. It is expected that the organisations with strong technical and domain capabilities deliver high information quality.

Organisational Capability Affects System Quality

We explore the relationship between organisational capability and system quality. It is expected that the organisations with strong technical and domain capabilities deliver high quality on development, implementations, operations and management of IT systems.

Organisational Capability Affects Service Quality

The relationship between capability of the organisation and the service quality delivered was explored in the study. Core and distinctive competencies (Azhar 2008) fulfil a valuable purpose if used to develop continues and sustainable strategic advantage through constructing the organisational capacity. It is expected that the organisations with strong capabilities score high on quality of their service delivery.

Information Quality Positively Affects Intention to Usage

Information quality is measured in terms of “right information at right time to right persons and in right quantity”. It is the measure for how precise, appropriate, well-timed and comprehensive the information is to focus on the requirements. From the literature it is observed that higher level of information quality boosts performance of users (Borek et al. 2014) and hence strengthens the usefulness, which means reinforced intention to usage.

Information Quality Positively Affects Client Satisfaction

It is expected that users will feel satisfaction while using the system, because information quality (complete, reliable, relevant and timely) is expected to help them optimally and effectively in using the system (Beldad et al. 2010; Chen 2010). User satisfaction leads to a satisfied client (the government organisation for the service provider).

System Quality Positively Affects Usage of the System

System quality is the extent of the working and scope of the functions covered by the system focusing on the customer requirements and with easiness (DeLone and McLean 2003; Chang et al. 2005), like user interface and ease of use of portal and response time of information system. High delivery of quality of the system is a necessary feature of any IT system, and a positive impact on usefulness and usage of the system is expected.

System Quality Positively Affects Client Satisfaction

It is expected that users feel satisfied in using the system, because ease of use expected to attract them to use the system. The system quality like transaction processing rate and response time representing the efficiency and effectiveness of the system enhances user satisfaction level (Rowley 2011; Venkatesh et al. 2012). Satisfied user will lead to satisfied customer (the government organisation) for the service provider.

Service Quality Positively Affects Usage of the System

The main objective of an e-government system is to deliver high-quality services to its citizens or businesses. Hence the service quality of the e-government system is very important. The service quality is generally gauged based on reliability, responsiveness and assurance, which is significant for success of an e-government initiative. Better service quality increases the opinions of usefulness and the usage of the system.

Service Quality Affects Client Satisfaction Positively

The service quality is an important feature of any e-services system because factors like empathy, truthfulness and timeliness of the responses to service requests increase the user satisfaction, which lead to client (government agency) satisfaction. The other important factors like willingness and potential to provide service influence the client satisfaction.

Usage of the System Positively Affects Client Satisfaction

A system is useful only if it delivers overall benefits. The system is perceived to be more useful and expected to have better usage if it performs the critical tasks, and hence inspires the user satisfaction. The more useful the system, the user is expected to be more satisfied from that system.

Usage of the System Positively Affects Overall Expected Benefits

If the perceived usefulness and the usage of the system are higher, it is easier to realise and support the overall value in the e-government systems (Rowley 2011), and it will make it simpler to understand the benefits and advantages of the investments. Cost benefits to the end user for usage of the system and productivity (Yusof and Yusuff 2013) are important factors which impact the usage.

Client Satisfaction Positively Affects Overall Expected Benefits

It is to be believed that government is providing e-services to benefit of the society and to get maximum for the public values. Defining the overall benefits mainly depends on the context of the stakeholder and the perspective it is being measured. Economic factors for all stakeholders are always part of the overall benefits. Positive or negative, the overall net benefits with the context of stakeholders of the system also impact the later usage of the system and stakeholders' satisfaction from the system (DeLone and McLean 2003).

Overall expected benefits generally measured in terms of net benefits depend upon the usage of the system and the satisfaction. Maturity level of the e-government project (Layne and Lee 2001) under study may impact the effect of each of the above relations. The quantum of the impact vary for each of these relationships.

8.5 Discussion

In this case study, as the perspective is that of service provider, the satisfaction of the client is a critical outcome (the government agency providing the e-service to the citizen and businesses). Continued usage impacts the satisfaction. Both these factors are further impacted by quality factors, namely, the system quality, service quality and information quality. The organisation (service provider) can deliver these qualities only if it has the organisational capability. It is evident in literature that the resources of the organisation even though valuable and unique may be worthless without organisational capability. Core and distinctive competencies are powerful assets for building organisational capability. However, management support, organisational environment and the infrastructure are the factors which impact the organisational capability. This resulted into the service providers centric performance assessment framework.

The study analyses the e-government models and frameworks in the existing literature on evaluation and assessment of performance, with the objective of identifying important and most used constructs. Based on the analysis, a comprehensive framework for assessing the performance of e-government projects is conceptual-

ised which considers the perspective of multiple stakeholders. These stakeholders are government agencies, citizens, businesses, service providers and employees of the concerned government agency. The literature review based on the existing studies reveals that citizens are the most focused stakeholders in the e-government scenario and have been widely researched. The other stakeholders including government, employees and services providers among others have not been considered while assessing e-government performance frameworks in the past.

The literature review study observed that there are some constructs that have been used across the studies of e-government assessment frameworks and IS adoption models. These are, for example, user trust, infrastructure, usefulness, user satisfaction, ease of use, security, transparency, quality (system, service and information), service affordability and empowerment. The scope and business functionality along with the perspective of the stakeholder of concerned e-government project actually leads to the applicability of constructs in the framework. The framework has been detailed in context of service providers (ICT partners).

This research is expected to contribute to the existing literature of information system and e-government through developing a comprehensive set of frameworks for the assessment of performance of an e-government project from the perspective of service provider as a stakeholder. Prior literature has not accommodated the perspective of maturity models of e-government services. We also introduced the context of the maturity level of the e-government system. These results would be helpful reference for future empirical studies in the similar fields.

8.6 Conclusion

The practical implication of the framework will be to evaluate the effectiveness of an e-government project by comparing it with the planned objectives, so as to be a factor to subsequent decision-making of the concerned project and to guide policymakers of government agencies, in making decisions about their current and future e-government initiatives. Policymakers would be empowered to think from the perspective of maturity of the e-government systems and the perspective of the stakeholders for the system.

While progressing in this research, some of activates which as part of this research process have also contributed to the knowledge repository. These are like a comprehensive and theme-based literature review on e-government assessment and the development of tools (set of customised questionnaires) to collect the relevant data for the frameworks. This literature review exercise also provides insights into the research in e-government assessment frameworks and models in terms of stakeholders and the economies where such studies have been held, thereby highlighting some gaps for future research.

The limitation of this study is that the framework presented is still conceptual in nature. It is to be validated in the future research using survey-based empirical methods based on statistics for hypothesis validation. The same framework may be

further validated in the future by examining on a spectrum of e-government projects, especially at different stages of e-government maturity levels. The outcome of the research as well as the limitations could be the bases for the future research further in the field of multi-stakeholder perspective of e-government projects.

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Chapter 9

Perceived Information Risk While Providing Sensitive Information for Consuming Digital Services



Syed Ziaul Mustafa and Arpan Kumar Kar

Abstract Since the increase on use of the digital services, there has been growth of risk surrounding information. So the measure of the information risk while using digital services has been a concern for the information security managers. The purpose of the study is to develop a conceptual model which can be used to measure the information risk while using digital services. The sharing of information during the purchase of the digital services is very certain. The conceptual model develops the antecedents of the information risk. The antecedents are network environment characteristics, network trust, general information security awareness, perceived information privacy concern and information type. The model also includes the contrast which shows the willingness to buy the digital services. It includes perceived risk, trust in service provider, perceived size and reputation of the digital service provider.

Keywords Information risk · Perceived risk · Digital service

9.1 Introduction

Most of the time, information risk happens because of missing or inaccurate data in the digital services (Nazimoglu and Özsene 2010). Risk related to information arises in all the hierarchy of an organization. Privacy risk (Alalwan et al. 2016; Chen and Huang 2016; Cocosila et al. 2009; Featherman et al. 2010; Glover and Benbasat 2011; Roy et al. 2016; Singhal and Kar 2015; Zhang and Benyoucef 2016), strategy risk (Drew 2007; Sherer and Alter 2004) and decision risk (Benaroch et al. 2006; Mitchell 1999) are also a part of the information risk (Cohen 2008; Drew 2007);

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Easley et al. 2002; Lee et al. 2016; Luo et al. 2010; Mohd Nishat Faisal and Banwet 2007; Roy et al. 2016; Sharma and Routroy 2016; Sherer and Alter 2004). With the increase in the legalization of the privacy in the jurisdiction as regards to what kind of information should be captured by the individuals and how the organization should use the captured information. Information risk also happens because of collecting unwanted, outdated information (Smith et al. 2001).

In the modern organization system, organization uses the information to make decisions. The decisions made by the organization contain risk. This type of risk is often called as the decision risk (Benaroch et al. 2006; Mitchell 1999). Risk is generally perceived as the negative outcome of any transaction (Alter and Sherer 2004; Chen and Huang 2016; Dinev and Hart 2006; Dowling and Staelin 1994; Janssen et al. 2017; Lee et al. 2016; Lim 2003; Sherer and Alter 2004; Youn 2005). In general information acts as an internal logic of an organization. Project manager, sales manager and executive members do not have control on the information they receive. Sometimes wrong information leads to the wrong decisions, which may lead to the loss of an organization. It has been noticed that the uncertainty and complexity involved in the information may also lead to information risk. Most of the time, the strategic decisions have been taken with the right information, in the right format and at the right time (Smith et al. 2001).

Williams, Chatterjee, & Rossi (2008) define digital services as ‘services or resources accessed and/or provided via digital transaction’. Most of the researchers said that the digital services are services which are obtained and/or arranged through a digital transaction like consumer services and software services over Internet Protocol (IP). Value-added services of the mobile phones are also digital services. Normally digital service provider provides services to the consumer directly (Wang and Li 2012).

The study has been categorized into six sections. The first section introduces the information risk and digital services. Literature review is in the second section. The third section gives the conceptual model. The fourth section describes the research methodology. Theoretical implications and practical implications are discussed in the fifth section. The sixth section discusses the limitations and future research direction.

9.2 Literature Review

Since the use of the Internet, the consumer has become very much cautious about sharing their personal information in the digital transaction (Bryce and Fraser 2014; Culnan and Williams 2009; Dinev and Hart 2006; Dong et al. 2014; Sharma and Routroy 2016; Steenbruggen et al. 2015; Teo et al. 2008; Yadav and Dong 2014). The digital transaction comprises of network infrastructure, the service provider (Featherman and Pavlou 2003) and the willingness of the consumer to share the personal information. The sharing of personal information includes perceived information risk. Organizations such as banking, airlines, supply chain and

telecommunication are making their whole effort to go fully online by closing the offline offices, but the consumers are reluctant to go online (De Ruyter et al. 2001). The penetration of digital services is becoming very high because of the penetration of Internet-based services (Froehle and Roth 2004). Thompson and Bloom (2000) highlights that when information risk manager has been told to identify the actual reason for consumers to not sharing their personal information online then the risk manager don't give any concrete reasons for that. So Smith et al. (2001) defined the information risk as the risk which generally arises from inaccurate or missing data. Since then there has been no consensus about information risk.

It is said that the information risk surrounds all the level of the organizational management. Most of the time, it has been noticed that the information risk arises because of two major reasons: first of all taking too much of information from the consumer and second not being able to properly manage the collected information by removing the unwanted information. The frequently use of digital services needs the information of the consumer frequently which increase the information risk. Specifically Roy et al. (2016) conclude that the information risk is an important construct in the adoption of the Internet-based services.

9.3 Conceptual Model (Fig. 9.1)

9.3.1 *Network Environment Characteristics*

Network environment characteristics have been defined as the threat and risk pertaining to the information technology (Loch et al. 1992). The risk created by the vulnerability in the network environment also creates information risk as discussed by Chen et al. (2011).

9.3.2 *Network Trust*

Trust in any network can be defined as the sense of confidence and security among the friends and family member (Couch and Jones 1997). The trust in the Internet network is perceived when a consumer is able to transfer the sensitive information. The construct network trust is an important construct for the information risk and intent to provide sensitive information online while purchasing digital services (Batty et al. 2012). Trust in the network increases confidence and dependence with the digital service provider. The trust in the network is assumed to be positively related with the information risk which increases the confidence in the consumer's intent to provide sensitive information. Once the consumer is confident and gets trust in the network, then he/she will be willing to buy digital service (Couch and Jones 1997).

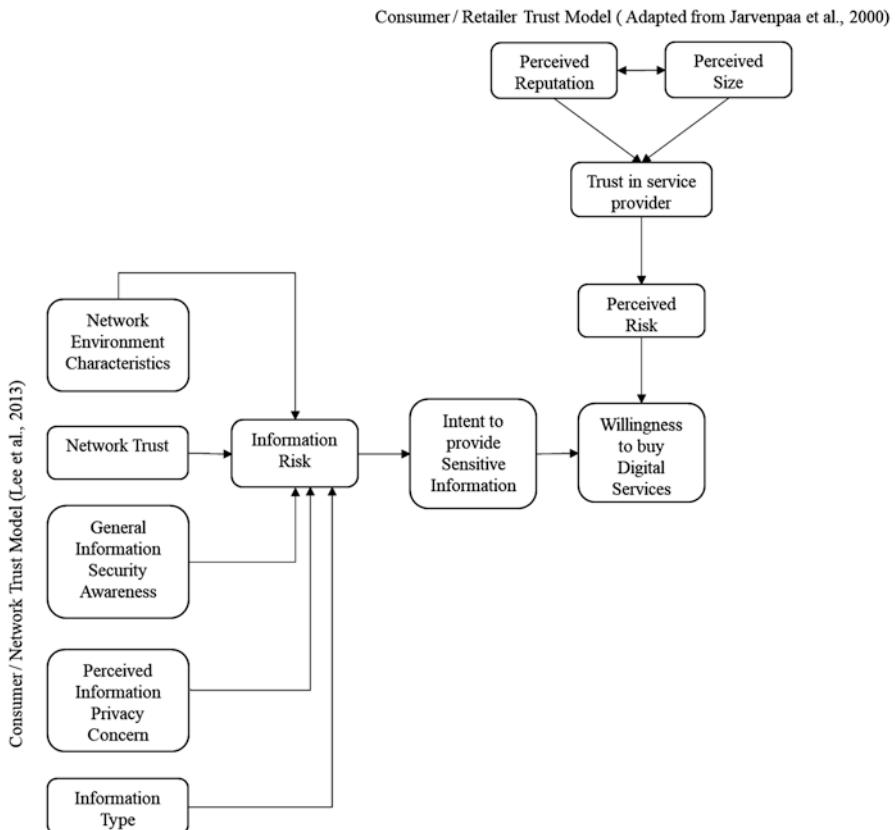


Fig. 9.1 Information risk to provide sensitive information while using digital services.

9.3.3 *General Information Security Awareness*

It is a fundamental for the information security. This construct is used in the model to evaluate the information risk and provide information to the consumer about the privacy concern and environmental danger. It also creates a belief on the service provider through their consumers (Bulgurcu et al. 2010). It also informs the consumer about the information risk associated with the purchase of digital services.

9.3.4 *Perceived Information Privacy Concern*

This construct is added in the integrated model which informs the consumer about the information privacy concern. The privacy concern also informs the consumer about the environmental dangers it may faces during the digital service transaction (Malhotra et al. 2004). The information privacy concern enables consumer to achieve

the anonymity by revealing minimum amount of personal information (Hernández-Ramos et al. 2015). In general information privacy concern is related to the risk perceived by the consumer. In most of the cases, it is also called as the misuse of information risk by Glover and Benbasat (2011). Malhotra, Kim, & Agarwal, (2004) suggest that there are four dimensions of information privacy concern which are collection, errors, improper access and unauthorized secondary use of the information.

9.3.5 Information Type

Information types play an important role in digital service transaction process. The types of information will be used to evaluate the information risk perceived by the consumer. This construct is included to generalize all types of services including digital services (Lee et al. 2013). The types of information requested by the digital service provider processes privacy threat and information risk. Most of the time, the consumer checks if the type of information being collected by the service provider is correct or not and how it is being used (Malhotra et al. 2004).

9.3.6 Perceived Reputation

The perceived reputation of the digital service providers affects the trust of the consumer in the service provider (Jarvenpaa et al. 2000). The concept of perceived reputation of the service providers affects the intention of the consumer to purchase the digital service or not (Chen and Huang 2016; Featherman et al. 2010). It also invokes the sense of trust in the consumer. The honesty of the service providers also gets reflected through the reputation of the service provider. According to Zhang et al. (2015) reputation perceived by the consumers will be high when he/she experiences timely delivery, accurate billing and excellent service, but when the expectations of the consumer are not met, the perception about the service provider will become negative.

9.3.7 Perceived Size

Perceived size of the digital service providers affects the usage of digital service. Trust in the digital service providers also gets affected by the size (Jarvenpaa et al. 2000). Similar to the perceived reputation, perceived size also has an effect on the consumer to decide whether to purchase the digital service or not (Chen and Huang 2016). Perceived size of the service providers invokes trust in the mind of the consumers, consequently reducing the risk. Hence, the willingness to buy digital services increase with the reduction in the perceived risk.

9.3.8 Trust in Service Provider

Jarvenpaa et al. (2000) focus more on the trust factor of the consumer towards their digital service provider. Trust can be of two types such as trust in the store as well as trust in the network service provider. Trust has been considered as one of the important factor for the consumer to purchase digital service. Teo and Liu (2007) have said that there is significant relationship between the trust and risk. So as long as the trust of the consumer increases, the risk reduces accordingly.

9.3.9 Perceived Risk

Jarvenpaa et al. (2000) said that the perceived risk combines uncertainty with the seriousness of the potential outcome. A study by De Kerviler et al. (2016) founds that adoption of digital service increase with the decrease in the perceived risk. Various authors (Baskerville and Stage 1996; Donner and Tellez 2008; Drew 2007; Gefen et al. 2008; Guriting and Ndubisi 2006; Hajli et al. 2015; Janssen et al. 2017; Kaplan and Garrick 1981; Keaveney and Parthasarathy 2001; Lee et al. 2011; Locander and Hermann 1979; Loch et al. 1992; Mohammadi 2015; Pan and Zinkhan 2006; De Ruyter et al. 2001; Sohail and Al-jabri 2013; Teo and Liu 2007) have discussed the perceived risk in a different context. The model shown above says that the willingness in the consumer to buy digital service depends on the risk perceived by the consumer.

9.3.10 Information Risk

In general information risk arises from the inaccurate and missing data of the digital service provider (Smith et al. 2001). The information risk is a risk in which information is treated as assets. The loss of that assets is treated as information risk (Loch et al. 1992). Most of the time, consumers are not willing to share the personal and sensitive information during the consumption of digital services because of the information risk perceived by the consumer.

9.3.11 Intent to Provide Sensitive Information

The risk perceived by the consumer to provide their sensitive information during the purchase of digital service is generally the risk involved in the purchase of digital service with the service provider. Network risk and the risk associated with the purchase of digital service become a barrier for the consumer with the intent to provide sensitive information.

9.3.12 Willingness to Buy Digital Service

The willingness to purchase the digital service comes when the consumer perceives less risk and has the intention to provide sensitive information during the transaction. The consumer willingness to buy has been discussed by J. J. Lee, Warkentin, & Johnston, (2016); Sweeney and Soutar (2001); and Teo and Liu (2007). The attitude of the consumers also plays a major role in the willingness to buy the digital service.

9.4 Research Methodology

The conceptual model can be empirically validated by collecting the data from the consumer who has experienced the digital service failure in the past 3 months. First of all a pilot study will be done to test the reliability and validity of the questionnaire. The questionnaire will be revised based on the feedback received from the consumer during the pilot study. The first few questions will capture the demographics information and the rest will be used to validate the model. A five-point Likert scale will be used to capture the experience of the consumers by considering '1' as 'strongly disagree', '2' as 'disagree', '3' as 'neutral', '4' as 'agree' and '5' as 'strongly agree'. Later on Cronbach's alpha test will be used to find out the reliability. The value greater than 0.7 is considered as acceptable level of reliability (Gefen et al. 2000). Moreover Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy can be done well.

9.5 Implication

9.5.1 Theoretical Implication

There are very few study has been done on the information risk while consuming digital services (Buchanan and McMenemy 2012; Fung et al. 2008; Higgs et al. 2013). The theoretical implication of the research is that it provides the researcher the antecedents of the information risk. The construct such as variable network environment characteristics, network trust, general information security awareness, perceived information privacy concern and information types acts as an independent variable to measure the dependent variable information risk. Now this information risk acts as dependent variable with the intent to provide sensitive information and indirectly willingness to buy digital service. Researchers can use the model to verify and validate in different context. This integrated model consists of consumer/network trust model by Lee et al. (2013) and consumer/retailer trust model (Jarvenpaa et al. 2000).

The empirical validation of this model has not been done, so it can be used by the researcher as a research gap to validate this model empirically. Moreover this model can be tested by adding more privacy and security construct. This model evaluates the risk from the consumer perspective, but it can be extended to evaluate from the digital service provider's perspective. The consumer/retailer trust model which is developed by Jarvenpaa et al. (2000) has been adapted to include the perceived reputation, perceived size, trust in service provider and perceived risk as the construct. The attitude has not been used as construct in this integrated model. The consumer/retailer trust model can be further added with the construct more specific to the service provider.

9.5.2 *Practical Implications*

The practical implication of this study is that the model provides a new direction to measure the information risk. It also provides an understanding about how much the consumer is willing to provide their personal and sensitive information while purchasing digital services. The conceptual model will be more interesting when it will be used beyond the domain of digital service. In general whenever the consumer is willing to purchase any digital service, then he/she has to provide his/her information to consume the digital service. The model provides more concern towards the digital service consumer and less towards the service provider. The policy maker can use this model to make better control of information given by the consumer. Using this model the security measures can also be implemented to protect the sensitive information. The infrastructure and security system of the digital service providers can use this model to further enhance the security system by considering the network environment characteristics, network trust and perceived information privacy concern construct. The framework has attempted to capture all the possible determinants available in the literature. Further the model can be enhanced by considering more construct in the future.

9.6 Limitation and Future Research Directions

The actual construct of the model to evaluate the information risk can be far more than what is shown in the integrated model because the dimensions of information risk are not limited to the above model. Since the model focuses more on the network, trust and privacy related issue for the information risk. The external and hidden factor has not been identified in the model. The verified and validated model cannot be used to generalize the finding. Since the model is testing the intent to provide sensitive information while purchasing the digital service, the model cannot be validated to any other services. The response of the experienced users can be changed as the network environment and infrastructure become more secure. More and more number of people will be willing to share their personal information.

The responses taken from the experts in the field of information security will add more valuable inputs to the integrated model under consideration. Additional situational factor which may influence the antecedents of the information risk, perceived size and reputation, trust in the service provider and perceived risk can be added. Most of the time, it has been seen while collecting response from the experienced users that only teenaged people have been given the preferences and people having age greater than 45 are ignored. Since the people having age greater than 45 would have different experience in the past related to technology adoption, they will provide more in-depth insight. Apart from consumer security, the service provider security should also be taken in the future course. Future research can be taken on the influence of information security on the policy makers. A qualitative case study can also be taken by the policy makers on the effects of information risk and security. The study can be further enhanced to other segments of the experts such as financial experts to evaluate the financial risk associated with the information risk.

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Chapter 10

Transparency: Panacea for Corruption-Free Governance and Reforms?



Anil Srivastava

Abstract In the aftermath of recent corporate and government scandals, stakeholders have become wary, demanding more transparency and accountability in organizational processes. Transparency is a complex concept, with various perspectives existing in academic literature and many organizations struggling to identify an adequate level of transparency which balances the expectations of its various stakeholders. These expectations may be shaped by the cultural environment, and consequently, the desired level of transparency from an organization may be a function of country culture. While there is much academic literature pertinent to transparency in developed countries, very few researchers have explored this domain in the Indian context. Hence, considering the importance of and need for organizational transparency in India, our study raises three key research questions, to empirically examine the concept of transparency and expand the understanding of factors affecting transparency in public and private organizations.

Keywords Transparency · Interest groups · Corruption · Governance · Public organizations · Private organizations · Culture

10.1 Introduction

In the highly networked and rapidly changing world today, access to information has become the currency to keeping pace with competitors and stakeholders. However, in the wake of recent corporate and government scandals, stakeholders have become wary, demanding more transparency and accountability in organizational processes. In early 2017, after the arrest of Samsung group's leader in a graft scandal, shareholder pressure forced the global giant to completely restructure with the purpose of improving financial transparency and strengthening compliance management (Lee 2017). South Korean President Park Geun-hye was also impeached in late 2016 for alleged involvement in unfair and illegal practices with

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the conglomerate. While company's earnings seemed to be unaffected by the scandal, Samsung Electronics' stock price and long-term strategic investment decisions took a hit as a consequence of negative investor sentiment (Jaewon 2017). In 2016, the International Consortium of Investigative Journalists (ICIJ) published a massive leak of around 11.5 million documents, which incriminated world leaders, politicians, and businesses in wrongdoings such as money laundering, tax evasions, and financing arms and drug deals. The 'Panama Papers' scandal, as it is known popularly, spurred the public demand for higher government transparency. As a consequence of immense pressure from the public, Iceland's Prime Minister Sigmundur David Gunnlaugsson was forced to resign following disclosure of his illegal assets outside the country (Nichols and Confalone 2016).

With the increasing significance of the transparency, many researchers over the past few decades have attempted to explore the concept of transparency along with its antecedents and consequences in various contexts (policies, geographies, functions, etc.). However, most of the extant literature is still fragmented and many questions still need empirical investigation. This research study proposes to examine the concept of transparency in government organizations and corporates, factors influencing the level of transparency in organizations (such as culture), the role of the various stakeholders, and its impact. In the following sections, we introduce the concept of transparency, which will be further elaborated in the following sections, and discuss the academic literature in the area.

10.1.1 Transparency

Demands for open flows of information have a long history, which clearly indicate that the perception of transparency has existed for a long time. James Madison, an American statesman, Founding Father, and the fourth President of the United States, wrote about it as: 'a popular government without popular information, or the means of acquiring it, is but prologue to a farce or a tragedy; or perhaps both. Knowledge will forever govern ignorance; and a people who mean to be their own governors must arm themselves with the power which knowledge gives' (as cited in Florini 2007). Early demand for transparency started arising from private sector, which can be traced back to the demand for corporate disclosures in Britain in the early twentieth century. The spread of democratic norms, the increasing strength of civil society, and the rise of increasingly independent media globally along with the proliferation of Information Communication technologies (ICTs) have intensified this pressure further. The use of ICTs in the traditional governing process is reducing information dissymmetry, thereby leading to increase in transparency in the local and state governments. Information is a source of power, and hence, very little transparency existed prior to the proliferation of ICTs. The cross-border global prosecution of corrupt individuals revealed by the Panama Papers in 2016 highlighted the power of whistleblowers, big data, and networked journalism in this age (Ernst and Young 2017).

Transparency is a complex concept, with various perspectives existing in academic literature. Ball (2009) discusses the multiplicity of transparency definitions, positing three metaphors: transparency as a public value embraced by society to counter corruption, transparency synonymous with open decision-making by governments and non-profits, and transparency as a complex tool of good governance in programmes, policies, organizations, and nations. However, most studies (Benito and Bastida 2009; Forssbæck and Oxelheim 2014) reflect two theoretical approaches to transparency:

1. Rule-of-law theory, which considers compulsory publicity and transparent management the cornerstone of public management
2. Principal–agent theory, which stems from the private sector and links more disclosure with better public sector governance

In the following section, we further discuss transparency literature in the context of government and private organizations.

10.1.2 Transparency in Public Organizations

Transparency amounts to sharing information and acting in an open manner, allowing citizens (stakeholders in a democracy) to gather information that may be critical to uncovering misuses of resources (such as funds) by public organizations and defending their interests. In the context of government, Bertot et al. (2010) list four primary channels through which transparency may occur:

- (i) Proactive dissemination by the government
- (ii) Release of requested materials by the government
- (iii) Public meetings
- (iv) Leaks from whistleblowers

Transparent systems have clear procedures for decision-making and open channels of communication between citizens and public sector officials, and make a wide range of information accessible. It is a measure up to which laws, regulations, agreements, practices, and procedures in a specific IT initiative affecting citizen are open, clear, measurable, and verifiable. From the democratic theory viewpoint, transparency is an end in itself. Increase in transparency means more information to citizen which in turn leads to more efficient government. Deficiency of transparency in economic and political systems implies less efficient and less predictability in a country which amounts to reduced confidence of investors and outside elements leading to reduced competitiveness and finally resulting into reduced quality of life for its citizens. Ann M. Florini (2002) talks about the transparency continuum in her article on developing transparency in government. According to Florini (2002, p.4):

Transparency is one end of a long continuum of behaviour. At one extreme, nothing is hidden...the task is thus to move global society closer to the transparency end of the spectrum.

According to Mitchell (1998), transparency is important to regime effectiveness and difficult to achieve, and its sources are poorly understood. The author further recommends understanding three influences on transparency: (i) purposes for which the information is sought, that is, the demand for information; (ii) the incentives and capacity of relevant actors to provide that information, that is, the supply of information; (iii) the strategies the regime adopts to increase transparency. In literature, we find that there are hardly any attempts to measure transparency (Transparency International Australia 2000). Most researchers use different perceptions of corruption as an indicator of the general level of transparency and accountability. Transparency International, a leading voluntary organization, comes out with its annual Corruption Perceptions Index which, though widely used and accepted, may be inadequate to predict transparency and corruption in governance (Baumann 2017). Historically, much of the research work on transparency is conceptual, with very few empirical studies seeking to provide a better understanding of transparency in public organizations and its determinants (Bauhr and Grimes 2012; Bertot et al. 2010; Kaufmann 2002; Mitchell 1998).

10.1.3 Transparency in Private Organizations

After the 2007–2008 global financial crisis which brought down financial giants such as Lehman Brothers and AIG, organizations were left with little choice, but to embrace corporate transparency. Under the constant scrutiny of regulatory firms, investors, and directors, organizations are facing challenges with corporate reporting. In most academic studies, the term ‘corporate transparency’ is used to refer to country’s information environment which includes accounting disclosures (Gelos and Wei 2002; Bushman et al. 2004; Francis et al. 2009).

An investigation into the impact of country transparency on the behaviour of international investment funds by Gelos and Wei (2002) yielded three significant findings:

- International funds prefer to hold more assets in more transparent markets.
- Herding among funds is more prevalent in less transparent countries.
- During a crisis, international investors tend to flee more opaque markets.

While these insights are valid for international funds, they highlight the criticality of corporate transparency to investor confidence, and consequently market performance. This research study attempts to systematically validate and address the gaps in this area.

10.1.4 Motivation for Research

Scandals, such as Bofors and Vyapam, underline the significance of transparency and accountability of the government and the private sector. According to Transparency International Corruption Perceptions Index 2016, India ranks poorly at 79th among

176 countries, which can be attributed to rampant corruption and the government's inability to deal with it effectively (Ernst and Young 2017). However, regulatory reforms such as Real Estate (Regulation and Development) Act, 2016, and digitization of land records in India are steps forward in the direction of transparency by the government. Additionally, the role of citizens, civil society, and other interested groups as change agents in demanding transparency from Government organizations merits academic attention. This research is motivated by the need to understand transparency in public and private organizations in India and the forces shaping it. Our initial research suggests that the level of transparency varies in public and private organizations because of various factors such as the rapid proliferation of technology and globalization. This has placed immense pressure on organizations to adopt systems to improve transparency. So, many organizations are working towards identifying an adequate level of transparency which balances the different expectations of various stakeholders. The expectations of stakeholders in both public and private situations, however, may be shaped by the cultural environment of a country, and consequently, the desired level of transparency from an organization may be a function of country culture. While there is much academic literature on the multiple facets of transparency in developed countries, very few researchers have explored this domain in the Indian context. Thus, considering the importance of and need for organizational transparency (public and private) in India, our research study endeavours to broaden the understanding of transparency in public and private organizations by delving deep into its various facets.

10.2 Background and Research Context

10.2.1 *Background Study*

Transparency in an organization is not only important for bringing in accountability to the financial and operational processes but also to build trust with all stakeholders in both public and private organizations – civil society, media, employees, investors, the board of directors, regulatory bodies, etc. Many studies associate transparency with good governance practices (Ball 2009; Bauhr and Grimes 2012), linking it to reduction in corruption (Florini 2007) and improvement in citizens' satisfaction (Park and Blenkinsopp 2011). Hence, transparency needs to be taken into consideration when designing, developing, and implementing public policies and programmes. But are high levels of transparency always desirable? In the following sections, we first look at the definitions of transparency and discuss the concept of optimal transparency as given in extant literature.

Defining Transparency

In the context of strategic negotiations, Finel and Lord (1999) have defined transparency as '... the legal, political, and institutional structures that make information about the internal characteristics of a government and society available to actors

both inside and outside the domestic political system. Transparency is increased by any mechanism that leads to the public disclosure of information, whether free press, open government, hearings, or the existence of nongovernmental organizations with an incentive to release objective information about the government'. Vishwanath and Kaufmann (1999) and Kaufmann (2002) have further defined transparency as the 'increased flow of timely and reliable economic, social and political information, which is accessible to all relevant stakeholders'.

A narrow definition developed by Bauhr and Nasiritousi (2012) proposes transparency as 'the release of information which is relevant for evaluating an institution'. Nevertheless, the multifaceted nature of the concept of transparency makes it complex and difficult to operationalize (Bauhr and Grimes 2012; Bauhr and Nasiritousi 2012; Forssbæck and Oxelheim 2014). Despite multiple cross-country studies on governance, very few transparency scales, except for World Bank indicators and Transparency International's Corruption Perceptions Index, have gained widespread acceptance. Table 10.1 below presents definitions of transparency in extant literature.

Kaufmann (2002) recommends a working understanding of transparency should encompass the following attributes: access, comprehensiveness, relevance, and quality and reliability. Grimmelikhuijsen et al. (2013) similarly consider three characteristics central to assessment transparency – information completeness, colour (the degree of positiveness) of information, and the usability of the information.

Many studies use transparency interchangeably with the concept of openness. Demchak et al. (2000) have used the term 'openness', which they say 'exists to the extent that an organization freely and universally provides comprehensive information about all its attributes and maintains timely communications directly to all key public audiences'. Based on prior work done on openness, Demchak et al. (2000) propose openness on the Internet as a new measure of organizational behaviour, 'as it taps a range of activities in fine-grained detail that are difficult to study comprehensively but that critically relate to democratic accountability and responsiveness'.

However, many authors such as Kopits and Craig (1998) and Bauhr and Grimes (2012) consider openness as a sub-element of transparency. For instance, in the context of government transparency, Bauhr and Grimes (2012) have attempted to measure transparency using an index comprising three principal dimensions: government openness, whistleblower protection, and publicity. Despite the multiple attempts by various researchers, a universally acceptable definition for transparency remains elusive.

Optimal Transparency

Forssbæck and Oxelheim (2014) view full transparency as 'the absence of information asymmetries', not to be paralleled with perfect information since from this perspective, incomplete (public) information may exist without anyone having the benefit of better and private information. Higher transparency may yield multiple benefits such as improved governance, detection of corruption, and increased

Table 10.1 Key definitions of transparency in academic literature

Author/year	Definition
Kopits and Craig (1998)	Fiscal transparency is defined as openness towards the public at large about government structure and functions, fiscal policy intentions, public sector accounts, and projections
Finel and Lord (1999)	Transparency comprises the legal, political, and institutional structures that make information about the internal characteristics of a government and society available to actors both inside and outside the domestic political system. Transparency is increased by any mechanism that leads to the public disclosure of information, whether a free press, open government, hearings, or the existence of nongovernmental organizations, with an incentive to release objective information about the government
Mitchell (1998)	Transparency can narrowly be conceived as information regarding the operation and impact of a regime
Kaufmann (2002)	Transparency refers to the flow of timely and reliable economic, social, and political information, which is accessible to all relevant stakeholders
La Porte et al. (2002)	Transparency refers to the availability of information for navigating a large-scale social system
Hofstede (2003)	Transparency of a netchain is the extent to which all the netchain's stakeholders have a shared understanding of, and access to, the product-related information that they request, without loss, noise, delay, and distortion. In this definition: Netchain refers to a directed network of actors who cooperate to bring a product to customers A netchain actor is an organization, usually a producer, distributor, processor, or retailer A stakeholder is a netchain actor, or an institutional actor with some stake in the netchain, or a customer A shared understanding is a precondition for transparency that involves sharing or seamless translation of language, meaning, and standards at many levels
Bushman et al. (2004)	Corporate transparency can be defined as widespread availability of firm-specific information concerning publicly listed firms in the economy to those outside the firm
Bauhr and Nasiritousi (2012)	Transparency can be defined as the release of information which is relevant for evaluating institutions
Forssbæk and Oxelheim (2014)	Transparency relates to reductions in information asymmetries and therefore entails the transfer of information from a sender to a receiver where the information transferred is trustworthy and has a value to the receiver
Ghauri et al. (2015)	Transparency is incorporating the evaluation of an action and the extent to which it is communicated. It encompasses: Actions undertaken by business and/or political actors Availability of information about specific actions Closeness of the actions to the existing ethical values both locally and in foreign countries

legitimacy (Bauhr and Nasiritousi 2012). However, many authors have questioned the advantages of full transparency (Forssbæk and Oxelheim 2014), expressing the necessity of understanding costs (e.g. information provision costs) and risks (e.g. security risks) associated with higher levels of transparency (Bauhr and Grimes 2012). Table 10.2 given below presents the outcomes of greater transparency discussed in the literature.

When examining transparency as ‘information transfer’, the gap between the cost of sharing information to the sender of the information and its value to the receiver may affect the degree of desired transparency (Forssbæk and Oxelheim 2014). Full transparency could be particularly challenging for companies who may be uncomfortable with admitting mistakes or fear it may expose them to criticism or even legal risk (Morgan 2014; Tennant 2015). A comprehensive analysis of transparency studies by Forssbæk and Oxelheim (2014) revealed that not only is the net benefit of transparency a marginally decreasing positive function, but it may turn negative beyond some point, suggesting a possible optimum. Hermalin and Weisbach (2007) also argue that, ‘from a corporate governance perspective, there are likely to be both costs and benefits to increased transparency, leading to an optimum level beyond which increasing transparency lowers profits’. Oxelheim (2010) posits three perspectives on optimal transparency:

Table 10.2 Outcomes of high transparency in academic literature

Positive outcomes of high transparency	Negative outcomes of high transparency
Improved quality of decision-making (Hebb 2006; Benito and Bastida 2009)	Costs of setting up systems for information disclosure, maintaining the practices, and disseminating the generated information (Kopits and Craig 1998)
Macroeconomic fiscal sustainability, and overall fiscal rectitude (Benito and Bastida 2009; Kopits and Craig 1998)	Undermining position during negotiations (Kopits and Craig 1998; Mitchell 1998)
Good governance (Bauhr and Nasiritousi 2012; Florini 2007; Kopits and Craig 1998)	Risk of reducing effectiveness of policy instrument (Kopits and Craig 1998)
Detection and reduction in corruption (Bauhr and Nasiritousi 2012)	Stakeholder confusion and mistrust due to misinterpretation and miscommunication (Grimmelikhuijsen et al. 2013)
Government accountability (Forssbæk and Oxelheim 2014; Kopits and Craig 1998)	Legal risks (Tennant 2015)
Lower risk premiums in financial markets and stronger support of government policies by a well-informed electorate (Benito and Bastida 2009; Kopits and Craig 1998)	
Enhanced legitimacy (Florini 2007)	
Stakeholder trust (Grimmelikhuijsen et al. 2013)	
Improved resource allocation and growth rates (Francis et al. 2009)	
Investment efficiency (Durnev et al. 2009; Gelos and Wei 2002)	

- In the first perspective, optimal transparency refers to the receiver of information, i.e. the outside stakeholders' interest.
- According to the second perspective, 'optimal' can be applied to the company's supply of information – risks to the company due to too much information disclosure.
- The third perspective on 'optimal' transparency considers the degree of transparency which reflects the self-interests of the management.

Taking the case of climate change, Mitchell (1998) suggests that greater transparency in international negotiations may hinder cooperation since control over information dissemination is a crucial factor in the information exchange among the various parties. Ghauri et al. (2015) also propose that opacity, defined as the 'dimness of information in actions of business units', can be legitimate and ethical, with the identification of transparent/opaque varying with different political/societal values. For their research, Gelos and Wei (2002) categorize opacity as:

- Government, which comprises measures for opacity in macroeconomic policies and in the availability of macroeconomic information
- Corporate comprising an index of availability and reliability of corporate accounting information.

In certain scenarios, the need to maintain secrecy and privacy may outweigh the benefits of higher transparency (Ball 2009). Kopits and Craig (1998), though, caution not to mistake misreporting for secrecy. Other factors cited in previous works as possible influences on transparency include timing of information disclosure, unavailability of information, lack of clarity in the division of responsibilities between national and subnational levels of government (Kopits and Craig 1998), and market capitalization of firms (Bushman et al. 2004).

10.2.2 Study of the Research Context

International Monetary Fund (1986) defines government as the sector that 'performs primarily the functions of supplying certain public goods and services and fulfilling certain public purposes not for commercial or financial reasons, or, if of a commercial or financial nature, not on a major basis or not primarily for a profit'. According to Kopits and Craig (1998), transparency in government behaviour is reflected mainly in the structure and functions of the public sector and particularly in the budget process, tax treatment, financing operations, and regulatory mechanism. Hence, the Government is responsible for 'the development of a well-defined and publicly available policy statement that sets the relative areas of competence and provides limited scope for private rent seeking in the public domain' (Kopits and Craig 1998).

Transparency in Public Organizations

Grimmelikhuijsen et al. (2013) state three objects for transparency in government and public organizations:

- Transparency of decision-making processes
- Transparency of policy content
- Transparency of policy outcomes or effects

In the case of budget transparency, Benito and Bastida (2009) propose that transparency comprises three essential elements: systematic and timely release of all relevant fiscal information, the effective role of the legislature, and an effective role for society through the media and nongovernmental organizations to hold the government accountable. The absence of budget transparency may increase voters' confusion and reduce politicians' commitment to be fiscally responsible (Benito and Bastida 2009).

When it comes to intergovernmental information, Roberts (2004) argues that Governments alone cannot be responsible for transparency since they do not have incentives to share information and influence, and may not have the right to share the information received from other governments.

According to Bertot et al. (2010), the cultural environment of a country may also be a crucial element in the transparency process. This would include aspects such as societal attitudes towards the value of information, level of identification by citizens with the government, freedom of press, and information policies enacted by the government. In the following subsections, we take a closer look at the role of culture and various interest groups with regard to transparency.

Influence of Culture

In order to explore the effect of culture and transparency, as drivers of business attractiveness, on global R&D intensity, Lopes and Serrasqueiro (2017) developed an econometric model wherein information from 31 European countries over the period 2010–2014 and their total R&D expenditures were regressed against several variables such as the Hofstede's cultural dimensions, the public sector transparency index, and other aggregated variables. Their investigation revealed that the corruption of a country level is bilaterally linked with culture and has a positive and significant impact on R&D national strategies. Several other studies concur on the link between culture and corruption (Barr and Serra 2010); however the extant literature is still unclear on the effect of transparency on the relationship between them.

A cross-country comparative analysis between South Korea and the Netherlands by Grimmelikhuijsen et al. (2013) suggests that the impact of transparency on citizens' trust in government is likely to be differentiated according to a country's cultural context. Furthermore, using Hofstede's cultural dimensions, they conclude that transparency may fit better with cultures oriented towards the short-term and have low power distance since transparency is 'essentially a power-reducing mechanism'. There is also a dearth of studies how cultural differences between countries affect perceptions of transparency (Grimmelikhuijsen et al. 2013).

Role of Interest Groups

Interest groups are groups characterized by their will to influence political and administrative decision-making, to successfully achieve their goals. Existing literature suggests that information asymmetry can allow certain interest groups with greater access to influence the agenda (Ball 2009). For the purpose of study, these goals would be with respect to transparency in a particular agency of government or government in general. These groups may not formally organize themselves on the issue of opposing transparency. So, they try to achieve their objectives by integrating themselves into or remaining a part of the political and administrative systems. Interest groups which may influence political and administrative decision-making could be:

- Members of the recognized political parties
- Political Leaders holding executive positions as elected representative or as political appointee
- Land owners, business and industrial units
- Government servants working at distinct levels as part of bureaucracy

One of the most relevant studies is by Jenkins (1999), which talks about interest groups with respect to reforms and e-governance mentioning them as extremely potent means of reforms, and transparency is one of the ends of it as described earlier. Our study will attempt to venture into an unexplored territory of interest groups which affect transparency.

Transparency in Private Organizations

Bushman et al. (2004) conceptualize corporate transparency within a country as output from a multifaceted system whose components collectively produce, gather, validate, and disseminate information. Figure 10.1 below summarizes the components of the conceptual framework proposed by Bushman et al. (2004) for assessing transparency in private sector organizations.

Influence of Culture

An empirical assessment by Bushman et al. (2004) uncovered two major dimensions of corporate transparency – financial transparency and governance

Components of Corporate Transparency

Corporate Reporting <ul style="list-style-type: none"> • Disclosure Intensity • Financial Disclosures • Governance disclosures • Accounting principles • Timeliness of disclosures • Credibility of disclosures 	Private Information Acquistion & Communication <ul style="list-style-type: none"> • Direct Reports - Financial Analysts • Indirect Trading - Institutional investors & Insider trading 	Information Dissemination <ul style="list-style-type: none"> • Media Channels - Penetration
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Fig. 10.1 Corporate transparency as conceptualized by Bushman et al. (2004)

transparency, which could also explain the variation of corporate transparency across countries since both these factors are related to the different aspects of a regime. While multiple studies (Bushman et al. 2004; Durnev et al. 2009; Francis et al. 2009; Gelos and Wei 2002) have empirically validated the cross-country differences in corporate transparency due to economic factors, such as property rights, investment policies, economic growth, etc., the relationship between concept of culture of a country and corporate transparency is relatively unexplored.

Interest Groups

Previous research suggests that interest groups such as news media may affect the outcomes of corporate transparency in a country, and this effect would vary across countries. According to Gelos and Wei (2002), ‘news about more transparent countries will on average convey more useful information than news about opaque countries, so that markets may react more strongly to news in transparent markets’.

10.2.3 Research Gaps

We find that considerable research is in the various areas related with transparency, but most of it is either exploratory or prescriptive in nature. Furthermore, while many studies mention the influence of stakeholders and interest groups on transparency, there is scarce empirical evidence to quantify the variation in transparency because of this influence. The research questions and propositions (discussed in the following section) will provide an opportunity to look at the issues from a distinct perspective. The research hypotheses will provide an opportunity to obtain a methodology for the measurement of transparency, which is a relatively new concept and lacks significant research. The country must develop and move forward for economic growth; demand for transparency from business, industry, civil society, funding agencies, and citizens is bound to grow. The research questions also attempt to establish a relationship between transparency, culture, corruption, and public image of an organization.

10.3 Research Design

In the previous chapter, research gaps were identified based on the literature review carried out. In this chapter the research design, i.e. the blueprint for conducting the research, involves the following steps:

1. Definitions of the required information and approach
2. Exploratory research through literature review
3. Qualitative research
4. Quantitative data collection
5. Measurement and scale development

6. Questionnaire design
7. Sampling process
8. Plans for the data analysis

To address the goals of the study, a multi-method approach will be taken to support the exploratory as well as empirical nature of the research. This study will utilize both quantitative and qualitative research techniques to operationalize transparency and develop a ‘Transparency Adequacy Scale’. This scale would capture the level of transparency existing in various organizations according to multiple subgroups of stakeholders in the public and private sector. For operationalization of culture, the methodology developed by Hofstede (1980) will be employed wherein culture is defined in terms of four dimensions: individualism, power distance, uncertainty avoidance, and masculinity. However, as suggested by Taras et al. (2009), definition of culture and operationalization of its specific dimensions will be aligned with the scope and objectives of this study. In the following sections, we discuss in detail the various aspects of the research design. The proposed research methodology is depicted in Fig. 10.2.

10.3.1 Exploratory Research: Literature Review

Exploratory research has been initiated to develop insights and development of the approach. To define the problem, an in-depth review of the extant literature in the area of transparency was undertaken, the findings of which have been covered earlier. This was essential to understand the origin and nature of transparency research. Based on this initial analysis, we formulated the specific research questions along with the associated research objectives and research hypotheses, summarized in Table 10.3 below and discussed in further sections.

Research Questions

The following research questions (RQ) address the research gaps discussed earlier under literature review and are proposed to be investigated in the present work:

- RQ1: How does degree of desired transparency vary with different stakeholders?
RQ2: What are the various forces influencing transparency? How does culture affect expectation and perceptions of transparency?
RQ3: How does transparency influence corruption and public image?

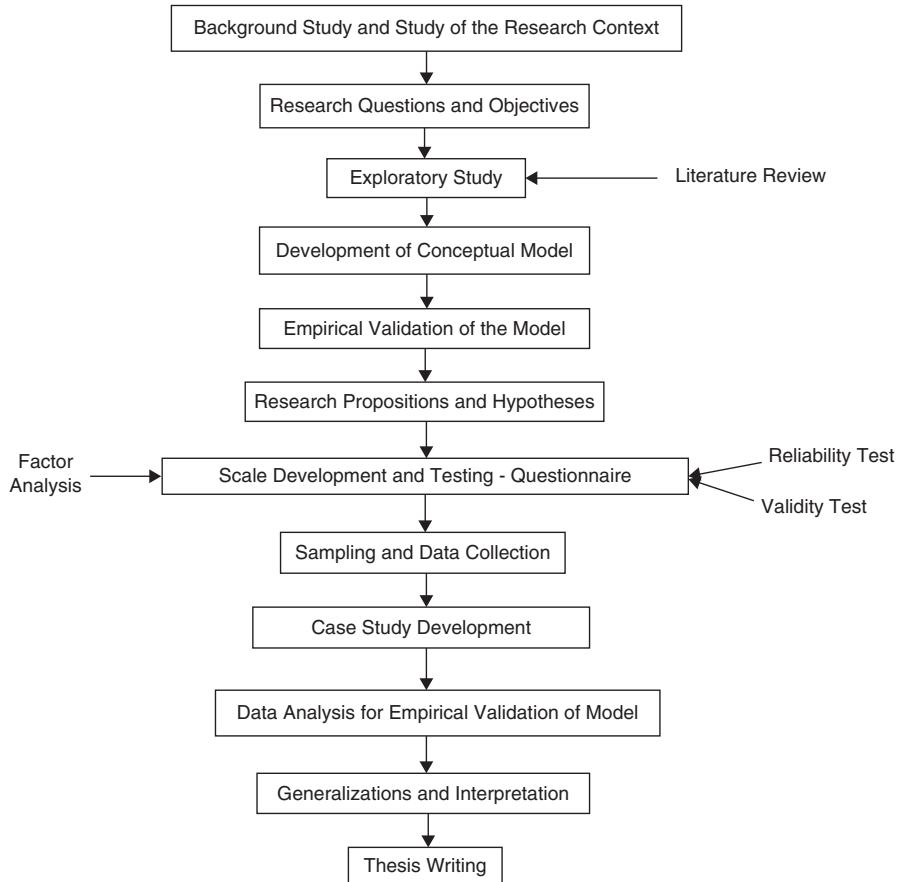


Fig. 10.2 Proposed research methodology

Research Objectives

The study aims to focus on transparency in the context of Indian entities. The key objectives are to

- Develop a 'Transparency Adequacy Scale' for public and private organizations.
- Study the variation in desired level of transparency across various entities.
- Understand and analyse the forces influencing transparency.
- Investigate the relationship between transparency, corruption, and public image of the entity.

Table 10.3 Proposed study design

Research question	Research objective	Propositions	Methods
RQ1: How does degree of desired transparency vary with different stakeholders?	Develop a transparency adequacy scale for public and private organizations Study the variation in desired level of transparency across various entities	P1 P2	Analysis of existing literature Expert opinion questionnaire survey Interviews Factor analysis
RQ2: What are the various forces influencing transparency? How does culture affect expectation and perceptions of transparency?	Understand and analyse the forces influencing transparency	P3 P6	Analysis of existing literature Expert opinion questionnaire survey Interviews Case study approach
RQ3: How does transparency influence corruption and public image?	Investigate the relationship between transparency, corruption, and public image of the entity	P4 P5	Analysis of existing literature Questionnaire survey Factor analysis Regression analysis

Research Propositions

P1: *The level of transparency desired varies with different stakeholders.*

P2: *Transparency varies among organizations.*

According to Mitchell (1998), empirical variations in transparency and its outcomes across international regimes suggest the influence of exogenous and endogenous sources, such as the regime's information systems and the issue area. This is supported by Forssbäck and Oxelheim (2014) who argue that the concept of transparency varies between users and between contexts across policy areas, countries, markets, and companies. In some cases, bureaucracy may derive power from holding on to information which could be utilized to bargain a premium from the citizen, depending upon citizen's need and urgency. Certain sections of the society, thriving on government resources at the cost of deprived ones, may also be affected as government decisions, processes, and facts become available across the board. Pointing out that Right to Information is a basic human right, Roberts (2004) says that political participation rights of citizens – such as their right to deliberate on and participate in policy choices that affect them in important ways – are constrained if a high level of transparency is not maintained. Thus, in the context of an organization, different levels of transparency may be desired by various stakeholders.

P3: *Because of various forces, the organization reaches an optimal level of transparency.*

P4: *The higher the level of transparency, the greater the public image of the entity.*

P5: *The higher the level of transparency, the lower the perception of corruption.*

The interest in transparency has been primarily driven by its economic value as an anti-corruption measure, which involves using reporting mechanisms to monitor and control the discretionary power of the government and company officials (Bertot et al. 2010). These reporting mechanisms, based on the interaction between the ‘content’ and ‘source’ affect the level of transparency (Mitchell 1998). These mechanisms can be categorized as

- (i) Self-reporting, wherein the actor provides information on its own behaviour
- (ii) Other-reporting, wherein the actor provides information on other actors’ behaviour
- (iii) Problem-reporting, wherein information is provided on the effects of behaviours and other non-behavioural aspects of the problem

Mitchell (1998) further suggests that above variations in the reporting mechanism reflect the ‘incentives and capacities’, which constrain the level of transparency achieved under a regime. For instance, the level of self-reporting by government officials on their decision-making processes would be influenced by their ‘illegitimate private benefits from not doing so – i.e., the level of corruption’, consequently affecting the level of transparency (Forssbäck and Oxelheim 2014).

A study by Park and Blenkinsopp (2011) in South Korea found transparency to be a significant moderator, increasing citizen satisfaction while reducing corruption. Transparency, as public value to countermeasure corruption, requires other-reporting achieved through active participation from citizens and the support of society, government, media, and business (Ball 2009; Benito and Bastida 2009; Kaufmann 2002).

According to Bauhr and Nasiritousi (2012), while most studies posit transparency may reduce corruption, it may also increase corruption without adequate support for a well-governed system. Studies indicate that markets, considering the payoffs of non-disclosure, may not work on their own towards the socially desired level of transparency (Kaufmann 2002). Ghauri et al. (2015) argue that an MNC’s surrounding units (society, business, and political) evaluate and judge the firm’s transparent/opaque behaviour, which further affects their market position and influences the level of optimal transparency.

P6: *There is a significant positive relationship between transparency and culture.*

Strategies for successful management of change depend upon circumstances, culture, opportunities, and resources. When Laudon (1977) says that ‘change in democratic systems is naturally emanating from the growth of technology and it is kind of implicit in the changing technology’, a question can be raised on the theory’s uniform applicability. This may not be applicable to developing countries like

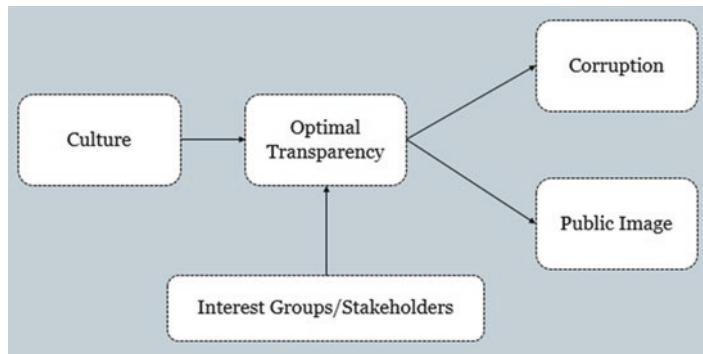


Fig. 10.3 Proposed conceptual framework for research

India where stakeholders have conflicting stakes and realities are different from what appears on the surface or visible; otherwise there is no reason to expect that bureaucracy who has the role of implementing policies would also oppose its growth. Political leadership, on one hand, may take policy decisions in favour of transparency, but as e-interest group may give in to constituency pressures and not ensure implementation of the very same policies. This suggests that cultural variance may affect the desired and achieved level of transparency in a country.

Based on the review of theory available in books and journals, a conceptual model was developed to serve as a preliminary platform for organizing, analysing, and interpreting findings. Figure 10.3 presents the key variables in the research study, viz. culture, transparency, corruption, and public image of an organization. Interest groups comprise the stakeholders that affect the level of transparency in an organization. This framework will also help in further development of an analytical model based on exploratory research, verified by conclusive research.

10.3.2 *Qualitative Research*

Since transparency research in India is a relatively unexplored area, qualitative methods will help gain an understanding of underlying attitudes in addition to giving clarity about the research context. For this purpose the following methods will be employed:

Depth Interviews

Depth interviews are ‘unstructured, direct, personal interviews in which a single respondent is probed by a highly skilled interviewer to uncover underlying motivations, beliefs, attitudes, and feelings on a topic’ (Malhotra 2008). For this study, depth interviews will be conducted with experts and target respondents, with

probing based on the research questions. Insights generated from these interviews would help in identifying the commonalities and differences in perceptions regarding transparency, which would further aid in the development of a Transparency Adequacy scale, as well as identifying interest groups and other forces influencing transparency. This would verify the findings from the theoretical review and highlight any missing elements.

Case Study Approach

Research question emanates from the actual experience in the field and observed results; hence, research would be based on drawing evidence from real situations. Empirical cases are expected to provide evidence for the theory or rival theory. Multiple case study design embedded with surveys would be used for this research. Multiple case studies have been chosen because of the availability of cases and resources. By having multiple cases, outcomes will not be dependent on one case only and reliability will be more. Multiple case studies as opposed to single-case study has analytical benefits, it is more compelling and more robust. Each case study would be embedded with survey at each site. These surveys would measure the desired level of transparency of interest groups at each site. Separate protocols would be prepared independently for each case. These case study protocols will be followed for each of them.

10.3.3 Conclusive Research

To test specific hypotheses and examine the relationships between the variables, conclusive research methods will be utilized wherein quantitative data analysis techniques will be employed. Empirical validation of the research framework will be done through a survey.

Sampling

The target population would be Indian nationals, who are reasonably knowledgeable and have certain level of experience with public and private organizations. This would include beneficiaries, policy makers, media, and other stakeholders in both public and private organizations. The sampling frame would comprise select organizations from among the public and private sectors in India. Since the target population comprises multiple subgroups of stakeholders (government, employees, citizens, implementation partners, clients, experts), stratified random sampling would be employed wherein random samples will be taken, in proportion to the population, from each of the defined subgroups.

Data Collection

The research data will be collected through a carefully constructed questionnaire. Prior to this, interviews will be conducted with experts and the various subgroups of stakeholders. The insights from the exploratory interviews and the literature review will be used to design the questionnaire. The questionnaire will be pretested in various stages. It will comprise of questions using five-point Likert scales and seven-point semantic differential scale to capture data related to perception of transparency, corruption, and public image of the organization. For the purpose of this study, measurement of corruption will be done along the lines proposed by Lanyi and Azfar (2005):

- Asking the respondents about their own experiences
- Asking respondents about their perceptions of others' experiences

Data Analysis

Data collected through expert opinion, questionnaire survey, and interviews will be systematically analysed using SPSS, and the hypothesis testing would help in empirical validation of the proposed research framework. Individual data such as gender, age, income, and education levels will be captured as the user profile. Four tests for judging the quality of research design would be applied. These tests are as follows: construct validity, internal validity, external validity, and reliability. The following checks would be applied for each of these tests:

- Construct validity: The constructs involved in the research are multidimensional. Validity of the construct will be assessed by collecting data for each of the components through a pilot done among approximately 50 people who would be a representative of the target population. Tests would be carried out to check content validity, convergent validity, and discriminant validity.
- Internal validity: To have internal validity rival explanations and possibilities will also be considered, evidence would be examined from the convergence point of view, and it will be ensured that it is correct and airtight. For internal validity patterns would be matched, and as discussed above, efforts would be made for explanation building and rival explanation and logic models would be developed.
- External validity: It will be easier to replicate findings because research will be grounded in empirical evidence. Theory would be generalizable because it will be based on multiple cases drawn from various locations.
- Data reliability: This test will be used to assess the internal consistency of the underlying construct. This will be measured through the Cronbach's alpha which is a coefficient of reliability. It is particularly suitable in the context of this research as even a single construct involved has different substantive areas within it that have significant intercorrelation among them.

Factor Analysis and Multiple Regression Analysis

Factor analysis will be performed to see how the underlying constructs influence responses of the measured variables. This will involve seeing the pattern of correlation between the observed measures. The factors will be determined using a scree test, and varimax rotation will be used to determine which questions loaded on each of the factors. Cronbach's alpha will be used to calculate the internal reliability of each scale. Factor analysis will be used in this study to develop a scale to measure transparency and to minimize variables to a manageable size while maximizing the information. Multiple regression analysis will be used to further investigate the impact of transparency dimensions on corruption and public image.

10.3.4 *Concluding Remarks*

We attempt to define transparency and clarify the relationship between the constructs as specified in the conceptual framework in the Indian scenario through analysis of existing theories supported by empirical evidence to arrive at an appropriate explanation. Transparency is a ubiquitous yet complex and under-explored concept in context of governance, both in the public and private sectors. Considering the dearth of transparency literature in India, further research is required to understand the antecedents and consequences of transparency. While India's rank has been improving in global transparency indices due to increasing awareness, reforms, regulations, etc., far more needs to be done and understood in this regard.

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Chapter 11

Value Chain Development for Government Sector: A SAP-LAP Approach



M. L. Singla and Apeksha Hooda

Abstract India is moving at a very fast pace towards the digitization of nation, but the true benefits of this digitization are not yet achieved. Reason being usage of technology to transform the same old physical processes of government and public sector (GPS) to realize the E-Governance as are being following since independence. E-Governance is a much broader term (then only providing online access to government services), which encompasses usage of technology to enhance transparency, accountability, collaboration and participation of citizen in policy making, decision-making and improving services. Merely transforming physical services to electronic service cannot yield the benefits of E-Governance; rather necessity is to go for re-engineering of old government processes which are in desperate need of transformation. And in order to redesign these old GPS processes, it is firstly required to evaluate the current GPS processes to identify the problematic areas and then diagnosing the non-value-adding and value-adding activities in same. Here comes the role of value chain analysis which enables the BPR teams and change agents to identify non-value-adding activities in the government processes and evaluate how technology can enhance value of GPS processes. Now, the problem is that there is a lack of concrete value chain for government sector in literature, and this motivated the authors to undertake the present research work and propose a conceptual value chain for GPS which would later be tested empirically using SEM at the next stage. Value chain here has been developed based on SAP-LAP methodology proposed by Sushil (Manag Decis 38(5):347–353, 2000).

Keywords Value chain · Value chain analysis (VCA) · Business process re-engineering (BPR) · Government of India (GoI) · Government and public sector (GPS) · NeGP · Digital India · E-Governance · Employee engagement · Customer satisfaction · Process management · Internal service quality (ISQ) · External service quality (ESQ)

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11.1 Introduction

With the execution of NeGP in the month of June 2006, GoI has set up the roadmap for attaining E-Governance of nation. Also, with the institutionalization of the term Digital India in the month of May 2014 across nation, GoI has set up the vision for achieving digitalization of nation by 2020. GoI has already marked success in transforming income tax filing service, passport filing services and Indian railways ticket booking services, to name a few. But if all these initiatives are carefully looked at, then it would be realized that these all are transformed w.r.t citizen convenience, but if benefits to respective departments are talked about, then these are incremental and not dramatic (Saxena 2005). Reason being the usage of technology to transform the same old physical processes of government and public sector to realize the E-Governance is attempted for a long time. Simply providing technocratic solution to the administration problem cannot achieve the means¹. There is a need is to look carefully at operational, personnel, economic, planning and implementation issues confronting GPS (Saxena 2005; Ray and Mukherjee 2007). India has just started moving in the direction of E-Governance to become Digital India, but processes in government sector which were designed during colonial time need to go through a long journey ahead. These processes need to be re-engineered to make them valuable both for the government agencies and citizens. The main essence of re-engineering is the separation of value-adding activities from non-value-adding activities which would help in differentiating critical processes from noncritical processes (Apostolou et al. 2011), and value chain analysis is the tool that would facilitate this value identification (Shin and Jemella 2002).

Value chain is basically a collection of activities that are critical for any organization to make final products/services valuable to the customer by utilizing technology or by process modification (Schmitz and Schmitz 2005). It helps assessing the value that each activity within a process adds to the product or services (Judith et al. 2016) and enables product differentiation/service differentiation by analysing chain of activities that happen in an organization (Porter 1985) by linking together the two resources that really matter in today's economy: knowledge and relationships of organizational competencies and customers (Normann and Ramirez 1993).

Value chain can be defined in three ways: based on activities, based on actors and based on strategic network (Hobbs et al. 2000). Value chain as a “chain of activities” is defined as a collection of activities undertaken to bring products/services to consumers through the stages of production including procurement of inputs and processing. As a “chain of actors”, value chain is defined as a chain of all actors involved in producing, transforming and delivering the product/service to the consumers. “As a network”, value chain is not limited to the small space; rather it is developed for better understanding of consumers' demands where many independent businesses work collaboratively to form strategic partnership. Thus, whenever a value chain is analysed, it is necessary to look at its political, legal and market context where actors are going to operate.

¹ <http://www.nasscom.in/events/ceo-round-table-iot-next-big-change-driving-e-governance>

Value chain is originally made popular by Porter (1985) who proposed it for businesses to gain competitive advantage in the market through product differentiation and cost leadership in the market by adding values in various activities performed by organization to produce product/service and managing the linkages between these activities (Porter 1985). A competitive advantage cannot be discerned by looking at a firm in isolation. Rather there are many stakeholders involved with any firm, leading to the production and final delivery of product or service, so if a firm has to gain the competitive advantage, then it has to take along all the stakeholders in a collaborative manner so that all can add strategic value to the final product or service (Judith et al. 2016) to allay customers' needs. Thus, the main objective of value chain is to add value and produce differentiated product in the market to achieve profit at all stages of chain with focus on quality, service and agility with distribution determined by consumers' demand than capacity utilization (Fearne et al. 2012).

Value chain analysis is a valuable tool that aids in BPR (Goksoy et al. 2012; Kassahun 2012; Andersen 2006; Kettinger et al. 1997). BPR is a "fundamental rethinking and radical redesign of processes to achieve dramatic improvements in critical contemporary measure of performance viz. cost, quality, service and speed" (Hammer 1990). Whenever any organization goes for BPR initiative, then the initiation point is to identify all processes followed in organization and activities performed in each process. Until or unless these activities are not fully understood, it won't be possible to identify what and where the problem is and how it can be resolved. Value chain analysis supports BPR by enabling BPR team and change agents understand all processes followed in an organization and activities involved in them, identifying what values can be added in each activity using technology or introducing some other changes; thus, value chain analysis discovers re-engineering opportunities (Kettinger et al. 1997).

If value chain development is talked about, then literature already has value chain for private sector businesses, but the same is not available for government sector. Value chain is not universal for GPS and private sector. Private sector develops value chain based on Porter's model of five forces in the market (Porter 1985). However, in GPS, since government is the sole provider of services and threat of substitutes is not there, value chain based on Porter's model of five forces cannot be used here. It is needed to develop a value chain for government sector in India if E-Governance has to be made sustainable. If E-Governance in nation is talked about, then it is very much in its infancy stage (Gupta and Suri 2017), and all operations of government are still based on old tools and techniques. To get actual benefits of E-Governance, it is very necessary for government to start with the transformation of government processes which is technically known as BPR or can be termed as GPR. But before going for BPR, government first need to analyse all its processes, activities and actors involved in providing the service to the citizen so as to learn the pain areas and then come up with the action to cure the same. This necessitates the need of value chain analysis before initiating any business process changes as, with VCA, knock-on effects up and down the chain become more apparent and complex interdependencies become more visible and can be communicated

easily (Schmitz and Schmitz 2005). Actors controlling the synthesis of services can easily be identified with value chain, and value chain analyses would bring together key stakeholders by connecting them with a common network. Further, value chain leads to improved working conditions, upgrading capabilities and building core competencies (Schmitz and Schmitz 2005).

Lack of availability of concrete value chain in literature motivated the undertaken research to go ahead with the development of value chain for GPS with focus on E-Governance. Value chain here has been proposed based on situation-actor-process (SAP)-learning-action-performance (LAP) framework (Sushil 2000). According to this framework, in any management context, there are three essential entities, namely, situation to be managed, actors involved in dealing with the situation and processes followed to deal with the situation (SAP). An interaction of SAP leads to learning about the situation in terms of problems faced and action to be taken to improve the situation and anticipating the effect of these actions on performance (LAP). In the present study, using SAP methodology, the current situation of government sector operations was diagnosed with the identification of actors involved in the situation and what role they play in delivering the services along with the processes being followed to deliver these services to the citizen. This SAP framework enabled the learning of key pain areas in the current situation which facilitated the development of action in terms of what should be done to improve the present situation of government sector which is presented in the form of value chain, with effect of the same on GPS performance anticipated, which constitutes LAP framework.

Public sector is one where government holds more than 50% stake, so in the text below, public sector and government sector would be used interchangeably or referred to as GPS.

11.2 Literature Review

11.2.1 *Value Chain*

The concept of value chain is not new. It holds its roots in the 1960s when it was used by analysts in charting path of development for mineral exploration economies (Kaplinsky 2000). But it became popular in the 1990s particularly after the work of Porter (1985) and an influential book by Womack and Jones (1996) who refer to it as a value stream. Porter (1985) proposed that there is a chain of events in the production of a product or services which starts from the procurement of raw material till the final delivery of product to the customer as well as post-sales service (Fig. 11.1). This chain consists of total nine activities, out of which five are primary activities that are basic to any organization and provide strength and sustainability to it. The remaining four are support activities which help in differentiation and maintenance of an organization. Both activities are very necessary for an organization to survive.

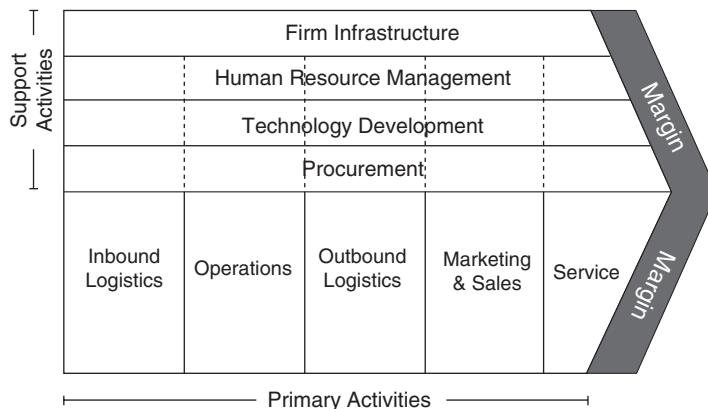
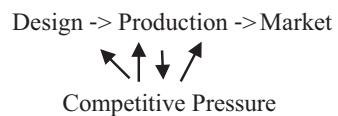


Fig. 11.1 Porter model's of value chain

Fig. 11.2 Kaplinsky's value chain



Value chain analysis is basically done to identify barrier to entry and rent, for good governance which includes three types of governance, viz. legislative, judicial and executive, and for achieving systematic efficiency (Kaplinsky 2000). Kaplinsky (2000) provided value chain in its most elementary form with range of activities within each link (Fig. 11.2) which, if comprehensively looked at, then would lead to discovery of pain areas in the production of products/services.

If service industry is talked about then, Heskett et al. (1994) had proposed conceptual value chain for service industry which was named as service profit chain. Service profit concept contended that in service industry if customer satisfaction is to be achieved, then main actors are employee satisfaction, employee productivity and loyalty and service quality.

11.2.2 *Government Sector Value Chain*

Picture in GPS is altogether different from private sector. In government sector, the main outcome is service to the citizen and the real appreciation for government sector is trust of citizen (Heintzman and Marson 2005) which is the bottom line here. Citizens value government sector much higher than private sector owing to its reliability and integrity. So it's the major binding on government sector to meet citizens' expectation of value.

In government sector, it is difficult to determine the bottom line as it involves contradicting and competing notion of public good owing to multiple departments involved and each having its own definition of public good. But using trust as an attribute, it can be identified if government is successful in achieving its mission of providing democratic society to citizen or not (Bouckaert 2002). Low trust indicates poor success of government despite success of any of its public policy or programmes. Government is considered to be successful in fostering the democratic mission, despite failures in some of the development areas, if citizen is found to trust the government. Van de Walle and Bouckaert (2003) concluded that trust is a common indicator of good governance in most situations. So, government sector value chain should focus on those actors that add value to the service being provided to the citizen to win citizen trust. Since value chain enables focus on all links and activities in each link in the chain, it would help in determining which activities are declining the trust and which activities are raising the trust. Such distinction will help policy maker in determining which threatened links need protection and which links need strengthening in order to generate more trust. Since government sector is not limited to a single department, multiple departments are rather involved in the service delivery; therefore, value chain analysis apart from leading to competitiveness leads to connectedness which again demands focus on macro policies and institutional linkages (Kaplinsky and Morris 2000).

If previous studies on government sector value chain are explored, then there is no concrete value chain existing in the literature. However, Rapcevičienė (2014) did some work in this direction where he proposed a public sector value chain based on the work of Heintzman and Marson (2005).

Heintzman and Marson (2005) proposed a public sector value chain where key actors are employee satisfaction, client satisfaction and citizen trust in the following manner (Fig. 11.3):

This model proposed that employee satisfaction is the key to generate the citizen satisfaction. If the employee is satisfied, then he will deliver good service to client which in turn helps in getting satisfied client, and this satisfaction would lead to building citizen trust and confidence in government departments. In fact, employee satisfaction and customer satisfaction have been mentioned as a “satisfaction mirror” in literature (Schneider and Bowen 1993). Andersen (2006) proposed a political value chain for public sector which is based on activities in public sector where IT can be used to add value and deliver faster service. This chain consisted of five primary activities and five supporting activities. Primary activities are automatic warehousing; flexible service delivery; links to suppliers, politicians, board members and politicians; front-office, one-stop shopping; and remote online access points. Support activities are EDI/email/E-commerce, staff selection and scheduling system, planning model, groupware and computer aided/multimedia.

Employee satisfaction \longleftrightarrow client satisfaction \longrightarrow citizen trust

Fig. 11.3 Heintzman and Marson (2005) proposed model

If these value chains of public sector are carefully looked at, then they all are found to focus on citizen satisfaction alone. But as pointed by Heintzman and Marson (2005) and Schneider and Bowen (1993), employee satisfaction and citizen satisfaction are mirror of each other. Therefore, effort should be on satisfying employee first who will then automatically work for keeping citizen satisfied, but this fact is missed out in all value chains exiting so far. Heintzman and Marson (2005) value chain does talk about the employee satisfaction and trust, but it is very narrow in its scope w.r.t. E-Governance. This study has not explored what motivates and hinders the employee engagement, what actors and processes add value to employee satisfaction and how processes are to be transformed to achieve E-Governance in the nation. Political value chain model proposed by Anderson (2006) is based on how IT can be used to automate the public sector. But if the bottom line of public sector is talked about, then this model barely analyses the activities that are necessary for engaging employees and building citizen trust in E-Governance. Using IT alone cannot make GPS ready for E-Governance. E-Governance means involving all stakeholders into national governance by empowering all stakeholders to collaborate, participate and communicate with government.

All models mentioned in literature have missed out another very important dimension that tends to influence trust and digitization of nation to achieve E-Governance – service quality. Service quality plays a major role in development of trust and confidence in public sector and delivery of high-quality services (MORI 2003). Further, if employee satisfaction is needed, then it is required to have employee engagement, and to ensure employee engagement, it is necessary to keep public sector employee well equipped with all the information that he would need to accomplish his task (Yang and Coates 2010; Marshall et al. 1998). Thus, internal service quality needs to be ensured using latest technologies. Until or unless employee is not having access to needed information in time, he won't be able to do his work satisfactorily (Cheung and To 2010; Sharma et al. 2016). This in turn would generate poor service quality to customer, thus leading to citizen dissatisfaction and loss of citizen trust. Apart from quality, another important factor that plays a major role in employee satisfaction and savouring the benefits of E-Governance is work culture of department which is missed out in Heintzman and Marson (2005) . If culture is not conducive, then quality of internal service would be poor which would result in employee dissatisfaction further leading to citizen dissatisfaction. Process management also wasn't found to be mentioned in any of the above discussed value chain models which is another important actor in ensuring high-quality service delivery in public sector. Process management is one of the most important pedestals for transforming non-performing processes of GPS, which ultimately acts as a fulcrum to achieve real E-Governance in nation.

People, service and trust are key constituents of public sector service value chain as proposed by Quinless (2012), which is again based on the work of Heintzman and Marson (2005). This model also misses out on service quality parameter, process management and organization culture.

Moullin (2017) recently proposed a scorecard for public sector having three actors, viz. capabilities, processes and outcomes. According to this scorecard, public sector needs to have capabilities in terms of its culture and resources to have effective processes, and these processes would then lead to quality outcomes. But service quality and employee engagement were not the components of this scorecard.

Through the review of past researches in the area of value chain for government sector, it is evident that there is a lack of concrete value chain that can lead to effective digitization of the nation. Since India is going in the direction of E-Governance, it is very necessary to ensure the employee involvement in the same as, ultimately, employees only are going to use the new systems in their jobs, and if they don't buy the idea of using technology in their duties, then the Digital India vision of GoI would be badly jilted. So, firstly it is needed to identify what is going to add value in achieving employee engagement who will then work for generating external services and ultimately having happy citizen. Based on above research, a conceptual value chain that would ensure employee engagement, citizen satisfaction and high-performing departments has been proposed to ensure successful transformation of India to Digital India in order to ultimately execute the E-Governance across the nation.

11.2.3 Proposed E-Governance Value Chain for Government Sector

Previous research on the development of value chain suggested that whenever value chain has to be designed for any organization, firstly it is needed to identify outcome of the organization. Outcome identification can only facilitate the identification of all actors and supporting activities that would lead to the value addition in that outcome (Kaplinsky and Morris 2000).

Since the main outcome of GPS is service and the main value for GPS sector is trust of citizen (Heintzman and Marson 2005), all activities of value chain to be developed should be in direction of winning citizen trust. Further it is suggested that, whenever a value chain is to be designed, then instead of focussing on goals, it is advised to focus on drivers that derive the achievement of these goals (Donovan et al. 2015). So, in order to develop the value chain, author started with the citizen and worked back up the value chain to those things that determine the customer satisfaction. Based on interaction with customs officers and their client, employees and process management are found to be key actors in fostering the citizen satisfaction and ultimately achieving the high-performing organization.

Other steps to develop value chain are engaging the chain, understanding the market, mapping the flow, identifying opportunities and threats and implementation of selected strategy and feedback for improvement (Judith et al. 2016). Engaging the chain refers to relationship development with stakeholders which is very critical for the success of any business value chain (Judith et al. 2016) where relationships

can be developed as collaboration and cooperation, information sharing, social bonding, performance satisfaction and level of mutual benefits gained, shared vision, adaptation, time and patience and micro and macro environment. Based on this, internal service quality and external service quality are found to be other critical actors leading to employee satisfaction which then leads to customer satisfaction.

Donovan et al. (2015) suggested that when value chain is to be developed to link government official with common citizen, considerable attention should be given to understanding the circumstances of actors in the chain and overall marketing, political and legal context in which value chain is going to operate. If value chain is developed for synergy, energy and performance, then focus should be on identifying bottlenecks in the chain and identifying how chain can be made competitive by allowing coordination and cooperation among actors of the chain. In order to have innovation and develop the potential based on this innovation, opportunity for using technology in a chain should be found out. If value chain is developed to improve the condition of employees, then attention should be focussed on condition of employees in the chain and methods that provide the opportunity to improve the same. So, value chain should always be developed keeping in mind the corporate value, knowledge management, information management and relationship management to ensure sustainability and stability of it (Walters and Lancaster 2000). This suggestion led to learning that value chain to be developed should have supporting activities in addition to primary activities so as to accommodate it in overall market, political and legal context, and ensure adoption of the latest innovation that would add value to each primary activity of the developed value chain.

In present study, to arrive at value chain for government sector, SAP-LAP methodology has been utilized to develop understanding of existing situations in the public sector, all the actors and processes involved in synthesis of quality services and learning the connection between all the actors in the chain of production and distribution of services.

Keeping in mind all the above learning from literature and conducting SAP-LAP study in selected departments of GoI, following value chain (Fig. 11.4) has been proposed which would ensure satisfaction of all stakeholders and high-performing departments and achievement of three key sources of public value, viz. delivery of quality public services, achievement of outcomes and development of trust (Golubeva 2007; Kelly et al. 2002) to make GPS competent enough. Efficiency, openness and responsiveness are the key indicators of public value of the e-government (Karunasena and Deng 2012), and every effort was made to incorporate them in the proposed value chain.

Actors that would ensure the success of E-Governance in India by facilitating the delivery of quality services to both government servants and citizens are identified through SAP study and divided into two categories: primary activities and secondary activities. The key activities identified in government sector to dramatically improve its performance and extend sustainability to it are internal service quality, employee engagement, process management, external service quality and customer satisfaction which together constitute the primary activities. In order to execute and

	Internal Service Quality	Employee Engagement	Process Management	External Service Quality	Customer Satisfaction
PRIMARY ACTIVITIES	Reliability	Involvement in decision making affecting officer	Removal of Non added activity	Reliability	Convenience to access the service
	Assurance	Recognition of achievement/ accomplishment	Processes with multiple version	Assurance	Ease of access to service
	Tangibles	Employee Empowerment	Process Standardization	Tangibles	Employees are willing to process their needs
	Empathy	Skill building opportunity	Process Integration	Empathy	Employee provides benefits
	Responsiveness	Clear roles and responsibilities	Process Automation	Responsiveness	Satisfied with the service
	Stress Management			Reliability	
		Goal setting is done mutually with the superior			
		Clear understanding of expectations out of me at work			
		Feel proud to be associated with the organization			
		The work that I do is meaningful to me.			
		Motivation is there to carry out the work.			
		Enough autonomy is their carrying out the work.			
Support Activities	Organization Culture				
	Involvement, Cross function Teams; Strong Communication; Continuous feedback; Paperless Environment; Collaboration and Cooperation; Code of Conduct				
	HR Practices				
	Recruitment & selection; Training & Development; Job Description; Motivation & Morale Boosting; Compensation & Rewards				
	Leadership				
	Openness to new ideas and initiatives; Listening to employees' problems; Recognize employee need, Recognize employee work, Spend great deal of time with customers and employees, Empower them in decision making; Telling job requirements clearly				
	Technology				
	Public Access Systems & kiosks; CCTV; ERP, EDI & SAP based systems; Data Center; Aadhar Interface; Task Automation; Interconnected Departments through Network Architecture; Cloud Based Systems				
	Security				
	Authentication, Firewalls, Biometric Security, Multilevel Password security, Cryptography, Digital Signature				

Fig. 11.4 Public sector value chain

maintain the primary activities, there is a need of supporting activities that would facilitate the high-performing organization by strengthening the primary activities. Supporting activities identified are organization culture, HR practices, leadership and technology support and trust and security. Each of these actors is discussed below with literature support to the same.

11.3 Internal Service Quality (ISQ)

The first primary actor identified based on interaction with customs officers posted in Delhi is ISQ which is found to play a major role in ensuring employee satisfaction in government department. When employees in Customs Department were interviewed to develop knowledge of prevailing situation, actors and processes in government sector, then it was revealed that this department work often gets delayed owing to lack of access to the needed information in time. Since government department works in collaboration with other departments and there is no interconnection among departments, therefore there is no way to ensure timely availability of information. Accountability is also not existing in system. Missing internal service quality is adversely impacting employee performance here.

Internal service is defined as services provided by distinctive organization units or people working in these departments to the other units or people in other depart-

ments of the same organization (Stauss 1995). Like an external customer, an internal customer also encounters many services, like information requirement and exchange from other departments and cooperation and collaboration with other departments, during the course of discharging their job responsibilities. The provision of good internal service is crucial for the overall success of the organization (Kang and James 2002) as ISQ delivers the employee satisfaction (Heskett et al. 1994) and satisfied employee leads to satisfied customer (Kang and James 2002) by providing high-quality external service. Thus, management should show commitment to the service quality as the same is positively related to the effective employee involvement with the job (Cheung and To 2010). Employee would deliver the excellent services to the customers if they are well equipped with all resources including technical, logistic, management and administrative resources (Markos 2010).

Improvement in ISQ will result in the improvement in the external service quality (Kang and James 2002). ISQ thus leads to happy and engaged employee in an organization who in turn will put best efforts to have satisfied citizen by ensuring best-quality external services which would ultimately lead to high-performing organization with minimal wastage of time and money (Marshall et al. 1998).

11.4 Employee Engagement

Another finding is lack of focus on employee engagement which, if literature is reviewed, is found to play a major role in enhancing citizen satisfaction and organization performance in service industry. In government sector, the major impediment to the delivery of quality service is lack of employee empowerment and employee engagement practices. Employees have no clear distribution of job responsibility, no autonomy in carrying out task and no involvement in decision-making which negatively affects their performance over the job.

Employee engagement means how employee commits during the performance of his job (Rizvi 2017). In service industry, employee plays the major role in creating, communicating and delivering the service. An engaged employee reflects the positive behaviour towards attitude, performance (Rich et al. 2010) and the success of business. A large body of research reflects that employee engagement does lead to satisfied customer (Rizvi 2017; Ellis and Sorensen 2007). It is very necessary to have engaged employees as engaged employees work for the upliftment of organizations (Gallup 2006).

Job-demands-resources (JD-R) theory contends that if resources which are needed by employee to carry out his job smoothly is available, then he will be more involved and satisfied in his job, thus enhancing engagement with the work (Demerouti et al. 2001). Internal service quality does help employees do their job better and make them feel satisfied (Sharma et al. 2016; Chiang and Wu 2014; Nazeer and Azeem 2014). If employee is not provided with quality service, he will get frustrated owing to non-availability of information pertaining to his duty which

then has an adverse effect on his well-being and satisfaction, thus reducing his job engagement (Sharma et al. 2016; Mirabito and Berry 2015). This frustration then vents out in terms of poor service to customer, arrogant behaviour towards citizen, laid-back attitude, lies and poor-quality service to the customer (Boyd 1997), thus lowering down the organization performance (Price and Hooijberg 1992).

A higher level of employee commitment leads to a strong will to accept organizations' goals and values and to work for the best of organization and willingness to maintain long-term relationship with the same (Wright et al. 2015; Paulin et al. 2006; Meyer et al. 2004). An organization that satisfies and empowers its employees tends to have satisfied customer and success (Kettinger and Grover 2016).

Thus in line of above discussion, the first hypothesis of value chain development has been formed as follows:

H1: ISQ is positively and directly leads to employee engagement.

11.5 External Service Quality and Customer Satisfaction

Next two actors of the proposed value chain leading to high-performing government are external service quality and customer satisfaction. Service quality directly and positively affects customer satisfaction (Subrahmanyam 2017; Zeithaml et al. 2011; Swan and Bowers 1998). Customers' perception about the organization and its service and service quality is influent to a greater extent by their interaction with employees of the organization (Rizvi 2017). Every customer expects the high level of courtesy and employee help, which are the reflection of employee engagement (Rizvi 2017). Perceived quality of service positively leads to the satisfied customer, and if employee won't show courteous behaviour to customer, he won't be satisfied (Kant and Jaiswal 2017).

Huili and Jing (2012) also found that service quality does have effect on customer loyalty directly and indirectly through satisfaction. Customer satisfaction decreases customer complaints and increases his loyalty and commitment (Yoo and Park 2007). If government sector is talked about, then citizen is treated as its client whose satisfaction is the topmost priority for GPS, and inclination is towards his inclusion in governance (Andersen 2006) as satisfied customer leads to a high-performing organization both in financial terms and nonfinancial terms (Kettinger and Grover 2016). And to ensure this, it is very necessary to keep employee in public sector engaged as effective employee involvement is positively related to the customer perception of service performance (Cheung and To 2010). Thus, employee engagement plays the mediating role between management commitment to service quality and customer perception of service performance.

So, next two hypotheses of value chain development are formed as follows:

H2: There is a positive relationship between internal service quality and external service quality through employee engagement.

H3: There is a positive relationship between employee engagement and customer satisfaction through external service quality.

11.6 Process

The last primary activity of the proposed value chain to ensure high-performing government is process management. Processes are set of logically related tasks designed to achieve business objective which can be interorganizational, interfunctio-
n and interindividual (Davenport and Short 1990). Such nature of processes which makes them run across departments demands the changes in old designed processes which focus more on specialization rather than deployment of technology to enable automated service delivery, resource management and innovation learning (Moullin 2017). Long-winded procedures, nontransparent processes, unclear responsibilities, increasing personnel costs and complex communication paths exacerbated the situation (Scheer 1991). GPS organizations often find that they are to deal with increased customer demands while operating with low budget (Parys and Thijs 2003; Appleby and Clark 1997). This leads to the need of changes in the processes which are followed in the same manner since post-independence. As a tool of rightsizing government, cutting red-tapism and reducing bureaucracy (Otenyo and Lind 2006), changes in processes promise to become a valuable and much-needed pitchfork in public administrations (Hooda 2014).

Ambidextrous organization architecture is the need of the hour for revamping the present public sector operations (Palm and Algehed 2017). In terms of public sector process changes, process improvement, process re-engineering, process redesign, process optimization, process integration and process standardizations are much-needed initiatives (Bala and Venkatesh 2017) which would lead to a high level of accountability, transparency and citizen participation which is negatively related to the corruption (Nguyen et al. 2017; Ray and Mukherjee 2007).

Customs officers posted in Delhi mentioned that existing processes being followed are old and now there is a need of technology-enabled processes with proper training of employees to work on them. There is no way to track the status of request issued to the other departments which negatively affects the quality of services exhibited by the employees and quality of services given to the citizens. The lack of transparency and accounting, same work done repeatedly in different departments and used in different ways by different officers, demands that processes should be made standard across the entire nation so that data portability issues won't remain and confusion owing to multiple versions of process won't exist. Government sector needs to be rebuilt, and re-engineering has to be undertaken to ensure efficient working of GPS in terms of service quality to both customer and employee (Andersen 2006). Thus the next three hypotheses of value chain development study are formed as follows:

- H4: Process management is directly and positively related to internal service quality in public sector.
- H5: Process management is directly and positively related to external service quality in public sector.
- H6: Process management is directly and positively related to the organization performance.

11.7 Organization Culture

In order to realize the benefits of E-Governance, it is very necessary to change the existing culture of GPS which is characterized by lack of transparency, lack of accountability, bureaucracy, lack of employee empowerment and lack of citizen involvement in decision-making. Organization culture is identified as a supporting activity to primary activities identified above.

Organization culture is an important driver to achieve the expected performance in public sector (Moullin 2017) by enhancing the internal quality of services, thus improving the employee engagement (Mehrzi and Singh 2016). RBV theory proffers that employees are the valuable asset for any organization and they have a direct and positive effect on organization performance as customer contact employees will behave with the customer in the same manner as organization behave with them (Moullin 2017), so it's necessary to provide them with the environment that promotes their performance (Kostopoulos et al. 2002).

The need of the hour is the workplace culture that facilitates employee well-being, openness and open sharing of information which ultimately enhances employee engagement and service quality (Karam et al. 2017). A strong organization culture is linked to the organization mission to enhance its ambidexterity and to embrace such culture; it is a necessity to have dialogues with employee and citizen (Palm and Algehed 2017) and empower them. Employee empowerment is the key to raise the organization effectiveness (Slåtten 2009). However, a most ignored objective of re-engineering is the effect of work quality and the performance of employee carrying out this work (Davenport and Short 1990) which should otherwise be made priority while going for the process change in organization as there is strong relationship between employee engagement and organization outcome (Mehrzi and Singh 2016). Since organization culture positively affects the job satisfaction (Cronley and Kim 2017), it is necessary to provide work culture to employee that enhances employee passion to work for the organization (Markos 2010; Bhatnagar 2007). Thus, in addition to providing ISQ to employee, it is necessary to ensure conducive organization culture to have engaged employee.

In light of above discussion, the next hypothesis of value chain development has been formed as follows:

H7: Organization culture positively moderates the positive relationship between the ISQ and employee engagement.

11.8 Leadership

Leadership plays a vital role in the change management to ensure the smooth transition to the re-engineered digitized environment (Weerakkody et al. 2011a). It's the leader only who will convince the employees to accept the new environment by sharing the vision for change, resolving their grievances and equipping them with all the

resources and knowledge needed to carry out the new job (Slätten 2009; Bhatnagar 2007; Demerouti et al. 2001). A committed and hands-on leadership is essential for the innovative quality development of the public sector as effective strategic leadership is essential to build ambidexterity in organization (Palm and Algehed 2017).

If effect of leadership on employee performance is talked about, then social exchange theory contends that if the employee finds the leader competent and confident, then they tend to show the same behaviour (Ugaddan and Park 2017) and easily adapt to the changed environment. Leader-member exchange (LMX) theory focusses on dyadic relationship and contented that there is a strong relationship between leaders and members. If there is a high level of LMX, then the employee will exert extra effort in performing well (Lunenburg 2010). Further, employee performance in any organization is found to be attributed by leadership and employee engagement (Rizvi 2017) where leadership asserts a positive effect on employee engagement (Karam et al. 2017; Moullin 2017; Ugaddan and Park 2017). A major work in this direction is done by Carasco-Saul et al. (2014) who cited close to 20 specific studies signifying the association of this relationship.

Thus, leader has an opportunity to create the supportive work culture in public sector which would enable employee to rise up to the challenges and perform well (Griffiths 1999). This leads to the formation of the next hypothesis of value chain development:

H8: Leadership positively moderates the positive relationship between the employee engagement and organizational performance.

11.9 HR Practices

The next supporting actor of value chain which contributes to the high-performing organization by enhancing the employee engagement is HR practices followed in organization. If E-Governance is talked about, then transition to the re-engineered environment is not a smooth journey. There would be a strong resistance to change from employees owing to fear of loss of power, lack of skills needed to perform the digitized job and insecurity about the change (Fuente 2013; Rana et al. 2013; Weerakkody et al. 2011a, b). But if high-quality HR practices are followed, then this journey of transition would be the cakewalk. Employees who are going to be affected by change should be involved into re-engineering project from the very first stage to get their valuable input on changes that are needed in the process which would make them feel involved in the change process. These employees should be carefully trained so as to impart the skills needed to perform the changed job. There should be clear communication starting with employees on the need of change and how it is going to be beneficial for them and the government agency itself. If such HR practices are followed in government agencies, then definitely there would be high employee engagement and such employees would definitely work for the upliftment of the organization (Karam et al. 2017; Ali and Farooqi 2014; Bowen and

Schneider 2014; Jiang et al. 2012; Markos 2010; Slåtten 2009; Bontis and Serenko 2007; Yoo and Park 2007; Marshall et al. 1998; Locke and Latham 1990).

Self-determination theory states that leaders and HR system of organization should provide such environment to the employee that not only promotes his self-determination, intrinsic motivation and satisfaction of his basic needs but should actively cooperate with employees to achieve so.

Previous studies clearly reflect that HR practices including selection, training, compensation, performance appraisal and employee participation are found to be significantly and positively related to organization performance (Rana and Malik 2017; Amin et al. 2014). Bontis and Serenko (2007) had empirically shown that human capital management practices positively moderate the relationship between employee capabilities and job satisfaction. Thus, to keep employee happy and ensure performing organization, HR practices play a major role.

In light of above discussion, the next hypothesis of value chain development is formed as follows:

H9: HR practices positively moderate the positive relationship between employee engagement and organization performance.

11.10 Technology

E-Governance is all about the usage of technology to promote transparency, accountability, responsiveness and citizens' participation. Lack of access to the urgently required interdepartmental information is major impediment to the smooth and timely operations of government sector in India. Thus, public sector processes and operations in India are in pressing need of technology deployment to ensure high-quality internal and external service; to standardize and automate the processes across the government departments; and to integrate national, state and local government so as to savour the actual benefits of E-Governance (Bala and Venkatesh 2017; Palm and Algehed 2017; Mandal and Bagchir 2016; Karunasena and Deng 2012; Andersen 2006; Bhatt 2006; Kaplinsky and Morris 2000). Technology enables effective and efficient working by providing transactional capability, bridging geographical distances, enabling process automation, providing complex analytical and information processing capability, enabling multitasking and knowledge management, allowing tracking and removing intermediation between two parties (Davenport and Short 1990).

With technology deployment, the next concern that comes is the security issue. When government processes go online and citizen data moves to cloud, then a very important issue that needs to be addressed is the security of government processes and citizen data stored in clouds or data centres to gain the citizen trust on the government services which ultimately bear direct effect on citizens' satisfaction (Shareef et al. 2014). Higher level of trust on government services is related to the more intensive use of E-Governance services (Belanger and Carter 2008; Lean et al.

2009). Two types of trust play a key role here: trust on government and trust on technology (Mishra and Sharma 2013; Voutinioti 2013; Weerakkody et al. 2011a, b; Belanger and Carter 2008; Detlor et al. 2008). Higher trust on government and trust on technology reduce perceived risk of using E-Governance service (Belanger and Carter 2008; Detlor et al. 2008). Also, there is a direct and positive relationship between system quality, information quality and trust on government and technology (Nulhusna et al. 2017). So, proper security measures need to be deployed to ensure citizen and employee trust.

In light of above discussion, the last hypotheses of value chain development are formed as follows:

- H10: Technology positively moderates the positive relationship between process management and performance of organization.
- H11: Technology positively moderates the positive relationship between ISQ and employee engagement.
- H12: Technology positively moderates the positive relationship between employee engagement and citizen satisfaction through external service quality such that this relationship is stronger for a high-technology deployment.
- H13: Security positively moderates the positive relationship between external service quality and customer satisfaction.

11.11 Methodology

11.11.1 Research Design

A phenomenology study utilizing SAP-LAP methodology has been undertaken to develop value chain for government and public sector. Phenomenology study has come from the academics of philosophy and psychology. It is based upon the work of twentieth-century philosopher Edmund Husserl, which was later extended by Heidegger. Phenomenology study is the approach of thinking about lived experiences (Manen 1990). This approach focusses on experiences, events and occurrences with minimal regard to external or physical reality. Here, the real experience of respondent is taken via tools like semi-structured interview and observation. Sample size is suggested to be kept small at less than ten as large data get unwieldy.

SAP-LAP methodology has been proposed by Sushil (2000). This methodology states that every situation has some actors and processes, understanding of which would lead to learning about the actions needed to be taken to handle the impending situation which would result into the performance of system. The feedback from the system on the one hand will provide additional learning, and on the other hand, it would lead to the identification of control actions that need to be taken. In the past, SAP-LAP has been used in supply chain management (Charan 2012; John and Ramesh 2012) and to measure the public value of E-Governance projects in India (Gupta and Suri 2017).

In order to make E-Governance a sustainable solution to achieve a high-performing government, it is necessary to identify all the actors, activities, processes and current situation prevailing in GPS as E-Governance is ultimately the interplay of these actors and processes existing in present situation (Larsson and Grönlund 2014). In the present study, in order to arrive at the value chain for GPS, no presuppositions were developed regarding the kind of value chain to be used. Rather, government sector employees were interviewed to develop understanding of what situation they are facing, what actors are involved in the situation, what processes need to be improved and what actors value the most in public sector operation to improve its performance. Based on analysis of data collected, a learning has been developed that operations in government sector are performed at snail pace and employee engagement practices are not followed. This demands changes in the processes being followed; internal service quality is another important aspect that needs attention in addition to its work culture, HR practices followed and technology deployment.

11.11.2 Research Instrument

Semi-structured interview with open-ended questions was used to collect the data from government sector employees. Structured interview was not conducted as its development would have then led to preconceived beliefs about the situation on author's part. So, in order to avoid this presupposition which is the main essence of phenomenology study, government sector employees were firstly asked semi-structured open-ended question to develop understanding of the present situation existing there. They were then asked question on their prerequisites to carry out the job effectively and to raise the pace of performing the tasks. Questions were also asked on what values are needed to be added in GPS environment to ensure a smooth working environment.

This led to the understanding and development of base framework of value chain for GPS as follows (Fig. 11.5):

After this framework development, previous work on public sector value chain, though it is in dearth, was reviewed to arrive at the final value chain (Fig. 11.4).



Fig. 11.5 Base framework for value chain development

11.12 Data Collection

11.12.1 Sample Selection and Size

In order to arrive at the value chain for GPS, it was decided to collect the data from government departments, namely, Customs Department, Delhi, India, and TDS, Income Tax Department, Vaishali, Uttar Pradesh, India.

Customs Department is selected because this department presently is not making use of any software or technology to carry out its operations, and operations are carried out very slowly, thus leading to delays in servicing the stakeholders. However, it is going to implement a SAP-based application very soon. So, in order to develop the understanding of pre-BPR situation, actors and processes, this department was chosen. Another reason to select this department is its nature of sensitivity. TDS Income Tax Department was chosen as this department has already received the best E-Governance award recently². This would provide an opportunity to identify how processes were changed to ensure successful E-Governance. So, to develop the understanding of post E-Governance situation, actors and processes involved, this department was selected.

In total eight officers of commissioner, superintendent and inspector rank were interviewed from Customs Department. The customers of this unit of customs are the courier companies which collect the courier after getting clearance from the customs inspection. So, two courier companies, namely, DHL and FedEx, are also to be contacted to get the customs service data from citizen point of view. It's from junior employees that some data has been collected. Appointment has been sought with senior management of these companies to collect more data.

However, interviews of eight officers from TDS Income Tax Department are to be taken very shortly, and appointments are already sought, but owing to shortage of time, value chain is proposed based on Customs Department officers' interview only.

The total sample size planned was 15.

11.12.2 Findings

Based on interview with customs officers, Delhi situation is identified as in desperate need of process changes. There are many serious concerns which need quick attention to improve the performance of departments. These departments work in collaboration with other departments where officers need access to various information like Aadhar number verification, PAN verification, police reports and company information, to name a few. So, whenever officers need such information, they need to write a letter which is then sent to the concerned department, and on approval from that department, the requested information is sent. This takes a long time to get the requisite information

²<http://nceg.gov.in/National-Awards-for-e-Governance>

and delays the process. Also, when these officers need information from other departments or raise any request, then there is no way to track the status of the information request or to mark request as urgent or routine. It's just that physical request is placed and information is sent back physically which takes time and sometime goes into files. This is the main impediment to the performance of these officers. There is no process standardization across departments. Every department follows its own version of processes which causes confusion and again delays in the operation completion. Next, employee engagement practices are not followed. Officers are rarely given recognition or rewards by departments for their outstanding performance or for odd hour's duty. It's only their immediate seniors who accolade them, but department wise no recognition is there which, at times, demotivates these officers. These officers do not need any monetary reward; it's the intrinsic motivation and rewards that matter to them. They mentioned that what they wish to have is the recognition of their work, availability of all resources to carry out their work efficiently and cooperation from other departments which is presently lagging. There is lack of adequate training and development practices to update the skills of these officers, and it is just on-the-job experience that leads to acquisition of needed skills. The customers of this unit of customs are the courier companies who collect the courier after getting clearance from the customs inspection. These customers reported that there is lack of technology usage here and there is no way of filing tax online or tracking the shipment for customs clearance, and this leads to delay in getting their deliveries and causes lot of inconvenience.

Based on the interaction with customs officers, SAP variables identified are summarized as follows:

Situations Identified

- Huge stack of pending cases files
- Interdependency among departments slowing down the work
- Lack of training and development
- Lack of recognition for high-performing employees
- No concept of quality service for internal employees
- Lack of tracking service
- No task automation
- No process standardization
- No clear description of roles and responsibilities
- No employee engagement practices

Actors Identified

- Process management.
- Internal service quality.
- Employee satisfaction.
- High-quality service needed for customer convenience.
- Technology deployment is needed to revamp the old processes, to automate the task and to reduce the departmental interdependence, for ensuring transparency and tracking the status of request.
- Organization culture.

- HR practices.
- Technology.

Processes Identified

- Physical request for information
- Duplicity of work
- Lack of status tracking system
- Lack of process standardization
- Lack of integration of department working in coordination
- Lack of information sharing
- Lack of process automation

11.13 LAP Synthesis: Proposed Conceptual Value Chain Framework

On the basis of SAP analysis and literature review, a learning has been developed that if performance of government sector has to be improved dramatically, then it has to go for BPR-enabled E-Governance. Another learning is that to ensure true E-Governance, firstly it is needed to identify what actors are involved in the creation and delivery of services that hold some value to the customer and then identify how technology can add value to these actors so that real benefits of E-Governance can be yielded. The conceptual model of proposed value chain is proposed as in Fig. 11.6. According to this model, citizen satisfaction is derived by external service quality, and this satisfaction is further strengthened if technology is deployed to provide services to the customer. If employee engagement is practised in GPS, then he will work to generate the external service quality, and this quality is further enhanced if technology is deployed to generate the service. Further, process management is needed in public sector to enhance internal and external service quality. Technology positively enhances the relationship between process management and organization performance. To ensure employee engagement, management needs to show commitment to the internal service quality, and if technology is utilized to provide internal service to employee, his engagement is further enhanced. Also, conducive organization culture will strengthen the employee engagement. Good HR practices followed to moderate employee engagement lead to a better-performing organization. Committed leadership also strengthens the positive and direct relationship between employee engagement and performance of organization.

Future work would be to empirically validate the above model (Fig. 11.6).

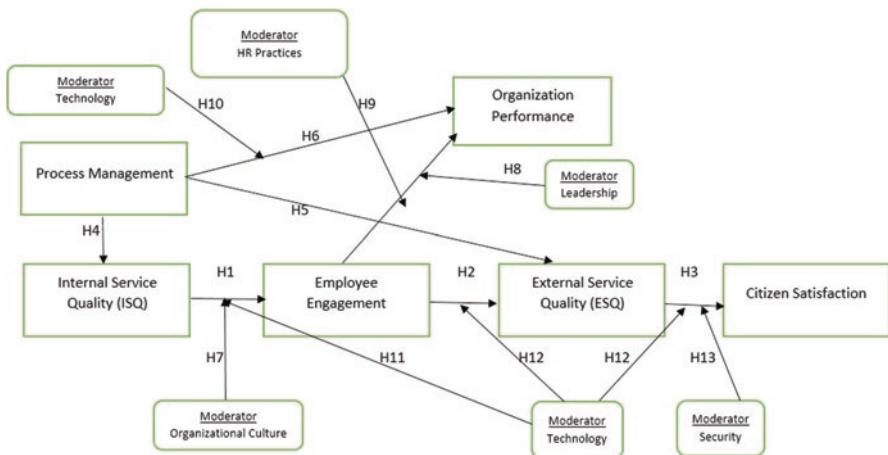


Fig. 11.6 Proposed conceptual framework

11.14 Conclusion: Implication for Government

India is moving at a very fast pace towards the realization of Digital India where every citizen across nation irrespective of region would be able to access government services online. But this journey is not as simple as it seems and GST implementation has already proven this. If one looks carefully at need of digitization across nation, then it would be realized that it is needed not just for the convenience in accessing the services; rather there is an increased demand for the digitization both from citizen and government employees owing to increased need of simplifying the complex government structure to simpler one which would make government systems transparent, accountable and more responsive. The ultimate aim of digitization is to achieve the E-Governance across the nation, and it should be kept in mind that mere transformation of physical service to the electronic service is not the E-Governance. E-Governance rather has much broader scope which encompasses e-participation, e-communication, e-administration and e-government. To achieve E-Governance, it is needed to transform the government processes which were designed during colonial periods, an aim of which is to control the citizen rather than service them. These processes consist of cumbersome long-winded procedures and non-value-adding complex activities running across departments which create room for nontransparent culture and fraudulent practices. As government sector has multiple stakeholders, so while going for its transformation, it is very necessary to win confidence of all these stakeholders to ensure smooth transition to the changed environment which is again a very daunting task. To overcome all these challenges, it is needed to go ahead with transformation by identifying all the actors of government sector involved in creating and delivering the services to the

stakeholders. Value chain analysis provides such opportunities and enables government managers to differentiate among value-adding and non-value-adding activities involved in operations. The proposed value chain for government sector is very comprehensive in nature, and it would equip the government BPR teams and change agents with bird's eye view of where and for what to focus at in government operations for bringing in the change, what changes and how these changes need to be brought in present government operations so as to make these processes valuable for its stakeholders. Value chain analysis is the only tool to make the government processes valuable both for its employees and citizens. Future work would be to empirically validate the proposed value chain using SEM methodology.

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Chapter 12

Current Trends in Industry 4.0 and Implications in Container Supply Chain Management: A Key Toward Make in India



Shubhangini Rajput and Surya Prakash Singh

Abstract The paper provides an overview on the current trends and future perspective of Industry 4.0. Besides, the paper also presents the advances of Industry 4.0 which has enabled systematic functionalities for cyber-physical systems. It has paved way to integrate functional capabilities in physical assets which facilitates monitoring and synchronization of real-time information over the Industry 4.0 network. Smart analytics of Industry 4.0 effectively and efficiently communicates and coordinates with entire components of the system. In addition, the paper also proposes six-leveled architecture for Industry 4.0 which shows an implication in the containerization system of container supply chain at the port. Further, advancements of Industry 4.0 are implemented in the containerization system to optimize business operation at the port to effectively and efficiently build container supply chain.

Keywords Industry 4.0 · Big data · 5C and 6C architecture · Cloud computing · Container supply chain management

12.1 Introduction

Indian economy is a developing mixed economy being contributed from three major sectors, viz., primary (or agriculture) sector, secondary (or industrial) sector, and the tertiary (or services) sector. Manufacturing (or industry) sector is one of the major components which contributes around 26% of Indian gross domestic products (GDP) and provides employment opportunity of about more than 20% of the total workforce and considered as one of the high development areas. Very recently, the

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Government of India (GoI) started an initiative worldwide termed as “Make in India” program to position India as the biggest and largest manufacturing hub in the world map. Make in India initiative due to continuing advancement of manufacturing technology is also undergoing paradigm shift at a fast pace which enables the Indian economy to be the fifth largest manufacturing country by 2020. Simultaneously, GoI has also initiated a dream project toward making digital country, thus, fully a digital economy. Therefore, in coming years, Internet of Things (IoT), which is a new digital technology seen as the most prevalent aspects for manufacturing sector, would capture close to 20 percent share in IoT market worldwide. Hence, IoT market in India is envisaged to develop at a compound annual growth rate (CAGR) of more than 28 percent in the next 5 years (Source: IBEF Report).

In view of above, Make in India and digital economy are initiatives by the GoI to create manufacturing hub for local and global markets. Recently, India made this declaration globally as the accomplice country at the 2015 Hannover Messe, Germany. Therefore, in this direction India intends to adopt Industry 4.0 ideas and new technology concepts for smart manufacturing through Industry 4.0 toward digital Make in India. Therefore, making logistics an efficient and effective becomes an important part in the manufacturing sector as logistics plays a vital role in the delivery of goods and services to the end customer globally. To provide timely goods and services globally logistic is widely connected through sea route, thus, port logistics need to be integrated with the IoT to make Indian economy fully digital. Therefore, container supply chain which is the major part of port logistics is essential to manage efficiently and effectively. This is only possible through integration of IoT and Industry 4.0 in the container supply chain which provides impetus to the manufacturing sector making truly digital economy in the Make in India process.

As mentioned above, digital industrial revolution is the need of the hour for any digital economy, as it is well known that the first industrial revolution was mechanical production facilities observed in the mid-eighteenth century. The second followed with the electrification process and labor division in the 1870s. It was followed by the third in the 1970s with the use of advanced electronics and IT system. It included the advent of automation process in production. Now with the automation and smart products, the current industry is headed toward the next industrial revolution named Industry 4.0 (Vuksanović et al. 2016; Wolfgang 2012). Industry 4.0 consists of three basic components, viz., the Internet of Things (IoT), the cyber-physical system (CPS), and the smart factories which enable products, components, and machines to interact with each other as well as capture real-time information and self-adapt accordingly (Shrouf et al. 2014). With the current market being volatile and dynamic, emerging technologies such as IoT (Varghese and Tandur 2014) lead to a phenomenal shift for manufacturing companies. IoT is a technological transformation of real-world data into virtual data and has the capability to share information and self-organize intelligently (Madakam et al. 2015; Chen 2012). It is embedded in physical objects linked through networks and acts as an analytical tool to understand the complexity and respond promptly. Industry 4.0 is seen as an umbrella term for immense growth in information technology to influence productivity, accuracy, quality, and deliverables of manufacturing companies. Reaching a higher level of production efficiency and

productivity with increasing automation is the main goal of Industry 4.0. The CPS bridges the gap between cyber and physical worlds to provide better understanding and functionality (Lasi et al. 2014). It includes the implementation of information technology with the physical world up to the production process at machines. In other words, CPS is the technical bridge between the physical assets and the computational capabilities (Gorecky et al. 2014). In today's time, due to changing socioeconomic variations, market needs customized products meeting their specific demands. Hence, the market, being driven by the changing need of consumers, is in huge demand for customized approach toward the development of CPS. Therefore manufacturing companies have to meet customer requirements regularly in the presence of VUCA (volatile, uncertain, complex, and ambiguous) environment. Hence, the sixth dimension of Industry 4.0, i.e., customization, will accelerate flexible production in terms of customized products (Plinta 2016). With the reinforcement of IoT, actuators, sensors, and CPS, smart manufacturing is managed autonomously with maximum optimization of resources throughout the process.

The rest of the paper is structured as follows. Section 12.2 provides an overview on current trends and future perspectives of Industry 4.0. Section 12.3 presents basic architecture of Industry 4.0 and proposed 6C leveled architecture for Industry 4.0. A case study of container supply chain in the context of Industry 4.0 is discussed in Sect. 12.4 and followed by future implications, limitations, and challenges. Finally, conclusion and future directions are given in Sect. 12.6 (Fig. 12.1).

The first industrial revolution is steam and power replacement of human and animal power with machines. The second is electricity, internal combustion engines, airplanes, telephones, cars, radio, and mass production. The third is electronics, the Internet, and IT used to further the automation of mass production, and the fourth is driverless cars, smart robotics, materials that are lighter and rougher, and a manufacturing process built around 3D printing.

12.2 Industry 4.0: Current Trends and Future Perspectives

Industry 4.0 came into existence in 2011 when German government launched a project of digital manufacturing at the Hannover Messe (Drath and Horch 2014). At that time, industrialist and academics who were involved in this project had

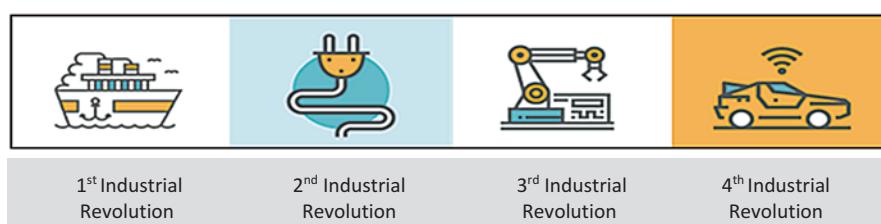


Fig. 12.1 Industrial revolutions

no idea that Industry 4.0 will be widely accepted. Industry 4.0 is also referred as “smart industry” or “smart manufacturing”. Its main goal is automation, process improvement, productivity optimization, accuracy, precision, etc. (Wang et al. 2016a, b, c). It is believed that Industry 4.0 is related with Industrial Internet, and since 2016 *Platform Industry 4.0* and *Industrial Internet Consortium* have started collaborating (<https://www.i-scoop.eu/industry-4-0/>) hugely. To know the current trends in Industry 4.0, a search methodology is adopted which is described in the following section. Based on search outcomes, current trends in Industry 4.0 and its future perspective are provided in Sects. 12.2.2 and 12.2.3, respectively.

12.2.1 Search Methodology

The main objective of literature review is to identify the aspects of Industry 4.0 which are widely accepted in academia and industry. It is anticipated to identify research gaps and highlight the boundaries of knowledge (David et al. 2003). Saunders et al. (2009) have supported for systematic literature reviews through an iterative process of defining suitable search keywords, searching the relevant literature and conducting the analysis. For the purpose of this study, the search strategy is devised by identifying the relevant source for publications related to Industry 4.0. For this, the authors have considered various scientific databases such as Scopus, Google Scholar, ECONIS, EBSCOhost Business Source Complete, ScienceDirect, etc. (Roblek et al. 2016) to retrieve the complete source of contributions in the fields of production, logistics, management, and engineering from both academia and industry (Hermann et al. 2016). These abovementioned databases include both German and English publications in which two different notations of the term “Industrie 4.0” and “Industry 4.0” have been identified. However, on analyzing the search results, it is observed that Scopus database contains most of the publications, is the largest database of abstract and citation of peer-reviewed literature, and has thorough overview of research outcomes in the areas of technology, medicine, social sciences, and arts and humanities (Fahimnia et al. 2015). In the paper, Scopus database is considered for search purpose.

For the purpose of keyword selection, authors have cited only the most appropriate research publications related with the paper title. Thus, the authors have considered the keywords “Industrie 4.0,” “Industry 4.0,” and “cyber-physical system” for the purpose of collecting the relevant articles. However, to interpret the insights of Industry 4.0 in manufacturing, factory, information technology, and customization, different keywords are used. Once the articles are obtained, the abstracts and keywords are used as primary filters, and those irrelevant articles are excluded from the study.

Inclusion criterion in this study is the research being evaluated had to originate from an academic source. Therefore, authors have excluded books, chapters, doctoral thesis, white papers, editorial notes, etc. from the scope of the study.

Publications fulfilling the criteria are then refined using exclusion criteria to keep the most relevant work related to Industry 4.0. Exclusion criterion eliminates publications which do not calibrate with the scope of the work and exclude those publications which contain Industry 4.0 for reference.

Further, Industry 4.0/Industrie 4.0 and CPS growth are depicted in Figs. 12.2, 12.3 and 12.4. From Figs. 12.2, 12.3 and 12.4, it can be seen that the concept of Industry 4.0 came into effect in 2011, but no published papers are seen till 2013. The number of publications related to Industry 4.0 is significantly less over the past few years. Moreover, using CPS and Industry 4.0 keywords in the context of “title” only, the resultant document is nil; thus, no figure is reported in the study.

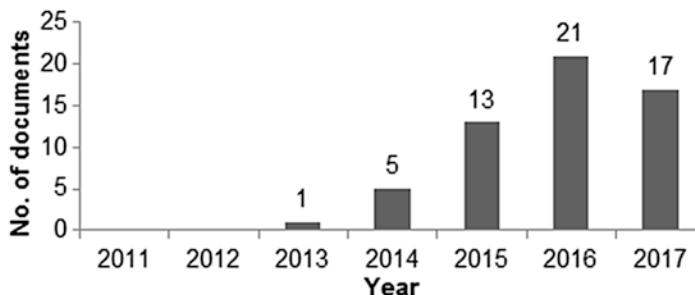


Fig. 12.2 Industrie 4.0 and Industry 4.0 under “title,” “abstract,” and “keywords”

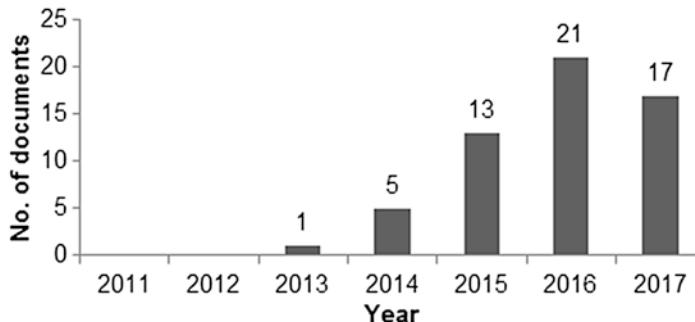


Fig. 12.3 Industrie 4.0 and Industry 4.0 under “title” only

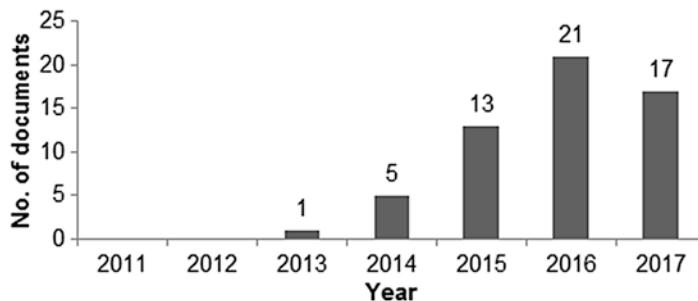


Fig. 12.4 Cyber-physical systems, Industrie 4.0, and Industry 4.0 under “title,” “abstract,” and “keywords”

12.2.2 Current Trends

Industry 4.0 is implemented in some of the leading manufacturing industries and has altered the production process by interacting with surrounding components. Bosch is leading the Industry 4.0 as a main operator of supplier and provider of Industry 4.0 solutions. The company has upgraded all its machines to Industry 4.0 in practice at Bosch Rexroth plant, Germany. The challenge is to manage 200,000 different product variations while producing small batch sizes. They upgraded the facility to become a fully connected shop floor with high transparency and zero setup time in a paperless shop floor. The product controls the manufacturing process using the smart factory feature. A virtual representation of the product is created at the starting point and assigned an ID, so it completely eliminates the issue of mix-up. The virtual image is available at all times to the employees through digital connectivity and enables them to monitor the production process. The plant has increased its productivity through vertical and horizontal integration (<http://blog.bosch-si.com/industry-4-0-germany-takes-first-stepstowardthe-next-industrial-revolution/>). Similarly, Industry 4.0 is applicable to manufacturing industries in India as well. India’s first smart factory is being set up in Bengaluru by Indian Institute of Science (IISc) with an investment from Boeing. Bajaj was the first company in India to start the application of Industry 4.0 followed by Maruti, Ford, and Hyundai. Bajaj commenced the process of automation in 2010, by using “cobots” (collaborative robots) in its production facilities. It manufactures its own bots and uses them for manufacturing in its plants in Chakan, Waluj, and Pantnagar. It operates around 300 bots in its manufacturing plants and most of them have been manufactured by itself. Maruti has employed one bot for every four workers in its Gurgaon and Manesar plants. These robots are generally employed in weld shops, painting, and pressing used for shaping cars. These three shops are completely automated now. These robots ensure precision and safety and avoid defects along with inconsistencies. Bots increase automation and provide better fit and finish.

12.2.3 *Industry 4.0: Future Perspectives*

The section provides salient issues as a future perspective in the area of Industry 4.0. These future perspectives are indicative and could be seen as some prominent areas where Industry 4.0 can directly provide some benefits. Due to gaining popularity and research potential in Industry 4.0, some of the technology-oriented firms are integrating the concept of Industry 4.0 in the fields of energy (CPS for smart grid), health (CPS for telemedicine and remote diagnosis), mobility (CPS for networked mobility), and industry (CPS for industry and automated production). Germany has a lead market for Industry 4.0 and has prioritized the areas for developing metamorphic steps for robotics services, machines, and other systems to deal with flexible infrastructure complex process autonomously. Industry 4.0 has its development in future-oriented production, logistics systems, knowledge-intensive devices, as well as integrating its technology in ICT-based projects to build intelligent interaction (<https://www.gtai.de>).

12.3 Proposed Six-Leveled Architecture for Industry 4.0

Industry 4.0 is associated with concepts of CPS, IoT, and smart factory. Industry 4.0 has laid its vision on CPS. Within the structure of smart factory of Industry 4.0, CPS monitor physical processes which create real-time information of the physical world and make decentralized decisions. IoT drives CPS to coordinate and communicate with each system in a network and humans in real time. The existing and widely accepted architecture of CPS has five levels which defines workflow, how to build CPS from initial stage of data collection to analytics (Lee et al. 2014; Lee et al. 2015). Brief description of these levels is given below.

- (i) *Connection level*: The initial step of CPS is to retrieve accurate and reliable data from the components of the system. The data can be obtained from RFID sensors, ERP, MES, etc. The data is managed and transferred to the second level.
- (ii) *Conversion level*: The data is converted into useful and meaningful information as per the requirement. This brings self-awareness to machines.
- (iii) *Cyber level*: Information from different components of the system is transferred and created to a network. It acts as a pivotal center as extensive information is stored and smart analytics play a key role in managing and producing additional information for humans in real time. These analytics induce the capability of self-comparison.
- (iv) *Cognition level*: This level generates information which becomes meaningful for the end users. Based on acquired knowledge of the system, the proper decision can be taken and manage their tasks to optimize the process.
- (v) *Configuration level*: At this level, feedback is provided to the physical world to apply corrective decisions which have been made previously (Fig. 12.5).

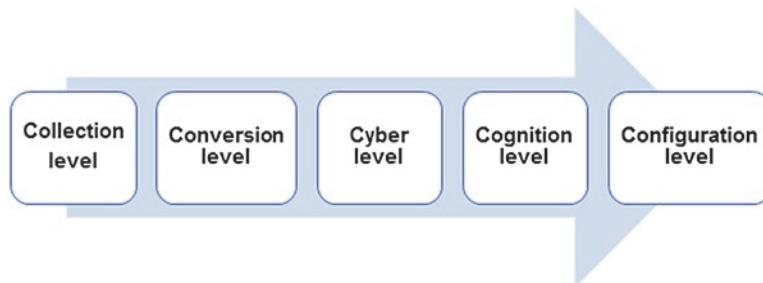


Fig. 12.5 5C levels of CPS in Industry 4.0

Industry 4.0 is considered as a major step toward the application of technology in the production, forecasting, and operations part of the industry. The customer needs to be continuously involved in the production process to reduce waste and time, thus to enhance productivity. The end users persistently require highly customized products in small batches, so they need to monitor the product that is being produced as it will increase the accuracy and precision in the system. It also increase the responsiveness and inclusiveness. Therefore, real-time feedback from the end user results in increase in efficiency.

- (i) *Connection level*: It is the level where meaningful and important raw data is collected and fed into the system through machines. The process of obtaining the data is through the RFID sensors or EMS. The huge amount of raw data obtained is available in a different format, so, storing them on a single central server is an important step.
- (ii) *Conversion level*: In this level, data collected initially is shared among the machines after pulling out the necessary information from it through different analytical tools or algorithms.
- (iii) *Cyber level*: The cyber level is basically a network of machines where the data from all the machines in the network gets assembled and is processed, shared with the machines through IoT.
- (iv) *Customization level*: The customization level will be adding the necessary customization specified in the product depending upon the details provided by the customer. This level is important from the customers' perspective. It enables them to interact with the machines and get the products of their chosen quality (Jazdi 2014).
- (v) *Cognition level*: The cognition level helps to generate a holistic view of the system through the data being collected and taking the correct decisions. It helps to optimize the system and generate a priority-driven process for the whole system.
- (vi) *Configuration level*: This level is for the human monitoring of the system. This stage acts as a preventive and proofing step for the decisions taken in the cognition and customization level whether the products and the current status inclines with the decisions (Fig. 12.6).

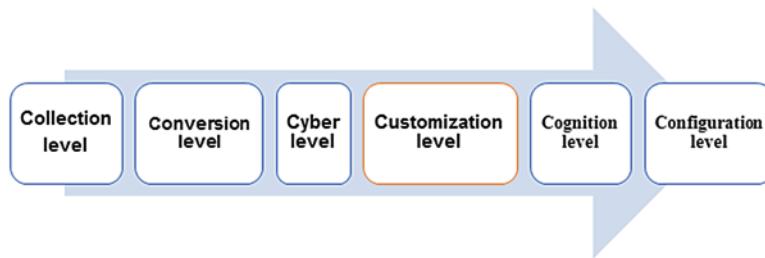


Fig. 12.6 Proposed 6C levels of CPS in Industry 4.0

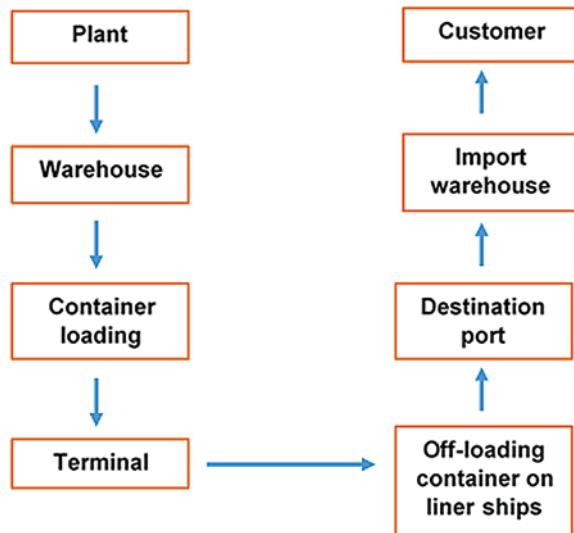
12.4 Container Supply Chain: Case Study

Container supply chain has a significant role in international trade because of its ability to carry huge freight over a long distance mostly intercontinental. Containerization system was introduced in the 1960s and the most popular international trade countries are China and Egypt (Mhonyai et al. 2011) which are using maritime transport. The containerization system is a conversion of freight transportation into the container in bulk, transported from production plant to end customer using intermodal transportation (Arendt and Meyer-Larsen 2009; Woxenius 1998) with minimum damage. In order to revamp container supply chain, advanced technologies have to be integrated to accomplish the objectives of allocating containers efficiently, loading and unloading of containers, transport, storage, and minimum damage while transporting (Yang 2009).

12.4.1 Generic Container Supply Chain Management (CSCM)

Thousands of containers arrive at seaport from all over the world, and it carries goods from the production site to end customer through intermodal transportation. The initial step in this process is “export haulage” – the movement of cargo to the forwarder’s warehouse, and it is by road or rail. The cargo is then positioned in a stack and kept ready to load into a container for the same destination port. A container is loaded and brought to the seaport by the trucking company. Transporting containers to and from the port is known as “drayage.” Till the designated ship arrives, containers are kept at the port in the container stacks according to their dimensions, i.e., weight and size. Once the ship arrives, the containers are brought near the designated ships by a bomb cart and then off-loaded on liner ships from their respective ports (Wang et al. 2014). The container is shipped on multiple vessels with trans-shipments in different ports, and it reaches the destination port as scheduled. Finally, containers are loaded onto a chassis or a special truck and transported to end customer via import warehouse which is commonly known as “import haulage” (<http://www.pacificmarine.net/>) (Fig. 12.7).

Fig. 12.7 Generic container supply chain flow



12.4.2 Existing Gaps in CSCM

There are some key issues with container supply chain which are needed to be resolved to make the container supply chain efficient and effective. These issues have consequential effect on containerization system as companies are unable to track containers; huge inventory costs are incurred subject to transportation, carrying costs, distribution, and manufacturing (<http://www.worldshipping.org>). The following are some of salient gaps that exist in the CSCM (<http://www.savi.com>):

- *Container utilization:* Companies are not able to track or monitor containers that leads to inefficient utilization of containers. Different port locations are unable to report the container demand and its availability accurately. Containers are not repositioned from importers' area to exporters' area.
- *Labor efficiencies:* Labor requirement is more in containerization system. Due to inefficiencies of labor, containers are not relocated in supplier and manufacturer locations.
- *Container losses:* There is no proper procedure to keep a record of container losses. The rate of container losses is high in vendor location or in transportation is significantly unknown by which costs get incurred in purchasing new containers.
- *Transportation management:* The strategy is not well defined for container operation to ensure timely delivery of the consignment. Periodically there is last-minute shipment due to which incremental cost gets incurred; who will bear this cost, vendor or a company, is not clearly addressed in CSCM.
- *Warehouse space management:* If container's demand and its monitoring are not handled properly, then there is a possibility of a shortage of storage space (Shaiful et al. 2016), and extra containers are lying outside the warehouse and apparently it is misused or gets stolen.

- *Distribution planning:* This approach ensures the timely delivery of the consignment to different distribution centers, in the right quantity, in the right location, and at right time.
- *Trade imbalance:* It signifies that empty containers are at importer's site and shortage in exporter's site. These empty containers need to be repositioned.
- *Expendable management:* Usage of expendables is high which leads to incremental cost on expendables. When shipment takes place in the form of expendables, there are the chances of higher product damage.
- *Uncertain demand on port:* This problem arises when port infrastructure is unable to adapt volatile demand and have a minimum capacity to meet future demand.
- *Fleet management:* It is the number of ships and the fleet size that a shipping company is allowed to keep in the fleet. When the demand varies, the shipping company sells, purchases, charters in, and charters out ships over different periods.

12.4.3 Proposed Framework for CSCM

Shipping companies usually implement ERP system at supplier level and generate data to track the movement of shipping containers, but mostly it provides information in silos. This becomes a disadvantage for the manufacturer as it becomes slightly difficult to retrieve information of shipping containers. Similarly, receipt of shipment is generated at manufacturer's location, but not shared with suppliers. To turn container supply chain into smart, ubiquitous supply chain, high-definition and robust technologies have to be integrated through IoT, sensors, cyber-security, and big data. IoT integrates into container supply chain a key enabler and allows different objects in a system, i.e., RFID sensors, to interact and cooperate with their adjacent components (Roberts 2006; Stahlbock and Voß 2008). All shipping containers' physical information is stored in the cloud using cloud computing to retrieve all components in a system on real-time and remains in connected mode. When shipping containers are equipped with sensors, they form a network and supports in collecting data on their location, position, and condition of containers, including sensory data such as vibration, dirt, temperature, moisture, air humidity, and amount of shocks sustained. It helps in locating and detecting the severe condition of containers as well as monitors the diagnosis. At conversion level, supplier or manufacturer can extract information from sensory data as per their requirement. There are several methodologies available to convert data into meaningful information at conversion level. CPS is interconnected between physical and the virtual world. Information from each connected components is being forwarded to it and forms machine network. When information from each level gets accumulated at CPS level, big data analytics comes into picture to retrieve additional information (Lee et al. 2014) that provides better status quo of containers in a supply chain. Big data analytics induces the capability of self-comparison and similarities based on historical information which can be measured to improve the performance

and can predict the future aspects of containerization system. Cognition level provides a systematic process to adapt experts' decision based on acquired information. This helps in optimizing the process and prioritizing the tasks. For user readiness, info-graphics are essential to transfer acquired information to the physical environment. At configuration level, components are self-aware and self-configure and apply corrective decisions which have been made in cognition level. The proposed conceptual framework for container supply chain using the architecture of IoT is shown in Fig. 12.8.

12.5 Implications, Limitations, and Challenges

The section provides implications, limitations, and challenges for implementing Industry 4.0 in general and specific to CSCM.

12.5.1 Implications

The current problem with containerization system is the allocation of the containers to the exporters. In earlier studies, researchers applied optimization techniques to allocate containers, but due to an imbalance of trade, this problem is not yet resolved

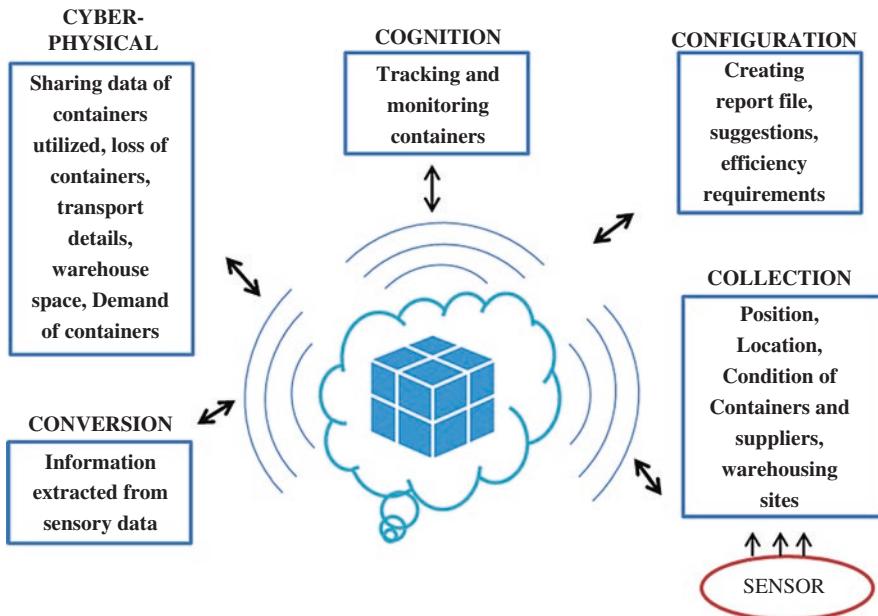


Fig. 12.8 Conceptual framework of CSCM

optimally (Mhonyai et al. 2011). In the current scenario of most of the shipping industries, containers do not have their own power supply system, not even their own sensors to track the movement of containers from manufacturer's plant to customer's place. Due to this, most of the shipping industries need to equip with high robust technologies. Not only are manufacturers or suppliers able to track their consignment, but even customers should be able to track via the Internet and be able to know the exact location and delivery of their consignment. Industry 4.0 will provide container monitoring facility from source to destination that will improve the efficiency of the system and efficient utilization of containers and automate and streamline business operations. IoT such as sensor or RFID will provide more transparency to the system (Borgohain et al. 2015; Hermann et al. 2016) and pilferage of containers or its item will be zero. CPS will play a vital role in sharing data between physical and virtual environment. It will give leverage to physical assets and computational capabilities to interact with each other and communicate over the network. This provides a large set of real-time information which can be shared between supplier and manufacturer. Further, a large set of data at cyber-physical level can be processed and analyzed using big data (Wang et al. 2016a, b, c). Big data will improve the quality of information and will enhance the process of containerization system. Various smart predictive tools are available to manage big data which can optimize the business operation needs. When container supply chain is implemented on the cloud or it is mapped on the architecture of Industry 4.0, data can be stored with security. Cloud computing technologies and its control system will protect IT infrastructure and applications associated with the system (<http://www.cloud-council.org>). Cloud service enables CSCM to be agile and will provide shipping industry different business models as well.

12.5.2 Limitations

Industry 4.0 is new concept primarily focussing on providing accuracy and precision in the entire operations of an industry. Most of the organizations, to implement it, need to go higher in its technological advancements and, thus, new huge capital investment. Another limitation in implementing Industry 4.0 is the lack of proper IT skilled manpower and correct training to understand the benefits of Industry 4.0. Moreover, limited understanding and awareness about Industry 4.0 and its implementation in the existing manufacturing setup are a hurdle and need to be removed.

12.5.3 Challenges

CSCM is facing challenges in the flexibility of usage of containers, where various types of goods, such as raw materials, liquid products, frozen products, perishable products, etc., are transported from one place to another. This requires different

types of specialized containers but due to unavailability of containers at port, it creates havoc in transportation. Several developing countries face challenges in finding capital investments (Wang et al. 2016a, b, c) for container handling infrastructure costs, for instance, road and rail access and portainer equipment in the shipping industry. Another challenge is the empty travel of containers. Whether the container is full or empty, it occupies the same amount of space in the warehouse and same time in trans-shipment. This will incur the cost and will not generate any profit for the industry. As a result, substantial amount of time and money gets wasted in just repositioning of containers. The opportunities in this area are challenging, and from the technologies' point of view, efforts are required to implement the whole system on the basis of the requirements of industry and customers.

12.6 Conclusion and Future Directions

The chapter presents the comprehensive overview of the Industry 4.0 and its current trends in academia and industry. The paper provides a concept for CPS and proposes a prototype six-leveled architecture. It argues that this definition and architecture not only meet all currently identified CPS requirements and characteristics but also includes customization feature in Industry 4.0 5C architecture. Industry 4.0 has its application and has developed recent advances in CSCM which includes smart analytics, IoT, big data, and RFID sensors. These analytical tools when fused with physical assets provide smarter and more connection to the network. Real-time information shared on the network will help in adopting smart decisions. IoT connectivity will automate container handling at the port which will minimize the container losses and number of containers can be optimally allocated to exporters. IT infrastructure of Industry 4.0 will control logistic processes and incremental cost incurred in purchasing containers will reduce, and this will streamline the business process. The future of Industry 4.0 is huge and its benefits in terms of precision and accuracy are immense. So far, Industry 4.0 concept is in good growth and it is found that those industries who have implemented have received benefits.

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Chapter 13

The Effective Design and Implementations of Policies in Smart Cities Contexts: A Conceptual Framework on Socio-Digital-Planning Environment



Harish Kumar and M. P. Gupta

Abstract The cities and urban areas are complex social ecosystems in any country. The smart city encompasses smart solutions for the urban development with the help of high-end technology to resolve the existing issues of urbanism and to improve the living environment and services for the residing citizens. The smartness in smart cities could be introduced by the integration of multimodal sensors, technological devices, telecommunications, computer-based technologies, analytics, and real-time response system into the city infrastructure. For this, effective policies are needed with the proper planning of the implementation especially in the large countries. The chapter proposes a conceptual framework to design effective policies and implementations for the smart city development. The indicators are selected from the vast literature studies. All the indicators have been classified into four groups. The results explain the socio-digital environment structure to enhance the smart city policy design with the help of planning, citizens' centricity, digital space, and city government. The chapter would form the basis for new learners, policy-makers, city planners, and government officials to understand, learn, and gain knowledge on effective policy design and implementations to develop the urban space as a smart city.

Keywords City government · Digital space · Policy design · Smart cities

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13.1 Introduction

The cities currently are facing a lot of problems in terms of applications and services as cities are multidimensional complex systems with dynamically changing circumstances. The raising population and unprecedented rate of urban growth have created an urgent need to find smart solutions to manage the existing urban challenges. The smart city development is a new multidisciplinary approach to enhance the facilities, services, resources utilization, and working environment to the global standards (Kumar et al. 2017b). Piro et al. (2014) have defined smart cities as “a city seeking to address public issues via ICT-based solutions on the basis of a multi-stakeholder, municipally based partnership.” The smartness of a city can be considered as an aggregation of smart initiatives and improvements in infrastructures, civic services, and management of urban resources. To achieve such goals, city authorities and policymakers have to plan and execute some strong initiatives and strategies that can create the advancement in urban space.

Planning has been recognized as a key area for governing and implementation of sustainable urban transformation (Wamsler et al. 2013; Charan and Venkataraman 2017). The collaboration and engagement of various stakeholders (Radywyl and Biggs 2013; Charan and Venkataraman 2017) are required for planning process for the urban improvements. The setting priorities and technological advancement usually determine the municipalities’ capacities to incorporate information and communication technologies (ICTs) into governance processes (Odendaal 2003) to provide the quality life to its citizens.

The failure of previous urban development efforts, the inability to sustainable growth, and limited effects on economic and social progress have forced city planners and government officials to focus on governance efficiency and effectiveness (Bertot and Jaeger 2008; Eyob 2004) and to take citizens’ preferences into e-strategies of urban development (Verdegem and Verleye 2009) to improve service quality and to achieve more effective outcomes in key policies areas (Relyea 2002). The success of smart cities initiatives generally depends on the designed policies and regulatory actions which include urban master planning, infrastructure development, governing practices, event promotions, and development of standards to provide better access, serviceability, and urban life.

Therefore, there is a strong need to find and combine new solutions, analytical methods, and innovative ways to overcome the existing problems affecting the urban policy design and implementations to achieve the smart city goals.

13.2 Literature Studies

The smart cities usually comprise technologies and advancements in urban components in previous literature. Caragliu et al. (2011) have defined smart city as “an urban environment which is supported by pervasive ICT systems, and able to offer advanced

and innovative services to citizens in order to improve the overall quality of their life.” The smart cities improve the physical urban infrastructure and deploy the resource utilization by infusing digital components to enhance the civic facilities and services.

The smart city development encompasses various objectives such as urban sustainability, economic viability, and development of institutional and social capital. Estevez and Janowski (2013) have focused on the delivery of public services and policymaking in the smart cities. Bimber (2001) has studied the relationships between availability of information and political engagement (Sæbø et al. 2008). Therefore, the city government should also adopt smart solutions to become smart while designing and developing the smart cities. The use of ICTs can reshape the governance, state, and democracy (Chadwick and May 2003; Sæbø et al. 2008). Odendaal (2003) has emphasized the role of information technology (IT) in local government for the better management and city functionalities. The Internet of things (IoT) can connect various smart devices with sensing and online processing capabilities. The networks of sensors and devices connected to the Internet can be embedded into urban space to enable innovative spatial intelligence, resource consumption, cost reduction, and advancing further capabilities. Table 13.1 illustrates the distinctive smart key characteristics for the smart city development.

Table 13.1 Key characteristics for smart city environment

Year	Authors	Smart city key areas for policy intervention
2000	Hall	Monitoring, integration
2001	Coe, Paquet, and Roy	Learning, adaptation, innovation
2003	Odendaal	Use of information technology
2007	Giffinger et al.	Self-decisiveness activities, independence, and aware citizens, smart health, living, governance, people, economy, mobility, environment
2010	Harrison et al.	Connectivity of infrastructures, collective intelligence
2010	Toppeta	ICT technologies, innovative management solutions, improve livability
2011	Caragliu, Del Bo, and Nijkamp	High quality of life and participatory governance
2011	Komninos, Schaffers, and Pallot	Wireless networks, middleware technologies, technology-mediated services
2012	Schaffers, Ratti, and Komninos	Innovation, change, spatial intelligence, sensors
2013	Lövehagen and Bondesson	Sustainability using ICT solutions
2014	Ojo, Curry and Janowski	State-of-the-art information infrastructure
2015	Mattoni, Gugliermetti, and Bisegna	Renovation and integration of cities
2016	Gil-Garcia, Zhang, and Puron-Cid	Technology savviness
2017	Navarro, Ruiz, and Peña	Use of ICT- and knowledge-based cities

The technology roadmaps should be designed by the government (Hoon Lee et al. 2013) to support future urban planning and public sector services. The services delivered to citizens must satisfy the citizens' (West 2004; Verdegem and Verleye 2009) needs with higher efficiency. The governments across the worlds are adopting new initiatives to achieve competing goals such as cost savings (Estevez and Janowski 2013), online public services, involvement of stakeholders in planning, and execution of urban design.

To accomplish advancement in urban space, the government of India has taken some policy initiatives such as smart city mission, e-Kranti framework for electronic delivery of service, e-infrastructure for delivery of e-services, policy on adoption of open-source software, policy on use of IT resources, collaborative way of development, use of cloud big data, securing India's cyberspace, knowledge network to enhance India's role in global platforms, and service deliveries (Kumar et al. 2017a) to fasten the smart city development.

Agenda setting, formulation of policies, making decisions, implementation of policies, and evaluation of policies (Bertot et al. 2016) are the key stages of effective policy design and implementations. To achieve these, the effective planning, collaboration, citizens' participations, and proper implementation of the solutions are required. The policymakers, citizens, and enterprises should primarily solve short-term solutions (Komninos et al. 2011) and achieve the long-term vision by encouraging the leadership and empowering the city authorities in terms of effective policy design and implementations for the smart city development.

13.3 Selection of Indicators

The indicators for effective policy design for urban space are identified from various literature studies performed on articles published in reputed journals. The searched keywords were selected based on the different definitions of smart cities found in the literatures. The database of Scopus, Emerald, Web of Science, EBSCO, and ScienceDirect was rigorously searched for the keywords such as smart city, digital city, city planning, public participation, smart city mission, smart governance, urban policies, regional development, urban policy failures, emerging technologies in city, etc. Simultaneously, the Google Scholar search engine was also explored for the literature selection. The papers from conferences, working papers, and books were excluded in order to sustain the quality. Overall, the search results gave collection of more than 167 meaningful research papers. After carefully going through the abstract of the research articles, about 123 papers belonging to different journals of the relevant field were selected for this study. Out of 123 selected papers, 83 papers were strongly focused on urban planning, smart city design, smart city characteristics, and key areas for the policy interventions.

13.4 Proposed Framework and Discussions

All the indicators (Table 13.2) selected from the various literature have been classified into four groups, namely, digital environment, government, citizens' centricity, and planning (Fig. 13.1), based on the context relevance. Navarro et al. (2017) have said that digitization of city using various technologies available to citizens can

Table 13.2 Selected indicators which can serve to form a socio-digital-planning environment for effective policy design for the smart city development

Indicators	Source
Interactive monitoring process	Baud et al. (2015)
Increased collaborative ability	Macintosh (2004), Kim et al. (2005), Picazo-Vela et al. (2012)
Transparency in government processes	Kim et al. (2005), Macintosh (2004), Picazo-Vela et al. (2012), Baud et al. (2015)
Public engagement	White (2016)
Planning and regional development	Maas (2015), Kumar et al. (2016)
Public perception	Mueller (2015), Kumar et al. (2016)
Ubiquitous information facility	Gil-Garcia et al. (2015, 2016), Choenni et al. (2016), Sá et al. (2016)
Crowdsourcing solutions	Bertot et al. (2010), Kumar et al. (2016)
Citizens' co-production	Linders (2012)
Trust in government	Nam (2012), Kumar et al. (2016)
Responsible resource consumption	de Oliveira et al. (2013)
Diversified employment opportunities	Beilin and Wilkinson (2015), Zhang and Li (2018)
Green urban planning	Kabisch et al. (2016), Pulighe et al. (2016), Pietrzyk-Kaszyńska et al. (2017), Kumar et al. (2017b)
Critical infrastructure planning	Chang et al. (2014), Zhang and Li (2018)
Digital infrastructure	Nour et al. (2008), Verdegem and Verleye (2009), Nam and Pardo (2011), Baud et al. (2015), Gil-Garcia et al. (2016)
Public participation	Stewart (2006), Giffinger et al. (2007), Sæbø et al. (2008), Jinmei (2011), Picazo-Vela et al. (2012), Estevez and Janowski (2013), White (2016)
Transparency in governance	Macintosh (2004), Giffinger et al. (2007), Picazo-Vela et al. (2012), Estevez and Janowski (2013), Gil-Garcia et al. (2014, 2016)
Improved serviceability	Ebbers et al. (2008), Sá et al. (2016)
Inclusion of social media	Stewart (2006), Bertot et al. (2012), Kavanaugh et al. (2012), Kumar et al. (2016), van Zoonen (2016)
Government responsiveness	de Oliveira et al. (2013), Baud et al. (2015), Maas (2015)
Sustainable urban development	Kumar et al. (2017b)

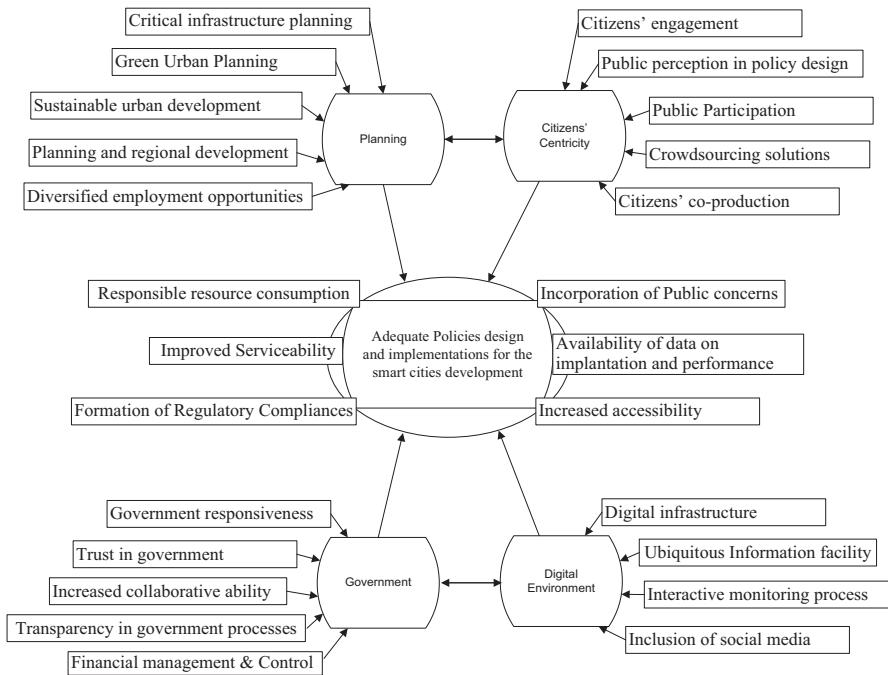


Fig. 13.1 The conceptual framework on socio-digital-planning environment for effective policy design in smart city contexts

make a city smart. Evolution of different technology areas such as sensors, automatic identification and tracking, embedded computing, wireless communications, broadband Internet access, and distributed services have increased the potential of integrating smart objects into our daily activities through the Internet. The Internet of things (IoT) has the significant potential to develop an interface for coevolution and interactions among human and physical world by connecting every physical object via sensors. The cloud computing (Liu et al. 2015) can enable IoT devices to utilize virtual resources, storage capability, resource monitoring, and service delivery. IoT integrated with sensors, embedded computing, wireless communications, and broadband access can enable the connectivity with things, automatic identification, learning about things, operating things, monitoring, and tracking capability for smart objects used in daily life of citizens. The integration of various networks can make full use of resources based on local conditions and applications demands. The big data technology can play a significant role in efficient data storage and analytic processing to enhance different smart services (Hashem et al. 2016).

The digital environment (Fig. 13.1) forms the base for smart administration (Kumar et al. 2016). The effective monitoring and control of remote things (Fox et al. 2012; Parwekar 2011; Rao et al. 2012), coordination (Fox et al. 2012; Parwekar 2011; Suciu et al. 2013), and real-time access to the produced data (Rao et al. 2012; Botta et al. 2016) can be done with the help of digital infrastructure. The capacity to

manage the city data, processing the information, and ubiquitous information facility are considered as key to communications among various organizations and partnerships for the smart government initiatives (Choenni et al. 2016; Gil-Garcia et al. 2015, 2016).

The evolution of digital government shows the government initiatives to innovate and provide digital solutions (Kumar et al. 2017a) to the citizens. The online services and interactive monitoring process (Kumar et al. 2016) can bring more accountability and transparency in the governance. The open government initiatives (Meijer et al. 2012; Stamati et al. 2015) increase the public participation and government collaboration to gain more efficient service design and cost-effective services for the public (Abu-Shanab 2015).

Smart cities are usually defined as citizen-centric cities (Lee and Lee 2014; Kumar et al. 2017b) in which people decide and contribute in city development planning. The city government also requires to collect information and perceptions about demands and priorities of citizens for the development. The citizens' participation in planning and decision process enhances the government capability and functionality for the sustainable development (Kumar et al. 2017b). Therefore, the governance should involve the citizens in the policy design and decision-making to solve the local problems. The improvements in policies can be done by increasing opportunities for the citizens to participate and collaborate (Chun et al. 2010; Bonsón et al. 2012; Guillamón et al. 2016) in planning, decision-making, voting, and feedbacks process. Citizens' participation in governance builds the necessary trust between the government and citizens (Janowski 2015; Gagliardi et al. 2017). The cost-effective services, delivery mode, and delivery time improve the serviceability (Kumar et al. 2017a).

The social media platforms can also be used as an important communication channel with citizens (Effing et al. 2011). Enriched government interaction with citizens on the social media has made possibility of co-production of public information and services (Linders 2012). The policymakers and city planners can mine the user-generated content to see the reactions to various policy proposals (Picazo-Vela et al. 2012; Sobkowicz et al. 2012; Kumar et al. 2016).

The critical infrastructure of a city can be managed effectively with the integration of smart computing technologies (Washburn et al. 2009). To develop a digitally enabled living place, innovative planning and solutions are required to integrate with city systems to improve the critical urban infrastructure. Apart from planning, adequate financing capacity, effective partnerships with all relevant stakeholders (Habitat 2016), and technological capability are also needed to develop a green economy. The green urban planning focuses on maintaining the natural aspects and biodiversity of that place that includes the strategic planning for clean air, drinking water supply, renewable energy usage, waste reduction, sustainable drainage system, and recycling processes to develop a green urban belt. The policies must be designed to generate new employment opportunities. The employment opportunities promote the development of education, health, sports, entertainment, and shopping facilities (Kumar et al. 2017b). The regional planning and responsible resource consumption reduces the cost of services and living in a sustainable manner.

Therefore, inclusions of digital infrastructure, advancement in government, and incorporations of public concerns into city planning can form the socio-digital-planning environment (Fig. 13.1) for the adequate policy design and proper implementations to achieve the smart city development goals.

13.5 Implications of the Study

The proposed framework includes four components to build an efficient planning environment to make the smart cities initiatives successful.

From the policymakers, city officials, and decision-makers, the framework suggests the use of digital infrastructure and collaborative ability of the government to offer new possibilities of service design and delivery. Digital environment can support the government to get potential outcomes and to manage ongoing growth, policy delivery, and effective transparent administration. Intelligent tracking and monitoring (Wagner et al. 2016) on supply side can enhance the government capability to implement changes in policies. Direct interactions with citizens can improve the policy quality addressing the local and priority development issues.

From service providers' perspectives, the framework suggests to provide ubiquitous information facility, online service delivery, and state-of-the-art information infrastructure to increase the accessibility for all. Introducing sensing and automated reacting capability into urban environment based on relevant data will improve the living quality and faster responses from the concern authority.

From citizen and user perspectives, the framework suggests the citizen involvement in effective design or improvements in city policies via crowdsourcing ideas, providing suggestions on social media sites, voting, and raising local issues to get priorities in the development. The citizens can also assess the implemented policies and can reshape the improvement processes (Maheshwari and Janssen 2014). This will build an open and user-driven urban ecosystems, which would fulfill the needs and interests of its citizens. It will also reduce the gaps between short-term priorities of city development and long-term sustainable goals.

From academic and research perspectives, the chapter produces new insights on building socio-digital-planning environment in terms of understanding especially in the contexts of smart cities.

13.6 Conclusions

Smart cities can advance urban life toward an instrumented, integrated, and intelligent living. To develop the smart cities, smart administration, efficient city planning, multichannel service delivery, and smart utilities solutions are required. The study identifies the various indicators which support the key characteristics of smart

cities and help in designing the smart planning environment in an efficient way by integrating the digital infrastructure, government officials, and citizens together.

The digital infrastructure includes IoT devices, embedded computing, wireless communications, and broadband access which enable the connectivity with things, operating things, monitoring, and tracking capability for resources used in daily life of citizens. The government can increase its collaborative ability and transparency by using digital platforms and can make improvements in infrastructures, public services, managing resources, and assets. With the increased digital infrastructure accessibility and government initiatives, the more local issues and priorities can be set in policy design and development at micro level with the involvement of citizens. Therefore, a digitally empowered citizen-oriented government planning environment is a prerequisite to formulate and implement the smart city policies.

13.7 Limitations and Further Research

The study is primarily focusing on building a citizen-centric digital government planning environment, but the study has not considered the digital divide in proposed solution. To increase usage of digital infrastructure and to enhance the public participation at maximum, the initiatives are required to reduce the digital divide to get potential inputs from citizens to design efficient policies in India. The study has not discussed the technical issues such as device standards, security, and privacy of data that are needed to be addressed while developing the digital infrastructure for a city environment. The interactive monitoring incurs high cost and requires additional resources and device interconnections at different levels of usage. Therefore, the future research can explore solutions to incorporate such challenges for the effective implementation of the proposed framework to achieve urban advancements through smart city mission.

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Chapter 14

Impact Assessment of Refresher Investor Awareness Sessions for Rural Citizens



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Abstract Technological revolutions have resulted in adoption of digital services by both public and private sectors. In this era of digitisation, the use of digital services increases the accessibility and penetration among the masses. This study is a review of the impact of the refresher investor awareness programme (IAP) conducted by the Government of India through Common Services Centres (CSC). The programme targets rural citizens to educate them about financial aspects including savings, investments and insurances. The study is an impact assessment of the programme and adopts a multivariate model to investigate the correlation between adoption constructs to the final outcome. The constructs comprise of training service quality, user satisfaction, training comprehension, usefulness and perceived benefits which impact the dependent constructs, namely, behavioural intention and social benefits. A total of 378 respondents have been considered for the assessment. Findings may be beneficial for policy-makers for initiation of similar programmes in future.

Keywords Digital transformation · Training and development · Impact assessment · E-governance · Citizen empowerment

14.1 Introduction

In an emerging economy like India, the often neglected poor from rural India require awareness on savings and investment, which provides them an opportunity to safeguard their hard-earned money (Verma 2007; Fan et al. 2008). Knowledge about investment and savings is often negligible. Often, if at all, the highest level of awareness for these poor people is savings account in nationalised banks (Burgess et al. 2005; Burgess and Pande 2005). However, given the rate of returns of such savings account and inflation rate, the savings effectively do not add much value year on

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year. The often neglected poor from rural India require awareness on savings and investment, which provides them an opportunity to safeguard their hard-earned money (Adams 1978; Basu and Srivastava 2005). For the success of inclusive development of the government programmes, the financial inclusion and development of all the citizens of India are very much needed (Dixit and Ghosh 2013). This requires involvement and training of all citizens across India, from both rural and urban locations. Scientific literature indicates that the levels of human development and financial inclusion in a country move closely with each other (Sarma and Pais 2011).

In view of this, there is a need to improve financial inclusion through financial education across all strata of citizens in an economy for inclusive development (Atkinson and Messy 2013). Thus, to share the concept of savings and investments, a project named investor awareness programme (IAP) was rolled out through CSCs during the months of March 2016 to June 2016 in the states of Assam, Bihar, Haryana, Odisha, Rajasthan, Madhya Pradesh, West Bengal, Jharkhand and Uttar Pradesh where a total of 112,133 citizens were sensitised through 2000 IAPs. During the months of March 2017 to June, 2017, refresher IAP sessions were organised in the same locations. The project aimed to review, reinforce and upgrade participant's existing knowledge and skills on safer options of investment and savings.

Further, in a country of more than a billion, economic development can only be reached through better utilisation of e-learning (Bhattacharya and Sharma 2007). Digitisation has an important role to play when it comes to content dissemination (Rao 2005; Prasad 2015). To sensitise the citizen, an e-content (telefilm) on investor awareness for rural adults was developed. The e-content is divided into five modules covering major topics as illustrated in Table 14.1. To reach out to a large number of audiences, the e-content has been developed in Hindi and regional languages. The e-content is often used to disseminate knowledge during the training sessions especially in rural areas which are usually isolated from the cities. VLEs will use the local language while conducting the training and explaining the subjects so that the

Table 14.1 Details of modules with learning objectives

Module	Learning objectives
Benefits of savings	The module covers what, why and how of saving. This included listing the reasons of saving money and how it could be done
Budget preparation	The module covers the importance of budget preparation
Opening and operating a bank account	This module explained in detail the process to be followed to open a savings bank account and how it could be operated
Different types of policies	This module covered and listed all the major insurance and pension products available for the rural people. It also provides information about its users
Investment through government schemes and capital market	This module highlights different schemes provided by government and capital market and process to avail them
Points to remember while investing	This module highlights about do's and don'ts while investing in any scheme and where to inform if there are any grievances

target audience could understand the entire program easily and could relate to most of the subjects covered in the e-content. The use of ICTs in such scenarios maximises the impact of digitisation by boosting content reach to a larger audience (Sabbagh et al. 2012; Tripathi 2006).

14.2 Literature Review

14.2.1 Adoption of Digital Initiatives

The revolutions in technology are often gauged by the innovations that change the processes surrounding industrial production and subsequently drive the economic growth as a long-term goal. These changes are often significant when it comes to their effect on business behaviour and interaction among individuals. Further, studies in existing literature also highlight the social impact of digitisation which is found to be critically essential for greater socio-economic growth (Katz and Koutroumpis 2013). In the current scenario, policy- and decision-makers face a challenging environment for the adoption of digital services. Information and communication technologies are way more pervasive than they have ever been (Malik and Ilavarasan 2011; Ilavarasan 2013). This is further empowering people to be a part of this data generation (Sabbagh et al. 2012).

Digitisation has further resulted in the growth of several services provided by government in their digital form, usually categorised as e-governance. E-governance not only impacts the ease of access and convenience of services provided by the government and information to citizens, but it also increases the accountability of government to its citizens (Carter and Bélanger 2005). It provides an efficient, effective and cost-effective mechanism for dissemination of services. However, the acceptance of these digital services is contingent upon the people to whom these services are provided and completely depends on their willingness to adopt the same.

Literature highlights several theoretical models including technology adoption model (TAM), diffusion of innovation (DOI)/perceived characteristics of innovating (PCI) and trust that have been investigated with diverse methods (Moore and Benbasat 1991; Rogers 1995; Davis et al. 1989; Belanger et al. 2002). The constructs for these models have benefitted the adoption research to a great extent. Carter and Belanger (2005) integrate these models specifically for e-governance adoption and provide useful insights surrounding the intent of use. Other popular adoption models comprise of theory of reasoned action (Fishbein and Ajzen 1975), theory of planned behaviour (Ajzen 1991) and UTAUT (Venkatesh et al. 2003). It is evident from the existing studies in service adoption research that the true potential of a proposed service is only realised when it is adopted and subsequently used by the target audience. The current study also adopts certain constructs which are mapped to the collected respondent data for analysing the benefits and the intent to use the knowledge gained from the refresher programme. The subsequent sections highlight the research proposition followed by the detailed analysis and findings.

14.2.2 *Digital Learning Programmes*

In the current scenario, digitisation has brought several changes in every sector including education and learning. It is believed that digitisation in the long run will have as much impact on learning as much as the print media did (Harnad 1991; Warschauer 2007). The use of digital technologies has enabled hybrid learning models that are beneficial across both the physical and the cyber space. Such models enhance the participation and collaboration when it comes to classroom teaching (Brown 1998; Greenhow et al. 2009).

Existing studies in literature highlight the impact of these e-learning models in various domains including medical education (Ruiz et al. 2006), refresher and corporate training (Strother 2002). Thus, ICT is considered as an important tool that enables, supports and further reinforces reforms in the education sector (Kreijns et al. 2013). Thus, through the IAP, the existing knowledge of rural citizens is strengthened on the concepts of savings and investments. The programme also enables them to know about various policies and schemes which are available in the market. The overall programme was conceived to educate the prospective rural investor so that he/she understands the benefit of saving, investment and capital formation/accumulation. The subsequent section discusses the existing literature surrounding digital learning programmes and their adoption.

This study is a review of the programme benefits as gauged from the data collected from the participants. Each CSC covered 40 participants, one from each household, i.e. each CSC on an average covered 40 households from the catchment area. The target group covered under the project were rural citizens who were covered during the previous sessions with a special focus on women, farmers and marginalised sections. The data of all the participants is captured through online monitoring applications after or before the sessions. The VLEs uploaded the session images after the sessions which helped the district, state and central team to track the progress of the project. The project has covered 2000 IAPs in the selected states where 112,512 citizens were provided with refresher training. The current study targets the responses of 378 respondents.

14.3 *Research Proposition*

The current study uses a set of constructs as dependent and independent variables to gauge the impact of the awareness programme. The constructs have been adopted from existing literature specifically targeting digital services provided by the government (Singh et al. 2017a, b). The study uses a combination of the popular adoption theories to derive constructs. This study uses seven constructs derived from the literature comprising of training service quality, user satisfaction, training comprehension, usefulness and perceived benefits which impact the dependent constructs, namely, behavioural intention and social benefits. The data collected from the

respondents is mapped in to these seven constructs and is used for the purpose of analysis. The goal is to investigate how significantly the five independent constructs impact the output.

The training service quality comprises of variables surrounding the customer satisfaction in terms of infrastructure, timing and resolving their queries. The user satisfaction construct targets whether they would be attending similar programmes and suggesting their peers about the same. Training comprehension comprises of the understanding of the respondents surrounding financial aspects including savings and investments. Usefulness is mapped to variables that gauge how the knowledge gained by the programme may be useful to the respondents. Lastly, perceived benefits target the factors that highlight the benefits of the programme to the respondent and its family in terms of financial security and betterment in lifestyle. When it comes to the dependent variables, behavioural intention and social benefits target the frequency of usage and advisory to friends/family regarding the knowledge surrounding financial aspects of investments, savings and insurances.

14.4 Research Methodology

A structured questionnaire is developed by the research team based on existing literature, with inputs from the funding agency. This took into account the curriculum developed for this IAP in terms of its content and target segment. The questionnaire is shared with the funding agency, and the funding agency administered the questionnaire to the participants of the programme while undertaking a systematic sampling methodology for the selection of participant. In a systematic sampling random methodology (Gundersen and Jensen 1987), every n th person from a population needs to be approached for data collection. Adopting such sampling methodology introduces higher rigour in the research and enhances generalisability of the findings.

A questionnaire-based telephonic survey was conducted. It is indicated in literature that telephonic surveys are effective for data collection when the geographical diversity is high among target sample and population (Sturges and Hanrahan 2004). The population was divided into different quotas using parameters like gender, SC/ST status and religion. The structured questionnaire was used for the survey. It collected information on gender, community, religion, age group, employment status, average monthly household income, marital status, educational qualification and language abilities. The beneficiary preferences surrounding insurance preferences, financial goals and savings are also captured.

The training has been assessed with respect to savings and budgeting; content delivery; impact on individuals' knowledge, usage and advice to friends/relatives; and benefits for savings, investments and personal usage. The impact has also been gauged surrounding managing monthly expenses, changes in lifestyle and future investments.

14.4.1 Sample Description

The sample description explains the representation of the selected sample that includes the percentage of beneficiaries in various groups for the present study. The constituents (states) along with the percentage for each state are as follows: Bihar (13.23%), Haryana (6.61%), Madhya Pradesh (11.38%), Rajasthan (14.55%), Jharkhand (7.94%), West Bengal (14.55%), Odisha (10.58%), Assam (6.61%) and Uttar Pradesh (14.55%). In the sample of 378 respondents, males (65.34%) are more than females (34.66%). In the community-wise classification, OBC (45.50%) is more than general (41.80%) and SC/ST (12.70%). In the religion-wise demographic classification, the concentration of Hinduism (87.57%) is much more as compared to Islam (12.43%).

Out of the total sample of 378 respondents, a major share of respondents (78.04%) belongs to the age category of 25–44 years, followed by the age group of ≥ 45 (16.93%), 20–24 (3.17%) and 15–19 (1.85%). As expected, the sample less than 14 years is nil since the IAP does not target minor population. The strength of self-employed (40.48%) is more than the respondents who work full time (25.13%), housewives (23.81%), those who have a part-time job (5.03%), those who are not working (3.97%) and students (1.59%).

Among the total respondents, 2.91% of the people earn a monthly household income of less than Rs.5000, followed by 33.07% who earn between Rs. 5001 and 10,000 household income per month, and 62.70% people who earn more than Rs. 10,001 household income per month, respectively. In the sample of 378 respondents, the presence of married (85.98%) is more than single (12.96%), widowed (79%) and divorced (0.26%). Further, most of the respondents have received education up to class 12th (30.69%) and class 7th (28.31%) as compared to the respondents who are graduate (22.75%).

Further, most of the respondents (78.04%) have more than 4 members in their family, followed by nuclear families (2 to 4 members) (21.96%), and none of the respondents was staying alone. Majority of the respondents' family have less than 2 people who are earning (76.46%). This is followed by 2 to 4 members in the family who are earning (23.28%) and then more than 4 members earning in a family (0.26%). Maximum 1 person of the respondent's family has attended similar training in most of the families (98.15%) and 2 to 4 members in the remaining families. The subsequent sub-section highlights the beneficiary details in terms of their preferences/usage surrounding financial decisions.

14.4.2 Beneficiary Details

This section highlights the details of essential information which is a prerequisite for the detailed impact analysis of the training. The section also highlights beneficiary preferences surrounding expenditure and savings. It is seen that about 95.77%

of the people were not handicapped and the remaining respondents was handicapped in one way or the other; 85.45% of the people did not stay in a rented house, and the remaining stayed in rented facilities; and 83.6% of the respondents had a bank account, while the remaining 16.4% did not own any accounts. Even though 83.60% of the people had bank accounts, only 78.31% of the people used to access those accounts. About 46.03% of the people have borrowed money, and the remaining respondents did not, and 68.52% of the people had insurance policies, and the remaining respondents did not possess it.

Majority of the respondents preferred to have a life insurance (82.80%) followed by medical (7.41%), general insurance (3.44%), motor vehicle insurance (2.91%) and crop insurance (0.79%). Banks were the preferred source to borrow money for the majority (57.94%) of the respondents, followed by friends and relatives (40.48%) and post-office (1.59%). For most of the people, monthly grocery supply was the most important (48.68%) long-term financial goal. This was followed by school and college fees of children (28.84%), festival/celebrations in 3 months' time (14.81%) and wedding of daughter (7.67%). Most of the respondents (41.80%) consider buying less clothes as the preferred approaches of cutting down non-essential expenditure. Of the remaining respondents, a significant majority went for alcohol and smoking (24.07%) followed by spending less on entertainment and festivals (20.90%) and healthcare (13.23%).

About 47.62% of the people consider household expenditure as the most critical component of the budget. This was followed by income (31.22%) and loan repayment (20.11%). Majority (39.95%) of the respondents thinks that they can save more than Rs. 2000 by cutting down on non-essential expenditures. About 35.71% of the people consider that it will be only in the range of Rs. 1001–Rs. 2000. This was followed by Rs. 501–Rs. 1000 (14.02%) and Rs. 100–Rs. 500 (10.32%). About 83.86% of the respondents would like to use the saved money by investing in fixed deposits or land. Some of the remaining people (5.56%) want to spend on visits to friends and relatives followed by shopping (5.29%) and spend lavishly on festivals and entertainment (5.29%). Keeping these details under consideration, the responses of the participants were captured based on the structured questionnaire. The details of the analysis and subsequent findings are discussed in the next section.

14.5 Analysis and Findings

The present study focuses on the impact of training delivered to the targeted audiences. This section covers the impact of training program in terms of convenience of the training program including location, trainers' efficiency, and infrastructural facilities and impact on individuals' knowledge, comfort, frequent usage, training benefits and training usage personally. This section explores the actual outcome that participants of the IAP perceive in terms of how it addresses their regular daily activities. In order to assess the overall impact of training program, three broad areas have been studied, i.e. understanding, usage and advisory to friends/relatives

from individual aspect. The study uses seven constructs derived from the literature comprising of training service quality, user satisfaction, training comprehension, usefulness and perceived benefits which impact the dependent constructs, namely, behavioural intention and social benefits. The goal is investigate how significantly the five independent constructs impact the output. For the purpose of mapping the relevance/significance for the same, we divide the questionnaire responses into these categories. A multivariate linear regression is subsequently used to do the analysis. Table 14.2 illustrates the parameter estimates of the model.

A significance value of less than or equal to 0.05 is considered to be contributing significantly to the dependent variables (behavioural intention and social benefits). When it comes to the behavioural intention for usage of the learning from the refresher programme, it is evident that user satisfaction does not statistically contribute (having $\text{Sig.} > 0.05$). When it comes to training service quality and perceived benefits, the constructs contribute to behavioural intention for usage of the findings (having a $\text{Sig.} < 0.05$). However, training comprehension and usefulness contribute the most significantly (with $\text{Sig.} < 0.001$), which has a clear evidence that if the respondents comprehend the training content and/or find it useful, there are higher chances of them using it.

Table 14.2 also illustrates that the training service quality doesn't play a significant role in estimating the social benefits of the learning from the refresher programme. The remaining constructs including user satisfaction, training comprehension, usefulness and perceived benefits prove to be highly significant with a $\text{Sig.} < 0.001$ indicating that these constructs play an important role when it

Table 14.2 Parameter estimates for multivariate regression model

Dependent variable	Parameter	B	Std. error	t	Sig.	Partial eta squared	95% confidence interval	
							Lower bound	Upper bound
Behavioural intention	Intercept	-0.111	0.151	-0.737	0.461	0.001	-0.407	0.185
	Training service quality	-0.089	0.042	-2.120	0.035	0.012	-0.172	-0.006
	User satisfaction	-0.040	0.033	-1.215	0.225	0.004	-0.105	0.025
	Training comprehension	0.831	0.036	23.079	0.000	0.590	0.761	0.902
	Usefulness	0.213	0.026	8.348	0.000	0.158	0.163	0.263
	Perceived benefits	0.047	0.023	2.001	0.046	0.011	0.001	0.092
Social benefits	Intercept	-0.289	0.147	-1.971	0.049	0.010	-0.578	-0.001
	Training service quality	-0.005	0.041	-0.114	0.909	0.000	-0.085	0.076
	User satisfaction	0.124	0.032	3.840	0.000	0.038	0.060	0.187
	Training comprehension	0.388	0.035	11.048	0.000	0.248	0.319	0.457
	Usefulness	0.126	0.025	5.050	0.000	0.064	0.077	0.175
	Perceived benefits	0.115	0.023	5.084	0.000	0.065	0.071	0.160

comes to gauging the social benefits of the programme. Further, by going through the partial eta squared value for these constructs, we can identify the most important one having the highest value. In this scenario training comprehension proves to be the most important construct having a value of 0.590 when it comes to behavioural intention and 0.248 for social benefits.

In addition to this, Table 14.3 illustrates the significance of the independent constructs in defining either of the two dependent constructs. All the main, covariate and interaction effects are significant at better than the 0.001 mile by any of the four leading multivariate tests of group differences (Pillai's trace, Wilks' lambda, Hotelling's trace and Roy's largest root). This means that each effect is significantly related to at least one of the two dependent variables, behavioural intention and social benefits.

Figure 14.1 also shows a schematic representation of the independent variables and how they impact the dependent constructs with respective weights mentioned on the edges.

Table 14.3 Results of multivariate tests

Multivariate tests ^a		Value	F	Hypothesis df	Error df	Sig.
Intercept	Pillai's trace	0.010	1.947 ^b	2.000	369.000	0.144
	Wilks' lambda	0.990	1.947 ^b	2.000	369.000	0.144
	Hotelling's trace	0.011	1.947 ^b	2.000	369.000	0.144
	Roy's largest root	0.011	1.947 ^b	2.000	369.000	0.144
Training service quality	Pillai's trace	0.014	2.654 ^b	2.000	369.000	0.072
	Wilks' lambda	0.986	2.654 ^b	2.000	369.000	0.072
	Hotelling's trace	0.014	2.654 ^b	2.000	369.000	0.072
	Roy's largest root	0.014	2.654 ^b	2.000	369.000	0.072
User satisfaction	Pillai's trace	0.064	12.561 ^b	2.000	369.000	0.000
	Wilks' lambda	0.936	12.561 ^b	2.000	369.000	0.000
	Hotelling's trace	0.068	12.561 ^b	2.000	369.000	0.000
	Roy's largest root	0.068	12.561 ^b	2.000	369.000	0.000
Training comprehension	Pillai's trace	0.591	266.105 ^b	2.000	369.000	0.000
	Wilks' lambda	0.409	266.105 ^b	2.000	369.000	0.000
	Hotelling's trace	1.442	266.105 ^b	2.000	369.000	0.000
	Roy's largest root	1.442	266.105 ^b	2.000	369.000	0.000
Usefulness	Pillai's trace	0.163	35.928 ^b	2.000	369.000	0.000
	Wilks' lambda	0.837	35.928 ^b	2.000	369.000	0.000
	Hotelling's trace	0.195	35.928 ^b	2.000	369.000	0.000
	Roy's largest root	0.195	35.928 ^b	2.000	369.000	0.000
Perceived benefits	Pillai's trace	0.065	12.920 ^b	2.000	369.000	0.000
	Wilks' lambda	0.935	12.920 ^b	2.000	369.000	0.000
	Hotelling's trace	0.070	12.920 ^b	2.000	369.000	0.000
	Roy's largest root	0.070	12.920 ^b	2.000	369.000	0.000

^aDesign: intercept + training service quality + user satisfaction + training comprehension + usefulness + perceived benefits

^bExact statistic

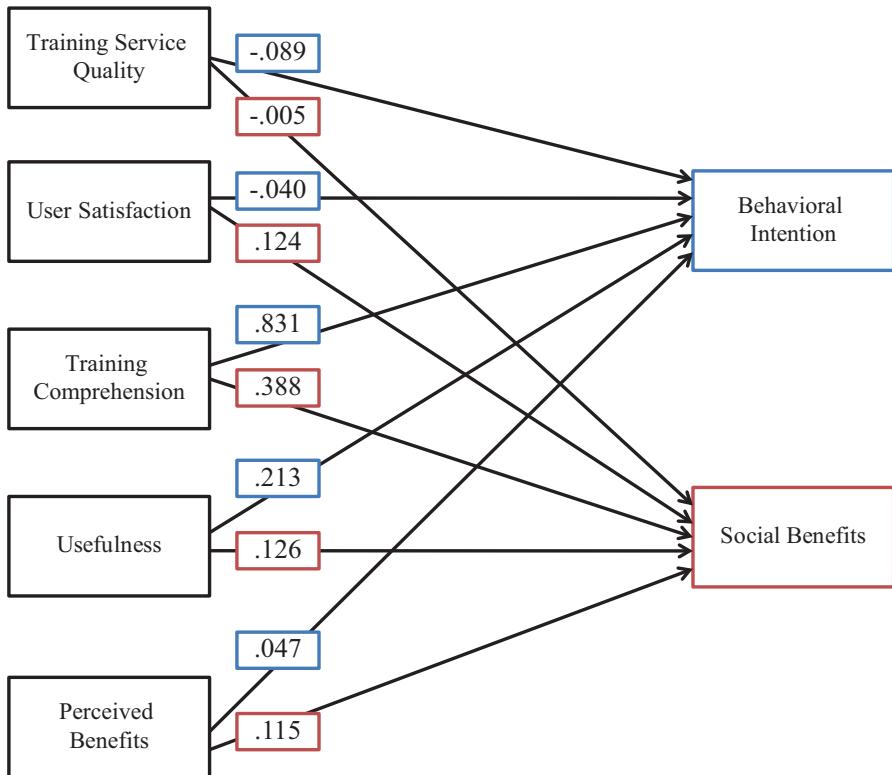


Fig. 14.1 Schematic representation of the model

14.6 Conclusion

In an emerging economy like India, the sometimes marginalised poor citizens from rural India require awareness on savings and investment, which provides them an opportunity to safeguard their hard-earned money. Inclusive economic development plays a critical role in the sustainable development initiatives of the nation. Knowledge about investment and savings is often negligible in these population segments. Often, if at all, the highest level of awareness for these poor people is savings account in nationalised banks. However, given the rate of returns of such savings account and inflation rate, the savings effectively do not add much value year on year (Feldstein 1976). In fact the actual purchase potential of savings reduces year on year, taking into account factors like inflation which becomes a major driver for initiating these IAP programmes in the Indian context.

However for assessing the success of these programmes, an impact assessment is needed. The effectiveness of such programmes can only be realised if the participants benefit from it both in terms of awareness and also in terms of using their acquired

knowledge for subsequent financial planning within their family. The objective of this study is to undertake an impact assessment of this programme. The study uses seven constructs derived from the literature comprising of training service quality, user satisfaction, training comprehension, usefulness and perceived benefits which impact the dependent constructs, namely, behavioural intention and social benefits.

Findings are indicative of the fact that when it comes to the intention to use the learning from the refresher programme, training comprehension and usefulness play a critical role followed by training service quality and perceived benefits. The user satisfaction has no significant contribution for the participant to decide whether he/she would use the knowledge gained from the programme. On the other hand, when it comes to the social benefits of the IAP refresher programme, user satisfaction, training comprehension, usefulness and perceived benefits statistically contribute to the outcome. However, training service quality does not have a statistical contribution in the social benefits gained from the programme. In both cases, training comprehension is the most critical metric for the respondent to decide the intention of use and social benefit.

Acknowledgements The study has been supported by Common Services Centres, Ministry of Electronics and Information Technology (CSC, MeITY), Government of India. The data was collected as a part of the impact assessment for the refresher investor awareness programme for rural citizens.

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Chapter 15

Analysis of Stakeholders Within IoT Ecosystem



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Abstract Internet of Things (IoT) as a field consists of multiple coexisting and competing products and platforms. IoT business ecosystem represents community of firms interacting with each other as well with the socioeconomic environment. To survive, the firms must cooperate as well as compete by using a common set of resources like hardware, software, platforms, standards that cater to the connectivity of connected devices, applications developed, provisioning services, assurance of quality and billing, etc. This paper analyzes prominent literature, reports, and white papers on the community psychology of members or players in the IoT ecosystem. Some of the key findings in this paper highlight that (i) the firms join the IoT ecosystem community due to their dependency on the ecosystem; (ii) they are motivated to bring in quality of life to the citizens via delivering cost-effective goods and services while focusing on profitable growth; (iii) depending on the role they play in the IoT value chain, their aspirations could differ from each other; and (iv) areas of special attention required around various challenges to ensure IoT ecosystem remain promising to stakeholders.

Keywords Internet of Things · IoT ecosystem · Community psychology

15.1 Introduction

15.1.1 *Background of IoT*

The term Internet of Things (IoT) was first conceived by Kevin Ashton in the early 2000. He coined this simple yet powerful concept of IoT when he searched the way a company can improve its business by linking RFID to Internet. In the daily life, if all objects carry an identifier and wireless connectivity, then they can communicate with each other and be managed by computers.

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IoT in very simple terms is the use of sensors to generate data from the environment of use which in turn is analyzed to give information based on which a subsequent action may be taken to either improve the environmental parameters or to deliver a service within that environment. Two major streams of IoT usage are industrial IoT and consumer IoT. The community psychology will be affected based on the stream that we choose to look at because of the severity of impact of failure in the two differs a lot. In industrial IoT, a failure can lead to loss of human life but not so in the consumer IoT. Thus, it affects the degree of seriousness and sense of responsibility on the ecosystem actors.

In IoT, identifiable and addressable heterogeneous physical things or devices are securely connected to the Internet using standard communication protocols. IoT is used across various domains or verticals like wearables, connected cars, connected homes, connected cities, the industrial Internet which includes transportation, health care, oil and gas, etc. (Goldman Sachs Global Investment Research). In IoT, smart physical and virtual things actively collaborate among each other to provide value-added functionalities and information to end users.

With the fall in device cost and emerging applications and business models, there is growth in the number of connected devices. Mobile phones are the connected devices which are largest in number. However, soon they will be surpassed by other IoT devices in the category of consumer electronics, connected cars, utility meters, and connected machines. There are predictions that connected devices are going to be doubled in the next 5 years, and half of them are going to be IoT devices, as captured in Table 15.1.

15.1.2 IoT Ecosystem and Its Stakeholders

Communities are made up of multiple populations in a specific area at a specific time. An ecosystem refers to the community and its environment. In natural life ecosystem, organisms form the biological community. To survive, they interact with

Table 15.1 Growth forecast of connected devices (“Ericsson Mobility Report November 2017 – Ericsson,” 2017)

Device category	Connected devices in 2015 (in billion USD)	Connected devices in 2021 (in billion USD)
Cellular IoT	0.4	1.5
Noncellular IoT	4.2	14.2
PC/laptop/tablet	1.7	1.8
Mobile phones	7.1	8.6
Fixed phones	1.3	1.4
Total	15	28

each other and with their physical environment. This is mainly because survival of one depends on survival of others.

The World Resources Institute (WRI) in its report (Estache and De Rus 2000, Page 11) mentions “ecosystems are not just assemblages of species, they are systems combined of organic and inorganic matter and natural forces that interact and change.” Each ecosystem “represents a solution to a particular challenge to life.” Biological ecosystems have five main types – grasslands, forests, agroecosystems, freshwater systems, and coastal ecosystems. WRI puts it distinguishing biological ecosystems is difficult since there is no border between different communities or habitats. It also emphasizes that “the division between ecosystems are less important than the linkages between them.”

Humans are influenced by ecosystems and are an integral part of today’s ecosystems and fully depend on ecosystems for their welfare and well-being (Kaufmann et al. 1994).

Authors capture classification and structure of biological ecosystems, different analogies of biological ecosystem like industrial ecosystem, economy as an ecosystem, digital business ecosystem and social ecosystem, etc., and key contributors of business ecosystem in their research (Peltoniemi and Vuori 2008). Business ecosystem is a dynamic structure of interconnected organizations. These organizations can be small firms, large corporations, universities, research centers, public sector organizations, and other parties which influence the system. In a business ecosystem, organizations compete and cooperate simultaneously.

Industrial ecosystem concepts are originally developed by Frosch and Gallopolous (1989). It is an analogy of biological ecosystem, where all material is recycled infinitely and efficiently. Ecosystems are complex adaptive systems, in which part of its features are determined by environmental conditions, and partly they are the result of self-organization (Levin 1998).

Performance of some of the successful firms is attributed to the success of their ecosystem, which is a loose network of suppliers, distributors, outsourcing firms, technology providers, makers of related products and services, and various other organizations, who affect or are affected by the development and delivery of the firm’s offerings (Iansiti and Levien 2004b). According to the authors, productivity, robustness, and ability to create opportunities for new firms are three critical success factors of a business ecosystem. This means the attitude of firms needs to change from protectionist to cooperative. There are differences between the biological ecosystem and business ecosystem – actors in the business ecosystem are intelligent and plan for the future, and they compete with members and innovate, whereas natural ecosystems aim at pure survival (Power and Jerjian 2001). One cannot just manage a business on its own, but one must manage an entire ecosystem.

Information technology plays a vital role in the supply chain and benefits both the network leader(s) and the suppliers (Subramani 2004). IoT is considered a business ecosystem (Moore 1993) rather than simply a supply chain. Moore is credited with theorizing the concept of an ecosystem and ecosystem modeling in business framework from the biological studies. No single entity or community can make the entire IoT solution for each domain. Similarly, in business ecosystem, makers,

suppliers, and buyers interact with themselves as well as with the socioeconomic environment like standardization bodies, regulatory framework, and academia. According to Moore (year), a company playing a leader's role in the business ecosystem is the "the keystone species." Such companies are trendsetters and have a strong influence over the coevolutionary processes. As per Moore, these are metaphors which can help to understand and clarify the business and its environment.

In the new business ecosystem, value for the customer is created through the Internet and other enabling technologies (Kandiah and Gossain 1998). IoT-based business ecosystem is more than supply network with connected items.

While designing solution for any sector, first an ecosystem must be established (Pang et al. 2013). Ecosystem-driven design strategy and technical solutions cover aspects of interoperability, security, merging of conventional sector with mobile Internet ecosystem, and system integration. Use existing standardization to simplify interface between actors and use ecosystem-driven security schemes to balance control and avoid monopoly.

Comparison of cluster, value network, and business ecosystem (Peltoniemi 2004) depicts that cluster's success is based on fierce rivalry within the cluster, value network has a cooperative structure, and members do not compete with each other. However, business ecosystem induces both competition and cooperation.

Complexity of the business ecosystems is presented in the form of self-organization, emergence, coevolution, and adaptation (Peltoniemi and Vuori 2008).

Business model is conceptualized (Galateanu and Avasilca 2013) by assigning roles to each element i.e., keystone, niche players, or dominators. It also defines hierarchy of the elements – local level, which is the core organization; intermediate level, which are related elements inside business ecosystem; and global level, which are external influence elements of ecosystem.

To utilize the IoT market potential, providers within IoT ecosystem of hardware, software, infrastructure, and other vendors develop end-to-end IoT solutions (Openshaw and John Hagel 2014). IoT ecosystem includes hardware makers, network service providers, cloud service providers, middleware vendors, device manufacturers, software vendors, IT service vendors, standards and bodies, regulators/government, industry groups, and customers.

In the context of IoT, there is a shift from focusing on business model of firm to the ecosystem business model. Ecosystem business model focuses both on the firm's method of creating value to the ecosystem partner's method of creating value (Westerlund et al. 2014). IoT ecosystem is still not matured and remains unstructured which implies while designing the business model, it may not be very clear on all the participants and the value coming from each. Value design is proposed as a tool which is more appropriate while describing the IoT business model.

Remote sensing technologies are used in sustainable urbanization (Dewan and Yamaguchi 2009). In the rollout of sensing technologies, consumers can participate in collection and sharing of data about the environment (Balestrini et al. 2015). This can be made more effective and meaningful by orchestrated actions of local champions.

Despite the potential of IoT, its business promise is not realized yet. In order to convert the technological opportunities from business perspective, more research is needed to be done (Westerlund et al. 2014).

15.1.3 Background of Community Psychology

The study of community psychology is all about how individuals relate to a group or a social fabric. Research in this area looks at the entire cross section of social, economic, cultural, political, and environmental influences that shape the lives of people all over the globe.

Community psychology involves relationship of the individual to the society and communities. Lot of research is in progress to understand and improve quality of life of people, society, and communities. Community psychology focuses to bring in positive change in quality of life and health and enhance empowerment both at the individual level and at the society level. It focuses on the integrated view of individual with cultural, economic, political, environmental, and social influences.

15.1.4 Research Problem

While the technical aspects of IoT are being studied, and discussed in detail, stakeholder analysis as a part of the ecosystem does not exist so far. This study involves analysis of community psychology in emerging IoT ecosystems particularly the study of the actor's roles in the emerging IoT ecosystem. The research questions include:

(i) What makes the IoT members join this community?

With the availability of many technical options to engineers, system integrators, and other stakeholders, it is interesting to see more and more budget being spent by big companies in trying to develop expertise and commercialize revenue streams from IoT technology. This is in addition to the new age companies whose only line of choice is IoT. The availability of skilled manpower is increasing which shows people are re-skilling them for this as a career option. So, the question remains largely unanswered why this community is growing.

(ii) What motivates and drives them to work?

Being an emerging field, the path in IoT is currently riddled with challenges. Failures in equipment design, in understanding ground challenges to develop solutions as opposed to laboratory-based testing, in integration challenges to legacy systems, and much more should have been a big deterrent. However, it is obvious that not only more companies are dipping their fingers in the IoT pie in lure of revenue augmentation and in defining future cash cows; they are also getting enough

motivated people who brush aside the obstacles and carry on to design, develop, and deploy great solutions. So, research is needed to find the driving force behind such mental makeup.

(iii) What are their aspirations for the future?

Aspirations define the short-term, medium-term, and finally the long-term career and self-realization goals. Career aspirations can be categorized as career success, security, expertise, freedom, and work-life balance. Being a part of an emerging and challenging industry may or may not touch all the aspirational goals that a person may have. So, research is needed to understand why and how the aspirations of the human resources tied to this field are being met.

(iv) What are the areas that require special attention to ensure IoT ecosystem remains promising for stakeholders?

IoT is redefining the working and living landscape. The vision of a better-connected world for the end user is driving business opportunities for the remaining stakeholders. However, for the end consumer to remain interested and drive growth through the other stakeholders, quite a few building blocks in the ecosystem need special attention to ensure IoT ecosystem remains promising to reach its potential. One area, for example, is gaining and retaining the end-user's trust in data exchange and privacy. There are a lot more issues which need further research to explore and highlight the same.

15.2 Literature Review

15.2.1 *Community and Community Psychology*

A community has both positive and negative aspects. Positive aspects of community include support, cohesiveness, and working together to achieve a common goal, while negative aspects lead to exclusion and segregation. A community includes group of individuals who are clearly distinguishable from each other. They build their identity based on their shared experience, processes, actions, perspectives, and characteristics. Community psychology, also known as community social psychology, deals with the concept of communities which differ in their context and purpose (Wiesenfeld 1996).

15.2.2 *Impact on the Ecosystem*

While defining the business ecosystem (Peltoniemi and Vuori 2008), definition of biological ecosystems is analyzed. The biological ecosystem includes all living organisms in an area as well as its physical environments functioning together as a

unit. In a business ecosystem, firms are loosely interconnected, and they depend on each other for survival and mutual effectiveness (Iansiti and Levien 2004a). Performance of a firm depends a lot on the firm that influences the assets outside its control. Business strategy and decisions of firms not only consider interest of its own strengths but also that of partners and customers.

According to Moore (1996), organisms interact with each other and also with the environment in a biological ecosystem. This metaphor is used to help understand and clarify certain complex issues of a business ecosystem. In a business ecosystem, firms support each other in the role of producer, supplier, partner, and customer. They also interact with the environment like government entities, financial institutions, trade associations, labor unions, regulations, media, and other interested parties. An ecosystem leader firm enables the community members to align investments in playing supportive roles and move toward a shared vision and common goal.

15.2.3 Role of IoT on the Ecosystem

Emergence of an IoT ecosystem would enable IoT adoption. This ecosystem includes IoT-specialized hardware and software vendors, system integrators, policy makers, and community of IoT users. IoT users include both commercial users and consumers (Manyika et al. 2015). In an IOT ecosystem, the core consists of interconnections of things of the physical world with Internet's virtual world, hardware and software components, and the standards used to enable the interconnection (Mazhelis et al. 2012).

The metaphor biological ecosystem can be used to understand the IoT ecosystem (Moore 1993). In the natural life ecosystem, the biological community consists of organisms and their interaction with the physical environment. Organisms of the business world are interacting cooperation and individuals. They form the members of the economic community and business ecosystem, which deliver goods and services to customers.

Literature review is done by searching for fixed pattern of Internet of Things ecosystem across various databases (Agarwal et al. 2017; Chauhan et al. 2016). Literature review and analysis is done based on two aspects shown in Tables 15.2 and 15.3.

15.3 Understanding the IoT Ecosystem Using IoT Value Web

IoT ecosystem does not have a single definition. Each player in the ecosystem has a role to play for successful development and deployment of IoT in each domain. They are all interconnected in this web of dependencies, not a pyramid structure like in a hierarchy. IoT value web explained here provides a perspective of the IoT ecosystem. It can be explained from various perspectives. Here we look at two major ones – stakeholder-based and connectivity-based usage.

Table 15.2 IoT ecosystem literature review with a focus on theory and frameworks

Authors	Framework Used	Remarks
Rong et al. (2015)	6C framework in the form of context, construct, cooperation, capability, configuration, and change	Context: external environment of the ecosystem Construct: elements of business ecosystem structure Cooperation: different governance systems and coordination mechanisms Configuration: patterns of business ecosystems along with the different capabilities Change: experience transformation Capability: to achieve strategic requirements
Leminen et al. (2015)	Business model of a IoT ecosystem is supported by value design, which consists of value drivers, value nodes, value exchanges, and value extracts	Value drivers create a non-biased, win-win ecosystem Value nodes include individuals, actors, activities/processes, and commercial/nonprofit firms that create value Value exchanges are exchange of value by different means, resources, information, and knowledge Value extract is the part of ecosystem that extracts value
Shin and Park (2017)	Multilevel socio-technical framework – Social construction of technology (SCOT)	SCOT is an effective tool for investigation of technological development processes. It shows how IoT will evolve and stabilize in a smart environment

In a market economy, many firms emerge instead of one just big firm for the whole economy (Coase 1937). Transaction cost in terms of time and money is involved in search of sellers and buyers, negotiation of exchange terms, preparation of contracts, inspection of results, enforcement of deals, etc. New firms develop when there is reduction in the production cost and transaction costs, which in turn makes price than market price. However, growth of a firm pauses when it becomes more than market price. Transaction cost includes the cost involved in the external transaction (interaction between the firm and the market) as well as internal transactions (Williamson 1973, 1981, 1998). Transactions happen with the environment of social, political, and legal institutions, which affect the transaction costs.

The key players of the IoT stakeholder are as follows:

- *Device providers* who provide the smart modules and smart objects. Smart modules include SIM cards, sensors, embedded chips, etc., whereas smart objects are smart devices like smart appliances, smart meters, connected cars, etc.
- *Operators* provide the network infrastructure and connectivity along with assurance on quality of service.

Table 15.3 IoT ecosystem literature review with a focus on stakeholders in various application domains

Authors	Domain	Key stakeholders	Additional consideration
Pang et al. (2013)	IoT-powered healthcare service	Traditional healthcare service: Healthcare financial sources, healthcare mean suppliers, healthcare service providers, end user Traditional mobile internet service: Advertiser, application designer, platform provider, content provider, application store, telecom operator, end user	Interfaces should be standardized Between healthcare mean suppliers and mobile application designers Between mean suppliers and mobile platform providers Format of electronic health record (EHR) Security schemes throughout the entire ecosystem
Rong et al. (2015)	Internet TV	TV companies, internet TV platform, government, third-party software vendors developing app, customers	Interaction among the customer and the TV provider is increased
Rong et al. (2015)	Car rental, self-organized car network	Car rental company, car rental platform, software developers for mobile apps, RFID facility, and government	Provides both fixed car-parking location and flexible car-parking location
Rong et al. (2015)	Location-based service E-map	Map service company, software developer/vendor, industry customers, and business partners like banks, restaurants, hotels, etc.	Open SDK (software development toolkit) and API (application programming interface) to enable partners to work together
Antonić et al. (2016)	Mobile crowd sensing (MCS), a mobile IoT application	Cloud broker, mobile broker, subscriber, publisher	Sensors and mobile devices collect data of interest for a large geographic area (ex: Urban crowd sensing for air quality monitoring) Scalability and elasticity are key architecture considerations
Schleicher et al. (2016)	Internet of things, people, and processes in a smart city architecture	Consumers (smart home, offices, and retail), providers (energy, transportation), infrastructure providers (cloud, servers), application (energy, transport), smart city operating system (security and compliance, data management, resource management, etc.)	Smart city application ecosystem (SCALE) is designed as a central middleware called smart city operating system

(continued)

Table 15.3 (continued)

Authors	Domain	Key stakeholders	Additional consideration
Papert and Pflaum (2017)	Ecosystem model for IoT service in supply chain management	IoT platform and hardware platform provider, consultancy, big data analyst, database provider, middleware provider, logistics service provider, application developer, financial intermediary, solution integrator, distributor, human-IoT-interface provider, telecom infrastructure and gateway provider, product manufacturer, standardization bodies, certification role, embedded system provider, research institution	Open source and open interfaces of IoT platform support in connecting and integrating smart products with different applications

- *Platform providers* enable a true ecosystem for the IoT products and services. They provide platform capabilities like IoT enabling capabilities, integration with third-party applications, analytics, etc. Sometimes platform providers also provide domain-specific applications, billing and customer care services, etc. Platforms also fulfill expectations from partners as well as end customers in terms of functionality, security, reliability, and flexibility.
- *Systems integrators* support in doing end-to-end integration by providing wrappers around incompatible interfaces, end-to-end testing and certification, etc. System integrators take the various available solution components from the market to tailor a specific end-use case-specific solution.
- *Application providers* provide domain-specific applications, billing and customer care services, etc.

The key players of the IoT connectivity and usage value web are as follows:

- *Sensors/objects* are the IoT devices that pick up the data from environment.
- *Connectivity and protocols* are the standards that define the connection of sensors to the back-end platforms.
- *Data sensing and filtering* consist of actual pick of the sensing parameters and middleware to filter repetitive data and noise.
- *Data transportation and storage* define the way the data bits are transferred over wired or wireless channels and how they are stored and retrieved.
- *Platform* is the base on which applications are created and managed. It runs in the background and allows for an easier and less expensive way for IoT stakeholders to use the collected sensory data.
- *Data analytics and information* act upon the collected data to extract meaning out of the data. Raw data is converted into meaningful information here.
- *Information-based action* is all about using the above information to alter the state of the environment of the sensor to initiate an action or derive end user value add.

- *Human-in-the-loop* is the most important part in many IoT applications where humans and “things” operate synergistically. These human-in-the-loop systems span a broad range of applications. However, unpredictable psychological behavioral aspect of human beings makes modeling human behaviors extremely challenging.

Figure 15.1 shows the IoT value web. Each player plays one or more role in the entire IoT value chain, from the stakeholder perspective, the platform providers bring the maximum value. Despite bringing maximum value, platform providers may play the lead role but still have to depend on the other players for delivering end customer value successfully. Also, out of all the value opportunities created by IoT that are available to technology suppliers, the largest share is expected to go to software and services and less to hardware. Similarly, from the perspective of IoT connectivity and usage value web, it is again the platform that provides the maximum value but is interdependent on the other actors.

15.4 Research Methodology

The study followed a two-step process. In the first step, literature review was done around community psychology, IoT, ecosystems, transaction cost economics, market and hierarchies, supplier-buyer relationship, etc. Research questions were formulated

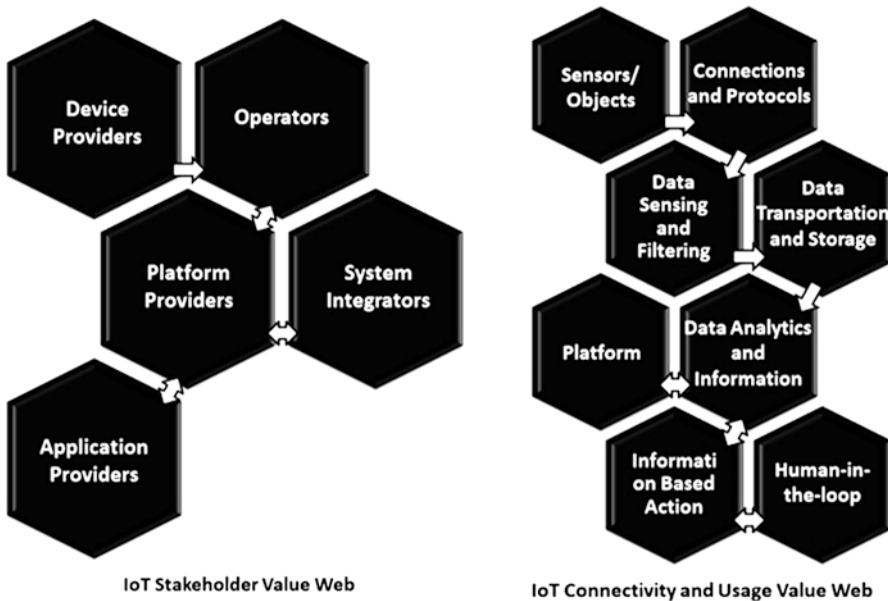


Fig. 15.1 IoT value web

around the IoT Ecosystem. In the second step, a focus group discussion (FGD) was conducted where 16 participants with similar knowledge and experience from industry, academia, and government attended the FGD. Participants discussed issues ranging from identification of the key actors in the IoT ecosystem to highlighting manpower challenges that would need to be addressed to tap into full potential of IoT.

Key themes that emerged from the discussion are key actors of the IoT ecosystem, challenges, motivations and aspirations, overlapping roles, who are leaders, value web, IoT ecosystem business model, regulation and standardization issues, manpower and skill issues, user adoption challenges, and opportunities. Key findings from the literature study and the FGD are captured in the subsequent sections.

15.5 IoT Application Domains

Some of the popular IoT applications are developed for the domains like wearables, smart health solutions, smart homes, smart cities and smart energy solutions, smart farming, connected car, etc. Each of these domains has an ecosystem of itself.

Wearables are smart electronic devices with microcontrollers which can be worn on the body like an accessory. Wearables are one of the most discussed themes of IoT in the social media like Twitter (Joseph et al. 2017). Wearable devices such as fitness trackers are a good example of IoT.

Smart health solutions have the ability to collect and transform healthcare data into knowledge and action (Demirkhan 2013). Healthcare organizations are the key players in this domain. They can provide cost-effective quality healthcare service by adopting smart healthcare systems.

Smart home solutions involve home safety and security, interaction with appliances, energy consumption management, etc. (Khan et al. 2012). Appliance manufacturers provide smart appliances to support the smart home solutions. IoT can help to design smart cities for efficient energy consumption with smart lighting solutions, monitoring of air quality, discovering emergency routes, etc. Smart farming systems help in increasing productivity by sensing data and processing and informing farmer on the kind of attention the land needs and help agronomists to understand plant growth models related to efficient farming practices involving land conditions and climate variability. Smart energy solutions involve monitoring, maintenance, and efficient usage of water, gas, and electricity supply to homes, buildings, and factories.

Connected cars are equipped with Internet access and also with a wireless local area network. They provide functionality like driver assistance, entertainment, safety features, etc. These customer value propositions are integrated into the connected car environment by the car manufacturers (Lee and Lee 2015).

Smart supply chain management (SCM) (Bandyopadhyay and Sen 2011) can provide smart items and smart shelves which can be tracked real time. This will enable efficient SCM by automatic checking of goods receipt, real-time monitoring of stocks, timely alerting out-of-stock items, etc.

Industrial Internet of Things (IIoT) (Sadiku et al. 2017) refers to IoT in an industrial environment across industries like manufacturing, logistics, transportation, chemical, aviation, oil and gas, and so on. IIoT is used in the context of Industry 4.0, which describes a new industrial revolution with a focus on data, automation, systems, processes, etc. The communication infrastructure of Industry 4.0 enables secured and safe access of devices.

15.6 Communities and Professional Identities in IoT Ecosystem

15.6.1 Technology Researchers

Technology researchers have the community, who are at the forefront of cutting edge research to make IoT sensors, devices, hardware, middleware, firmware, communication protocols (RFID, NFC, BLE), security, and a lot other parameters more efficient or innovative in these areas. Although the expectation is that the field is open to engineers, especially with a background in computer science, electronics-communication, networks, radio engineering, etc., the ground reality is that IoT also needs a lot of skills in “associative thinker” (Grandin 2006; Oxman 1999). This is a skillset for connecting ideas and facts. It is usually recognized that a major in English, history, political science, or economics adds to capabilities of joining different experiences which rearrange observations across unrelated domains. This assists in developing technologies for analyzing the captured sensor data to obtain the common themes. Knowledge of machine learning algorithms help to identify data patterns for prediction to design smarter appliances.

15.6.2 Hardware Developers

This is the community who work very closely with the embedded programming community to develop the hardware platforms on which the codes run efficiently. They also work as part of the design projects that can make sensors smaller, more efficient, and ergonomic to make the hosting platforms stable, fail-safe, fast, etc. These communities have skillsets like multilayer PCB design and 3D printing, radio frequency (RF), and microwave engineering, which need background on electrical engineering.

15.6.3 Embedded System Programmers

This is the community who picks up from the research output and makes the machine resident codes and communication among devices more efficient by writing codes that stay as part of the embedded system. Their work output is crucial in

managing response time of data capture, filtering, efficient middleware design, etc. Specific language like Arduino is used in sensor automation projects to add intelligence to the sensors (devices) to help process the tasks. There is a high demand in GPS technology-based embedded and wearables in healthcare and vehicle industry adopting IoT solutions.

15.6.4 Software Developers

This community works on the platform software. They are in charge of making the front-end GUIs and the back-end engines that power the IoT platform. They look into API usage to extract or push back data into the system via the sensors. They also develop the mobile apps that run a majority of the IoT interactions with the end users. Today, this field does not demand only geeks because “command block”-based stackable and straightforwardly connected coding programs have been developed which are stable and easier to use. Growth of open hardware boards like Raspberry Pi and Arduino are used as connected devices. Node.js for server-side web development is used to manage these. Similarly, size constraints and small wearables, etc. demand a relook at the design principles to standardize and personalize the IoT sensors. Thus, AutoCAD developers are in demand.

15.6.5 Systems Integrators

System integrators support in doing end-to-end integration by providing wrappers around incompatible interfaces, end-to-end testing and certification, etc. System integrators take the various available solution components from the market to tailor a specific end-use case-specific solution. Data breaches have heightened the focus on this area to mitigate the risks. System integrators need security engineering solutions that span both physical and logical threats to local controllers, gateways, middleware, and other embedded systems. Skillset specific to IoT security is in demand. Internet-based sensor connection within an IoT ecosystem exposes the systems to risks, especially endpoint security. Thus, skillsets under these areas are in great demand.

15.6.6 Data Scientists

IoT usage generates a lot of data which may be structured but mostly unstructured. It must be inferred for information which in turn will translate into actions. This community is an extremely important part in the IoT wheel in the industry to make sense from the data, define trends, and help with actions. For analytics, Hadoop, Python, Hive, or Pig are now essential skillsets. A mix of skillset is needed in the

fields of artificial intelligence, data sciences, etc. to code for algorithms and architect the databases to analyze the huge volume of data that IoT application collects.

15.6.7 End Users or Consumers

End user community is the consumer of the solutions. They also are the originator of the needs of the industry, based on unique use cases and business challenges that they have. These requirements feed back into the ecosystem to develop and innovate more in the field of IoT with a contribution of a lot many of the above stakeholders. Acceptance of the new product and service is also done by the user. Users' need is key to make things IoT enabled. For example, a user may not need a smart toaster to send the user a notification once the toast is done. User's safety, security, and privacy need to be considered during design, development, and testing of the IoT applications in various domains of wearables, automotive, healthcare, etc. Consumer participation is key in collection and sharing of data about the environment by participating in the rollout phase. This can be further orchestrated by local champions. Consumers and end users of the IoT technology will capture most of the value at the end of the IoT value chain. This is no different from any other technology market.

15.6.8 Consortiums and Standardization Bodies

IoT is defined by various standardization bodies in addition to the definition by various white papers, books, academia, national initiatives, and IoT projects. Some of the key bodies dealing with Internet-related work are part of IoT-related technical standards too like W3C (World Wide Web Consortium), IETF (Internet Engineering Task Force), and OASIS (Organization for the Advancement of Structured Information Standards). Since IoT data transfer relies a lot on telecommunication networks, especially for the last mile link, many of the telecom-focused bodies like the ITU (International Telecommunication Union) and ETSI (European Telecommunications Standards Institute) are in the forefront too. Of course, technical bodies like the IEEE (Institute of Electrical and Electronics Engineers) and NIST (National Institute of Standards and Technology) too are adding a lot of value to the standardization efforts.

The work being done by these members pertains not only to standards relating to technology but also for quality and integrity standards for data creation. Security-related issues are paramount. So models and yardsticks around device safety, device security like for BYOD (bring your own device) environments, data integrity, data privacy, data traceability, data accuracy, and security standards are ever-evolving. Of late interoperability, process definition, cloud communication standards, standards for energy consumption, spectrum energy communication protocols standards, and energy conservation are all part of various work-in-progress papers within the committees.

15.6.9 *Government Bodies*

Government's role is in setting up regulations and policies to oversee safety, testing, cybersecurity, and privacy of the things connected to the Internet. Some of the government intervention policies are related to net neutrality of the Internet traffic and privacy as part of fundamental right, etc.

15.7 What Makes IoT Members Join This Community?

IoT community members see several opportunities in joining the IoT community. Since no single provider can enable IoT alone, ecosystem players need to have strong collaboration and relationship with community members, groups, and organizations to improve IoT-enabled devices and win-win situation for themselves and for end users. They have a common goal of improving quality of life in the society by providing efficient and cost-effective products and services across various domains. IoT ecosystem provides opportunities to participate in diversified fields and explore a huge market with size of multitrillion US dollar. IoT ecosystem will touch every sector including telecom, utilities, healthcare, oil and gas, smart homes, and insurance, etc. It enables them to participate in diversified fields. IoT provides a networked infrastructure which enables innovation and related business development.

Technology researchers have intense desire to work in new fields. They create something more unique by amalgamation of various existing technologies. Embedded system programmers have the desire to work in new cutting edge-of-technology fields. The lure of challenge for developing compact but powerful codes and possible career springboard for more bigger profiles and responsibilities. Hardware developers are tempted with the challenge for developing compact but powerful hardware components. There is a possibility of a career change and trigger a larger profile and responsibility. Software Developers move away from simple application development to platform-based tools development as a huge value add to profile. To create unique mobile enterprise applications (iOS and Android only as of now) which showcases their new skills of converting idea possibilities into utility and monitoring tools on mobile. System integrators look at possibility of New revenue generating areas and they find this a less crowded market with less competition as of now. Data Scientists join the community due to the natural attraction toward the amount of data generated by the IoT systems. The supply is less than demand in this area so it is a natural for them to showcase expertise and work on new tools, skills, and theories. End user community is attracted due to innovative applications which provide lot of utility benefits, efficiency improvement due to the instruments that help in better decision making, and the automation they provide. Consortiums and standardization bodies define specifications and standards for the IoT communities to follow and ease interoperability. Government bodies and agencies play the role of setting up of regulations and policies.

15.8 What Motivates/Drives Them to Work?

As a business strategy, motivation of any business owner is to achieve profitable revenue growth. In the IoT ecosystem, each player sees the market opportunity which is the size of multibillion USD and grows every year. They have a focus on revenue growth while providing efficient goods and services to its ecosystem partners and end customers. Value proposition from IoT ecosystem is new product cycles and better services along with cost efficiencies.

On the revenue generation aspects, below key reasons drive the ecosystem players:

- IoT will generate new and incremental source of revenue streams by creating new goods and services. For example, operators team up with automobile manufacturers to offer subscription-based in-vehicle high-speed 3G/4G connections which allow for remote vehicle diagnostics, offer emergency services, and let the data stream be used like Wi-Fi hotspot for all devices within the vehicle environment.
- IoT will lead to new business models for supplier companies and users. For example, there will be a paradigm shift in business model for industrial equipment manufacturers to position products as services, not as goods. This is due to the ability to monitor machine usage via sensor data and charge by usage. Services and maintenance could also include periodic upgrades via software downloads. “As-a-service” concept would lead source of new revenue streams and business models and give competitive advantage by data mining and offering analytics around the captured data.
- Connecting things and allowing data to be stored, moved, and mined, which will open new market for the data itself.

On the productivity, profitability, and cost savings, below are the key motivating factors:

- Attain sustainable competitive advantage by achieving cost efficiencies.
- The vision of faster and better but cheaper costs for existing goods and services powers the current development and deployment funding in IoT.
- Costs traditionally associated with capex, workforce, and energy are being slashed but not at the cost of productivity by embracing IoT-based solution platforms involving sensors wireless control points.

For technology researcher, motivation is possible recognition in the field of breakthrough innovation and feeling of achievement. For embedded system programmers and hardware developers, motivations are career aspirations, monetary benefits, and desire to develop something groundbreaking. For software developers, motivation is to be able to get a chance to learn new skills and stay relevant in the industry that is being taken up by robotic process automation (RPA) tools and pushing up redundancy of human code developers. For system integrators, IoT portfolio generates new business with high margin. Companies’ brand value goes up when

such projects are showcased or employee skillsets are flaunted. Data analysts are motivated to showcase their expertise, power, and utility of analytics. End users possibly derive benefits in operations management with better quality control, resource planning, and many other areas. Another motivation is to offer rich user experience to their customers, thus increasing customer stickiness and brand image too. Consortiums and standardization bodies are motivated to develop standards that help in interoperability across the IoT components and products. Government's motivation is to set regulations and policies and oversee safety, cybersecurity, and privacy of the things connected to the Internet.

15.9 What Are Their Aspirations for the Future?

Key players of the IoT ecosystem have very high potential to contribute and they have the below aspirations for the future:

- *Social*: Get products to market with a larger goal of bringing better quality of life to the citizens of the society.
- *Standardization*: Ecosystem players have their own proprietary solutions. For a broader acceptability, they try to influence and aspire their solution to evolve as de facto standards. They aspire to influence toward standardization, which could go in their favor to capture bigger market share.
- *Diversification*: Business goal is to exploit market potential by developing vertical solutions in various industrial sectors like transportation, energy, industrial automation, education, health, etc.
- *Governance model*: This is critical to maintain harmony among ecosystem players and to ensure a healthy cooperative ecosystem. It should be established with clear "ecosystem rules."
- *IoT strategy*
 - *API strategy*: Define API strategy keeping the market as well as the partners in mind. APIs are going to be one of the building blocks of the IoT ecosystem. Hence, API roadmap needs to be in line with overall IoT strategy. If the APIs don't create sufficient value, then the ecosystem partners will be reluctant to use it by investing effort and time.
 - *Brand service*: Offer complete end-to-end solution by offering integrated solution along with their partners. This will help in kick-starting the expansion of the ecosystem as well as indication of commitment to the market. One example is AT&T's branded home monitoring solution. This is an integrated solution from various ecosystem partners under the AT&T brand. This solution also signals AT&T's commitment to the IoT and helps inviting wider set of partners in expansion of the ecosystem.

Technology researchers aspire to develop new protocols or hardware innovations that become industry standards. Also, they aspire to do research citations and get

associated with renowned technology companies on their technical boards. Hardware developers aspire to do proprietary, robust, and compact designs. Also, use open-source platform for quicker, easier, and cheaper deployments. Embedded system developers aspire to be always on the new technology forefronts. Software developers aspire to create generic IoT platforms which others can use with custom API which in turn will showcase skills as well as be huge financial motivation. Also, aspire to fuse seamlessly with IPV6 rollout along with security, scalability, and connectivity of IoT platforms. Data scientists opt to follow the path of researchers, some decide to open own consulting units around analytics, and some desire to open own company and use the power of analytics across fields like telecom, social media, healthcare, insurance, etc. End user's aspiration is not to focus on IoT as a technology that they need to understand, but they look at how the IoT projects benefitting them in their business financials. Consortiums and standardization bodies aspire for a broader acceptability and evolve de facto standards. Government bodies and agencies establish ecosystem rules to maintain harmony among ecosystem players.

15.10 What Are the Areas that Require Special Attention to Ensure IoT Ecosystem Remains Promising for Stakeholders?

15.10.1 Interoperability

- Interoperability among IoT systems is extremely critical for the IoT ecosystem to work and generate maximum value.
- Conflicts may develop like two different applications try to take contradicting actions on the same device or try to apply mutually incompatible changes. Such situations can be handled through mechanisms that can manage policies and relationships among needs of various applications.

15.10.2 Engagement with Stakeholders

- IoT involves extremely complex and dynamic relationship among stakeholders. While developing IoT ecosystem, it is important that the business and the product roadmap consider views of both end customers and intermediate customers as well. Views of intermediate customers or the partners are equally important in the development of end-to-end solution. They need to be attracted, supported, and delighted as much like the end customer.
- While developing global solutions, good collaboration and smooth adoption to the local needs by the partners of the ecosystem.

- Each stakeholder should have complementary and not competing interests. All should have a shared ethic that allows all to work together without anyone cheating the other (Moore 1996).
- Attract investments and move the entire ecosystem toward adoption.

15.10.3 Security and Privacy

- Within the IoT value chain, confidential and personal data flows from one component to another, while the components belong to different stakeholders. Level of security and privacy could differ from one to another. Hence, security and privacy concerns could lead to friction among stakeholders, which may lead to slow adoption by users.

15.10.4 Financial Viability of Networked Business Models

- In the current form, the unstructured IoT ecosystem is the key challenge for developing the business model for various stakeholders.
- Right revenue generation and sharing models to take care the interest of existing players, incentivize new players to join, and reduce risk of conflict of interest. The new age business models around use of IoT-enabled controls are no longer based on a single company perspective but involve the IoT ecosystem as a whole (Westerlund et al. 2014).
- During early adoption phase, freemium model could be a viable model while moving to licensing and then to fixed royalty model as the ecosystem matures.

15.10.5 Information Interchange Among the IoT Community

- Due to dependency among the ecosystem, stakeholders established mechanism need to be in place for sharing information regarding interfaces and dissemination of knowledge. Manage communication throughout the ecosystem, including shared learning.
- Involve all stakeholders by leveraging various channels like social media, conferences, and workshops.

15.10.6 Structural Changes and Support Functions

- There would be a need of establishing an organizational structure that promotes creating partners and strategic allies such as customers, partners, and suppliers.

- Firms will be required to support different types of business models and partnership models, and hence a new decision making and management structure will be required.
- Partner management will be a critical function to support and incentivize ecosystem partners in the entire life cycle of partnership. This function needs to play integrated role of technical (support in terms of how to use the APIs), operational (helps integration), and marketing (support selling of apps of one in the marketplace of other).

15.11 Summary of the Findings

As a part of the study, communities of IoT ecosystem are identified, and their motivation to join the community and future aspirations are captured in the matrix format in Table 15.4.

To achieve the expected scale of deployment, new research directions in IoT lead up to areas where technology touch human lives in unpredictable ways, also coined as the concept of human-in-the-loop. Sensors, data, analytics, and the outcome of

Table 15.4 Communities of IoT ecosystem matrix

Communities	Why join	Motivation	Future aspirations	Focus areas for relevance
Technology researchers	Intense desire to work in new fields Amalgamation of various technologies they currently worked in (RFID, NFC, BLE, etc.) for generating something more unique	Feeling of achievement Possible recognition in the field for breakthrough innovations	Development of new protocols or hardware innovations that become industry standards Research citations and association with renowned technology companies on their technical boards	Looking at industry needs to dovetail into research topics for developing innovation in the technology space
Embedded system programmers	Desire to work in new cutting edge-of-technology fields The lure of challenge for developing compact but powerful codes Possible career springboard for more bigger profiles and responsibilities	Monetary Career aspirations Desire to develop something groundbreaking	Fusing IoT principles of sensors into AI use To always be on new technology forefront	Convergence applications to see use of IoT codes into more daily life objects

(continued)

Table 15.4 (continued)

Communities	Why join	Motivation	Future aspirations	Focus areas for relevance
Hardware developers	The lure of challenge for developing compact but powerful circuit designs Possible career springboard for more bigger profiles and responsibilities	Monetary Career aspirations	Two branches here: Design proprietary design for robust and compact designs Use of open-source platform for quicker, easier, and cheaper deployments	To keep a focus on development of software tools for hardware design so that they do not become irrelevant in the process
Software developers	To move away from simple application development to platform-based tools development as a huge value add to profile To create unique mobile enterprise applications (iOS and android only as of now) which showcase their new skills of converting idea possibilities into utility and monitoring tools on mobile	To value add into the realm of IaaS, PaaS rather than the SaaS model To be able to get a chance to learn totally new skills and stay relevant in the industry and pushing up redundancy of human code developers	To be able to fuse seamlessly the IPv6 rollout for security, scalability, and connectability of IoT platforms To be able to create their generic IoT platforms which others can use with custom API which in turn will showcase skills as well as be huge financial motivation	Keep updated on all new tools not only from software development world but also from mobile application development too Be very close to the end consumer market needs and competition analysis
System integrators	New revenue generating area Less crowded competition as of now	Monetary This portfolio generates new business with high margin The company branding goes up when such projects are showcased or employee skillsets are flaunted	Very few companies want to remain 100% IoT focused in the long run and want to embrace similar high-profile growth avenues through RPA, AI, machine learning, chatbot applications, etc.	Keep a very close tab on the market requirements so that relevant technology partners are tied up with to have first mover advantage to offer new skills and tools to the marketplace

(continued)

Table 15.4 (continued)

Communities	Why join	Motivation	Future aspirations	Focus areas for relevance
Data scientists	IoT is all about data and thus attracts them naturally to this area The supply is less than demand in this area, so it is a natural magnet where they can showcase expertise and work on new tools/skills/theories	To showcase the power and utility of analytics To showcase their own expertise	Many opt to follow path of researchers eventually Some decide to open own consulting units around analytics Some desire to open own company and use the power of analytics, irrespective of in IoT or any other fields like for telecom, social media, healthcare, insurance, etc.	New development in statistical tools New requirements from industry New platforms for analytics automation
End users	Innovative applications Utility benefits Automation tool	To possibly derive benefits in operations management with better quality control, resource planning, and many other areas To be able to offer rich user experience to their customers thus increasing customer stickiness and brand image too	Not to focus on IoT as a technology that they need to understand but make it mainstream in application use by focusing on their core competency and allowing outsource IoT-based projects to allow them to derive the benefits of the reports and trends To demystify the technicalities from teams and focus on benefits only	The IT team must work very closely with business units and marketing teams to capture the ground requirements and then evolve unique use cases which the SI partners can solve with relevant IoT tools/devices/platforms, etc.
Consortiums and standardization bodies	Define specifications and standards for the IoT communities to follow	Interoperability across the IoT components and products	For a broader acceptability and evolve de facto standards	Define specifications and standards for the IoT communities to follow
Government	To play the government role of setting up of regulations and policies	To oversee safety, cybersecurity, and privacy of the things connected to the internet	Establish ecosystem rules to maintain harmony among ecosystem players	Setting up of regulations and policies and maintain harmony among ecosystem players

such analytics also assist in areas of artificial intelligence and machine learning. Thus, in many areas, the research borders on zones where technology touches human psychology of behavioral inputs for the entire ecosystem to work seamlessly. Other interdependent areas like massive scaling of data bandwidth, creation of data lakes and its management, engineering system robustness, and securing human identity and data security are also significant topics to enable IoT as a technology to grow (John A. Stankovic, Life Fellow, IEEE). The research around soft areas like cultural impact on use of these technologies also borders on the psychological aspects for human-in-the-loop simulation. It is very dynamic but fluid area because the outcome of such simulations is difficult, if not impossible, to reproduce again and again.

15.12 Conclusion

In the IoT ecosystem, the concept of IoT value web has set in. The value creators are no longer islands of technologies or solutions. The technology suppliers are deeply interwoven with the customer. Similarly, the individual organizations are interlinked to create the value and eventually share a common fate. No single firm can develop the entire IoT ecosystem. In true ecosystems, partner communities coexist. Ecosystem partners develop products and services using the resources (e.g., APIs) of the firm as well as those of the ecosystem partners.

The study finds the reasons that inspire the IoT members to join the IoT ecosystem. It also finds the motivation and future aspirations of the IoT ecosystem members. Additionally, it also identifies the areas that need special attention to ensure that the IoT ecosystem remains promising to the stakeholders.

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