



TRANSFORMING SUPPLY CHAIN MANAGEMENT THROUGH CLOUD COMPUTING

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Abstract— Cloud computing is revolutionizing the IT industry by enabling them to offer access to their infrastructure and application services on a subscription basis. As a result, several enterprises including IBM, Microsoft, Google, and Amazon have started to offer different Cloud services to their customers. Increasing complexity of supply chains due to globalisation efforts have led to organizations having difficulties with both collaboration, as well as agility in getting aid to individuals in need. Throughout this research paper, RBV and social capital theory are used to clarify the positive association between cloud computing use and collaboration among organizations and their suppliers. It is also discussed to demonstrate the association of inter-organizational trust and its moderating role in the relationship between cloud computing use and collaboration, as well as collaboration and its positive association with agility.

Index Terms— Cloud computing, Service sector, Supply chain management, Resource based view.

I. INTRODUCTION

Cloud computing has emerged as a paradigm to deliver on demand resources to customers similar to other utilities. The three main services are provided by the Cloud computing architecture according to the needs of IT customers [1]. Firstly,

Software as a Service (SaaS) provides access to complete applications as a service, such as Customer Relationship Management (CRM) [2]. Secondly, Platform as a Service (PaaS) provides a platform for developing other applications on top of it, such as the Google App Engine (GAE) [3]. Finally, Infrastructure as a Service (IaaS) provides an environment for deploying, running and managing virtual machines and storage. Technically, IaaS offers incremental scalability (scale up and down) of computing resources and on-demand storage [1].

II. LITERATURE REVIEW

A. Cloud computing use and collaboration

Based on service level agreements, cloud computing is a large scale, distributed, computing paradigm where virtualised, dynamically scalable, managed computing power, storage platforms and services are delivered on demand to customers via the internet [1], [4]. According to the research, there are two defining attributes of cloud computing technology: massively scalable service and on-demand access to information. Massively scalable service refers to a cloud computing user's ability to choose from a variety of services offered (i.e., infrastructure, software and platforms), payment options (i.e., pay-as-you-go, up-front fee or two tier), as well as how it is delivered (i.e., public vs. private cloud) [5]. Each service can be tailored according to a user's or a supply chain

partner's needs. Since collaboration typically involves consistent communication and alignment of incentives, cloud computing's ability to offer instant scalability in service, pricing options and media, according to an organisation's and the supply chain partner's needs, will enhance alignment in terms of communication and incentives received from cloud computing use [6]. Further, cloud computing offers mobile interactivity and the ability to share information with supply chain partners using a variety of different media [7], [8], [9]. This is dissimilar to web-based EDI applications, which still require a common platform on either end [10]. Additionally, cloud computing offers the ability for users to analyse terabytes of data in a period of minutes, which is a substantial increase in speed of information flow over traditional information technologies [7], [8].

B. Inter-organizational trust

There are various definitions of inter-organisational trust with dimensions including credibility, goodwill, honesty, integrity, benevolence, etc. Inter-organisational trust, which is one party's confidence and belief in the credibility and goodwill of an object of trust [11]. Further, both dimensions take into account the importance of dependability, reliability, and acting in the best interests of one another. Dependable and reliable supply chain partners are vital for several reasons. First, organisations are increasingly demanding accountability, transparency and value in return for sponsorship. This expectation is also influencing companies to become more professional in their approach to managing operations. Agile supply chains require reduced security risks, while at the same time delivering speed and efficiency that can prove difficult with complex supply chains involving various actors. A transparent supply chain provides timely and accurate exchange of information. This greater transparency is also likely to lead to improved systems' processes. In the majority of empirical studies, inter-organisational trust is seen as a main effect that leads to positive attitudes, higher levels of cooperation and higher levels of performance [12]. Various studies have examined the direct effect of trust on workplace attitudes and performance [13]. Trust overall is identified as critical for effective collaboration in a supply chain

[14].

C. Collaboration and agility

Perhaps even more vital than the relationships between cloud computing use, inter-organisational trust and collaboration is the ultimate impact on agility. Agility has several definitions, including a supply chain's ability to respond to customers unforeseen changes [15]; responding rapidly to short-term changes in demand and market turbulence [16]; ability to thrive in constant and unpredictable change; being centred on customer responsiveness and focused on market turbulence. All of these definitions have one commonality: responding quickly to unforeseen changes. It also requires higher levels of responsiveness and effectiveness in delivering the correct products to the right place, at the right quantity, and during the right time period [17].

III. THEORETICAL BACKGROUND AND MODEL

A. Resource-based view (RBV)

The connection between information technology and collaboration is not new in literature and has a strong background in RBV [18]. RBV mentions that firms compete using unique resources that are valuable, rare, difficult to imitate and non-substitutable by other resources [19]. These resources in turn can be used for competitive advantage. While resources are vital, it is more critical how the firm utilises them to maximise competitive potential. It has been considered in this research that cloud computing to be a valuable, rare and difficult to imitate resource if firms utilise and scale it according to their own and their partner's needs. As described in the previous sections, cloud computing offers users massively scalable service and pricing options that allow organisations to scale according to their own and their supply chain partners' needs [7]. Since collaboration requires mutual incentives [6], cloud computing can optimise it through massively scalable services that perpetuate greater collaborative relationships between supply chain partners.

B. Social capital theory/ agency theory

Social capital theory suggests that benefits derived from relationships between entities can generate intangible and tangible benefits, including those that are social, psychological, emotional and economic in the short- and long-term [20]. Social

capital is comprised of seven dimensions, including: group characteristics, generalised norms, togetherness, everyday sociability, neighbourhood connections, volunteerism and trust, which help to develop both short- and long-term benefits [21].

This theory helps define the relationship between collaboration and agility, and the moderating impact of inter-organisational trust on the relationship. Collaboration typically involves both continuous communication, as well as an effective platform to collaborate on [22]. When communication and platforms are present, other types of social capital develop, including generalised norms, togetherness, sociability and established connections, which, according to social capital theory, can lead to a variety of benefits, including agility.

Trust is also considered a vital social capital that can lead to a variety of internal and external benefits. Trust is known to offset risks associated with behaviours underlying competitiveness, thereby allowing greater benefits of knowledge transfer, joint learning, and sharing of risks associated with exploiting opportunities in collaboration. Given the recency of cloud computing and associated security concerns; an adequate amount of inter-organisational trust can provide a foundation for using cloud computing to perpetuate greater collaboration.

Both RBV and social capital theory can be used to explain the intricate relationships depicted in Figure 1, which presents our conceptual model that we will analyse using partial least squares analysis.

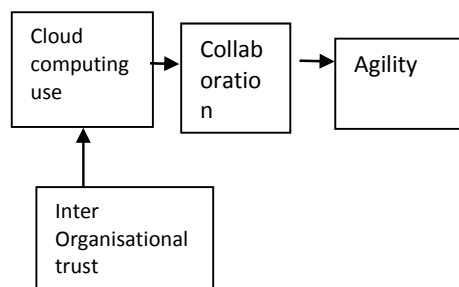


Figure1: Conceptual model

IV. RESEARCH METHODOLOGY

The quantitative approach is adopted as the research methodology for this research. A quantitative survey is considered to be the most feasible and adequate research strategy for this research as it is beneficial to deal with the questions

of ‘what’ the important factors are, and ‘how much’ strength these factors have. To increase the sample size of the survey, two approaches are adopted. First, an invitation letter and e-mail are sent to directors and senior executive managers of various major IT companies in Bangalore, Delhi, Mumbai, Kolkata, Chennai, Pune, Coimbatore, and Mysore in India. Then questionnaire surveys are distributed by e-mail or post to those directors or managers accepting the survey invitation. The respondents are invited to distribute the questionnaires to their industry partners or practitioners that they know to have rich experiences in SCM development in India. A total of 180 questionnaires are despatched via both e-mail and post, and 58 returns are usable for the analysis—giving a net usable response rate of 32%. The questionnaire consists of two sections. The first section serves to introduce the objectives and scope of the survey. This section is also used to collect demographic data regarding the respondents’ previous experience and general knowledge in the area. In the second section, participants are invited to provide their opinions on the importance of proposed factors that influence cloud computing in SCM on a seven-point Likert scale (1‘Not important at all’ to 7‘Most important’). In order to guarantee that the respondents are knowledgeable about the topic of the research, a survey has been conducted directly associated with information technology or supply chain management activities in the organisations. Titles included information officers, directors of supply, chief and head of operations, etc.

V. RESEARCH FINDINGS

The Pearson correlation coefficient has been adopted to test the relationship among all factors. In Table 3, it is found that the Inter-organisational trust, collaboration and agility are all significantly and positively correlated to cloud computing use.

variable	1	2	3	4
Cloud computing use	1.00			
Inter org trust	0.26**	1.00		
Collaboration	0.25**	0.36***	1.00	
Agility	0.08	0.23**	0.34***	1.00

Table1: Pearson correlation (Notes: *p<0.01,

p<0.05, *p<0.001)

Descriptive statistics for all survey items appear in Table. Our model was assessed and validated [23]. Individual item reliability is assessed by looking at the loadings of each item with their construct. The minimum level threshold for item loadings is 0.7 [24]. As seen in Table 2, all items in the research analysis are well above the 0.7, thus providing results for individual reliability. Convergent validity suggests that a number of items represent one and only one underlying construct. To assess convergent validity, each of the composite reliabilities is assessed for each construct all of which has a minimum value of 0.7.

Sl. No	Factors	Mean, SD	Factor loading
1	Cloud computing use [25, 26]		
1.01	Use of cloud computing technology relative to Industry standard.	4.48, 1.55	0.739
1.02	Extent to which our organization uses cloud computing to integrate with our supply chain partners.	4.02, 1.54	0.868
1.03	Reliance on cloud computing technology in conducting business processes.	3.73, 1.46	0.815
1.04	Reliance on cloud computing technology in conducting business with our supply chain partners.	5.07, 1.33	0.829
2	Inter-organizational Trust[27]		
2.01	Our organization feels that it is important not to use any proprietary information to our supply chain partner's disadvantage.	3.89, 1.45	0.913

2.02	A characteristic of the relationship between our organization and its supply chain partners is that neither supply chain partner is expected to make demands that might be damaging to the other.	5.05, 1.26	0.849
2.03	Our organization feels that our supply chain partner will not attempt to get its way when it negatively impacts our organization.	4.81, 1.33	0.762
2.04	Our organization has strong confidence in our supply chain partner.	4.93, 1.31	0.737
2.05	Our organization can always rely on another supply chain partner when it counts.	3.75, 1.78	0.709
2.06	Our organization believes that our supply chain partner will work hard in the future to maintain a close relationship with us.	3.74, 1.65	0.823
3	Collaboration [28]		
3.01	Our organization and supply chain partners exchange timely information.	3.90, 1.63	0.851
3.02	Our organization and supply chain partners exchange accurate information.	4.24, 1.48	0.811
3.03	Our organization and supply chain partners exchange complete information.	4.12, 1.59	0.823
3.04	Our organization and supply chain partners have agreement on the goals of the supply chain.	3.83, 1.65	0.792
3.05	Our organization and supply chain partners have agreement on the importance of collaboration across the supply chain.	3.64, 1.44	0.856

3.0 6	Our organization and supply chain partners share benefits (e.g. saving costs).	3.80, 1.50	0.76 0
3.0 7	Our organization and supply chain partners share any risks that can occur in the supply chain.	4.07, 1.59	0.79 3
3.0 8	Our organization and supply chain partners share benefits for providing to our end user.	3.70, 1.55	0.82 8
3.0 9	Our organization and supply chain partners have frequent contact on a regular basis.	4.40, 1.48	0.73 8
3.1 0	Our organization and supply chain partners have open and two-way communication.	4.48, 1.47	0.76 5
3.1 1	Our organization and supply chain partners influence each other's decisions through discussion.	4.60, 1.38	0.82 3
3.1 2	Our organization and supply chain partners jointly search and acquire new and relevant knowledge.	4.22, 1.44	0.81 4
3.1 3	Our organization and supply chain partners jointly identify end user needs.	4.35, 1.54	0.81 7
4	Agility [29]		
4.0 1	Our supply chain is able to respond to changes in demand.	4.73, 1.35	0.73 5
4.0 2	Our supply chain is able to leverage the competencies of our partners to respond to demand.	4.93, 1.18	0.78 6
4.0 3	Joint planning in our supply chain is important.	4.20, 1.45	0.74 1
4.0 4	Our organization works with our suppliers to seamlessly integrate our inter-organization processes.	4.90, 1.33	0.84 1

4.0 5	Improving our organization's level of service is a high priority.	5.51, 1.22	0.74 5
4.0 6	Improving our organization's delivery reliability is a higher priority.	4.48, 1.54	0.71 9
4.0 7	Improving our organization's responsiveness is a high priority.	4.23, 1.61	0.75 0
4.0 8	Demand is accessible throughout our organization's supply chain.	4.67, 1.77	0.71 3
4.0 9	Inventory levels are visible throughout our organization's supply chain.	4.21, 1.61	0.74 2

VI. CONCLUSIONS AND FUTURE WORK

Increasing complexity of supply chains due to globalisation efforts have led to organisations having difficulties with both collaboration, as well as agility in getting aid to individuals in need. RBV is used to clarify the positive association between cloud computing use and collaboration among organisations and their suppliers. Social capital theory and its ability is also discussed to demonstrate the association of inter-organisational trust and its moderating role in the relationship between cloud computing use and collaboration, as well as collaboration and its positive association with agility.

A conceptual model of cloud computing has been provided that is both theoretically and empirically supported through the use of RBV, social capital theory and partial least squares analysis. Research provides empirical support for the positive association between cloud computing use and collaboration among organisations and their suppliers, as well as the ultimate positive impact on agility. This, in turn, creates a framework for supply chain management scholars to examine agility and how it may be impacted by information technology such as cloud computing.

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