How cloud computing impacts supply chain performance and business strategies

SongIl Choe[1,2,*], IlNam Li[1], WonJunMin[1] UnChol Li[3], JongSu Kim[2]

1 College of Information Science, Kim Il Sung University, Pyongyang, Democratic People's Republic of Korea
2 Department of Information Science, HuiChon Industry University, HuiChon, Democratic People's Republic of Korea
3 Ham Hung University of hydraulics and power ,Ham Hung , Democratic People's Republic of Korea

Corresponding author.   * E-mail address: cx12015316@163.com

Abstract- This paper explores the managerial perceptions on the use of cloud computing in enterprise supply chain (SC) management. Specifically, this paper seeks to address how cloud computing impacts supply chain performance and bussiness strategies.
This paper also presents a comparison of traditional supply chain concepts such as the efficient SC and responsive SC and a new concept for emerging ICT as the cloud computing area with cloud services as traded products. The comparison analysis suggested thatcloud computing can improve supply chain performance and business strategy objectives.

Keywords-supply chain performance; cloud computing; business strategy; cloud supply chain

1. Introduction

Nowadays with the increasingly fierce competition of market, the globalization of economy, the fast development of information technology and the individuation of customer demand, enterprise must respond to customer needs quickly, and then introduced to meet customer demand for products. The traditional inventory management of supply chain are the VMI (vendor managed inventory), JMI(Jointly Managed Inventory), CPFR(Collaborative Planning, Forecasting and Replenishment) and other methods, but they are required to share and exchange the information quickyly in supply of chain, especially the CPFR. The traditional technology methods as the EDI(Electronic data interchange) and bar code can not resolve this problem effectively. So enterprises have to integrate its resources and core competitiveness, improve the efficiency of corporate supply chain collaboration, and occupy a good position in the increasingly fierce market competition. Also it has been shown that current enterprises have begun transitioning to more digitally focused business strategies. It has also been shown that business strategies are currently being reshaped by cloud computing which is a key factor in digital business strategies. After change PC

change, the Internet, cloud computing is viewed as the third wave of the IT, is an important part of world's strategic emerging industries. Cloud computing from the development of emerging technologies in the past few years, become the hot technology. Cloud computing with open, dynamic and low cost characteristics, which make the problems in the supply chain and business strategies has a great advantage. Thus, this paper seeks to address how cloud computing impacts supply chain performance and bussiness strategies.

2. How cloud computing impacts supply chain performance

Cloud computing has provided supply chain management providers the opportunity to take advantage of new processes related to ethereal space. While traditional supply chain processes have focused on physical, in-person IT, cloud computing has provided on-demand access to information vital for procurement practices, store shelf optimization, sales and operations planning. With cloud computing, inventory information is updated instantly without users having to wait for central servers to populate information across a supply network. Companies can use cloud computing to share real-time overviews of inventory and sales information resulting in closer integration between channels and more efficient supply chain and customer analytics[1]. This is especially useful for larger companies which can have many supply chain partners, each using different platforms. These differences in platforms can be problematic when supply chain partners need to request or track supplies and inventory on a real-time basis. This problem can result in time delays and costly errors, thus increasing a company's capital costs and IT labor costs. Further, cloud computing offers on-demand server capabilities. Many supply chain companies using in-house IT systems only use five to 10 % of server resources. With cloud computing, companies only pay for the amount of server resources used. In addition, new servers can be added on-demand with or without additional charges. This is useful in cases with large fluctuations in demand. With each additional order comes the need for extra bandwidth and processing capability.

Within minutes a supply chain management provider can extend services with a cloud host in order to allow for the growth in capability. Another example of how cloud computing differs concerns landline dependency. External company information flow typically is dependent on landlines dedicated or not. Particularly in global supply chain environments, landline infrastructures delay the speed of information and in some cases prohibit delivery of information and product in a timely manner[2]. Cloud computing provides more secure data backup and recovery capabilities. This is vital to supply chain management performance as data loss was recently named one of the most significant risks associated with supply chain relationships. Cloud computing also provides companies with massively scalable service and payment arrangements. The massively scalable services provide an environment conducive for enhancing social capital among companies, while the scalability in payment arrangements reduces the cost structure, thereby making information sharing more cost effective.

The service offerings include software(SaaS-Software-as-a- Service), platforms (PaaS-Platform as a Service) and infrastructure(IaaS).

Each one can be tailored according to the needs of both the focal company and its external partners. Cloud computing also offers different payment arrangements(i.e., one time flat

fee, pay-per-use and hybrid approach) that allow supply chain partners to scale services according to business strategy goals and competitive priorities[3]. The ability to process data can help reduce order-to-delivery cycle times and is considered to be vital in an increasingly globalized supply chain network. According to MIT's integrated supply chain management program, one of the most commonly reported bottom line benefits in supply chain management are centered on reducing costs. The pay-as-you-go service is vastly different from traditional EDI and web-based applications which require high upfront technology costs. Cloud computing allows companies to pay for information sharing capability in a similar manner as to how utilities such as water and electricity are paid. This benefit allows companies to add resources during high volume seasons and growth periods and reduce expenditures during downtimes [4]. This cost structure is useful for reducing costs in inventory management. Cloud computing decreases the upfront costs of installation of hardware and software. Moreover, it significantly reduces upkeep and maintenance of data centers, which can account for up to 80% of total IT expenditures.

3. The Effects of Cloud Computing Within Business Strategies

According to Kaplan and Norton's strategy map firms aim to achieve primary objectives, which are dependent on secondary objectives as shown in Table 1 [5], [10]. This study reviewed literature on how cloud computing affects business's secondary objectives in order to achieve firm's primary objectives as shown in Table1.

Table 1.   The Effects of Cloud Computing Within Business Strategies

Primart Objective	Secondary Objective
Increase return on capital	Improve productivity Increase revenues in existing segments and markets Grow revenues in new products and services
Improve operating quality and efficiency	Be a leader in quality and reliability Improve quality, cost, and flexibility of operating processes
Grow high-valued customer relationships	Provide valued service, application expertise, and support Optimise customer profitability Expand channels, offerings, and markets Build and maintain strong customer relationships
Accelerate product innovation	Introducce innovative, high-performnmance products and solutions excel at technology Product development, and life cycle management Identify next-generation market opportunities
Create a high-performance culture	Expand and build strategic skills, capabilities, and expertise Develop leadership and an execution-driven culture Establish and require continuos learning and sharing of knowledge

3.1 Increase Return on Capital

3.1.1 Improve Productivity

The first improvement due to cloud computing in terms of productivity is the reduction in infrastructure and maintenance costs. Reference [9] reinforces reductions in maintenance costs, stating that with less infrastructure there is less need for the management of technology. Cloud computing also allows work to be extremely mobile, allowing people to work from home or anywhere where they can access the internet, increasing productivity in firms. One of the benefits of cloud computing infrastructure scalability which improve productivity in functions such as supply chain, marketing, and finance within organisations [5].

3.1.2 Increase Revenue in Existing Segments and Markets

Cloud computing can lead to increased customer satisfaction, which in turn result in increased revenue. Cloud computing makes it possible for firms to deliver new applications and services within their existing segments and in markets that were not possible before [9]. Cloud computing is integral in driving revenue growth in digital business.

3.1.3 Grow Revenues in New Products and Services

According to [8] cloud computing solutions are cost effective and thus allow organisations to increase revenue in unattractive markets by creating new products and services that are appealing to the grander market. Cloud computing has also seen growth in online transactions. Due to cloud computing, e-commerce market has seen a boom. For example, e-bay is the most popular domain to purchase goods and services online.

3.2 Improve Operating Quality and Efficiency

2.2.1 Be a Leader in Quality and Reliability

Outsourcing firm's IT services has seen improvements in the quality, reliability and flexibility of operating processes, taking pressure off the contracting firm [6]. Cloud computing increases the agility of responsiveness within an organisation, improves redundancy as well as improving back-ups, disaster recovery plans, and the security of data.

3.2.2 Improve Supply Chain Efficiency and Effectiveness

Reference [6] maintain that cloud computing is very connected to supply chain operations and helps the supply chain to become more dynamic and scalable. Rapid scalability creates more available capital and resources and allows firms to constantly adapt to and accommodate growing workloads[5].

3.2.3 Improve Quality, Cost, and Flexibility of Operating Processes

Cloud computing has allowed firms the capability of exchanging value (good, services, money, information) digitally and business processes have specifically been designed so that firms can conduct business for that purpose. Outsourcing firm's IT services result in improved quality, flexibility and minimised the cost of operating processes, taking

pressure off the contracting firm [6].

3.3 Grow High-Value Customer Relationships

3.3.1 Provide Valued Service, Applications Expertise, and Support
The cloud creates a digital medium that facilitates consumer and supplier interaction.
Cloud enables real-time transactions and, therefore, supports businesses by
strengthening business relationships [5]. "Slowness in response could mean customers
moving away from companies perceived as being out of tune with the new reality" [5].
In cloud environments, firms can create a competitive advantage by developing a particular
type of digital service for consumers [10].

3.3.2 Optimise Customer Profitability
Cloud computing has enhanced the quality and quantity of data, eliminating poor conditions
of information scarcity and poor quality information, as well as data abundance, providing
firms with the more reliable digitisation of information on products and services [5].
The speed by which decisions can be made regarding product launches and product launches
themselves have been accelerated, creating increases in customer satisfaction due to the
timely fashion that products and services can be delivered to consumers [5].

3.3.3 Expand Channels, Offerings, and Markets
According to [5], the cloud has dramatic power shifts in market channels. The cloud has
expanded channels over the years in certain industries, such as music industry. The cloud
has enabled digital downloads to compete with traditional music distribution channels,
forcing the music industry to digitized music distribution channels. Cloud computing has
also made it possible for firms to offer new applications and services to new markets and
segments that were not possible before[9].

3.3.4 Build and Maintain Strong Customer Relationships
Cloud computing enables maintenance of customer relationships, for example, cloud-based
CRM applications allow firms to afford higher levels of service, resulting in a stronger
customer relationships. Consumers are adamant on receiving good customer service and are
more likely to be loyal to a certain firm that assists consumers in the best possible fashion
[5]. The internet, which can be viewed as a cloud in itself, is a tool used to create customer
value, and long-term sustainable profitability is achieved through cloud computing
applications assisting customer relationship management.

3.4 Accelerate Product Innovation

3.4.1 Introduce Innovative, High-Performance Products and Solutions
Scalability and cost effective cloud infrastructure solutions create new opportunities
for new products that better suit customers [8]. Cloud computing allows organisations to
keep information on consumers, regarding user preferences and other important
market-related information, allowing firms to customise their products and services for

a suitable fit for consumers. Cloud computing allows firms to fine-tune their actions based on readily available information [5]. Rapid prototyping and short deployment cycles give firms the opportunity to foster innovation as well as reducing time that products or services take to reach the market. Reference [9] states that firms no longer need to invest large capital amounts for new innovations, and cloud computing can lower IT barriers to innovation.

3.4.2 Excel at Technology, Product Development, and Life Cycle Management

Reference [10] states that cloud computing gives firms flexibility to handle environments in turbulent environments. For example, cloud computing improves time-to-market and efficiencies in new product development. Cloud computing creates a platform for a simpler exchange of data through decentralised locations, which as a result create a product life cycle that is much more flexible.

3.4.3 Identify Next-Generation Market Opportunities

There are obviously next-generation market opportunities that encompass cloud computing, and with the assistance of cloud computing itself, accurate information made readily available assists in enabling firms to identify new market opportunities in which organisation can engage [5],[10]. "Exponential advancements in the price/performance capabilities of computing, storage, bandwidth, and software applications are driving the next generation of digital technologies to be delivered through cloud computing" meaning that cloud computing, through such advancements, is essential to exploit next generation opportunities".

3.5 Create a High-Performance Culture

3.5.1 Expand and Build Strategic Skills, Capabilities, and Expertise

Reference [5] highlights possible skill development opportunities for IT personnel in firms that are implementing cloud computing. For example, firms need to educate their IT teams in order to make cloud project transitions smoother. According to [5] cloud environment require certain capabilities such as adoption of "cloud first" policy for new cloud projects, cloud-based software testing and development[4]. According to [7] it is believed that cloud computing presents an opportunity for staff to develop new skills and capabilities that should be in demand for years to come.

3.5.2 Develop Leadership and an Execution-Driven Culture

Cloud computing places pressure on leadership. Reference [7] says that information as well as the increasing access that leaders have in the business world is forever growing in so many different ways, making transparency inevitable. Every process or action will be visible to anyone and everyone and the speed to which information can be accessed on a particular item related to a firm is forever accelerating. If leaders cannot understand how to use cloud computing they will fail to develop leadership culture and will be left behind . Reference[7] stated that transparency is so important within an organisation and organisations that are more transparent are more competitive. Cloud computing allows

organisations to quickly access cloud application services so that they can share knowledge .

3.5.3 Establish and Require Continuous Learning and Sharing of Knowledge

Cloud computing is forever changing, requiring firms to constantly manage their digital business strategy [5]. Firms therefore need to make sure that employees are aligned to market skills [5], [10]. Sharing knowledge within organisations allows employees to continuously learn and adapt to changes in cloud technologies. Cloud computing allows organisations to quickly access cloud application services for on collaboration and ease share of information despite geographic boundaries [7].

4. Comparison of Traditional and Emerging ICT Supply Chains

Table 2 presents a comparison of Traditional Supply Chain concepts such as the efficient SC and responsive SC and a new concept for emerging ICT as the cloud computing area with cloud services as traded products. [12]

Table2 Comparison of Traditional and Emerging ICT Supply Chains

Comparison term	Traditional supply chain conceps		Emerging ICT concepts
	Efficient SC	Responsive SC	Cloud SC
Primary goal	Supply demand at the lowest level of cost	Respond quickly to demand (changes)	Supply demand at the lowest level of costs and respond quickly to demand
Product design strategy	Maximize performance at the minimum product cost	Create modularity to allow postponement of product differentiation	Create modularity to allow individual setting while maximizing the performance of services
Pricing strategy	Lower margins because price is a prime customer driver	Higher margins, because price is not a prime customer driver	Lower margins, as high competition and comparable products
Manufacturing strategy	Lower costs through high utilization	Maintain capacity flexibility to meet unexpected demand	High utilization while flexible reaction on demand
Inventory strategy	Minimize inventory to lower cost	Maintain buffer inventory to meet unexpected demand	Optimize of buffer for unpredicted demand, and best utilization
Lead time strategy	Reduce but not at the expense of costs	Aggressively reduce even if the costs are significant	Strong service-level agreements (SLA) for ad hoc provision

Supplier strategy	Select based on cost and quality	Select based on speed,flexibility , and quantity	Select on complex optimum of speed, cost, and flexibility
Transportation strategy	Greater reliance on low cost modes	Greater reliance on responsive modes	Implement highly responsive and low cost modes

This mixed characterization is furthermore reflected when it comes to the classification of efficient vs. responsive Supply Chains. Whereas functional products would preferable go into efficient Supply Chains, the main aim of responsive Supply Chains fits the categorization of innovative product. Cachon and Fisher [13] show that within the supply chain the sharing of information(e.g. accounting and billing) is not the only contributor to SC cost, but it is the management and restructuring of services, information, and funds for an optimization of the chain that are expensive [13]. In above table, the concept of a Cloud Supply Chain (C-SC) and hence Cloud Supply Chain Management (C-SCM) appear to be viable future business models for the enterprise cloud computing paradigm. The idea of C-SCM represents the management of a network of interconnected businesses involved in the end-to-end provision of product and service packages required by customers. The established understanding of a supply chain is two or more parties linked by a flow of goods, information, and funds [11]. A specific definition for a C-SC is hence: "two or more parties linked by the provision of cloud services, related information and funds." Figure 1 represents a concept for the C-SC, showing the flow of products along different organizations such as hardware suppliers, software component suppliers, data center operators, distributors and the end customer.
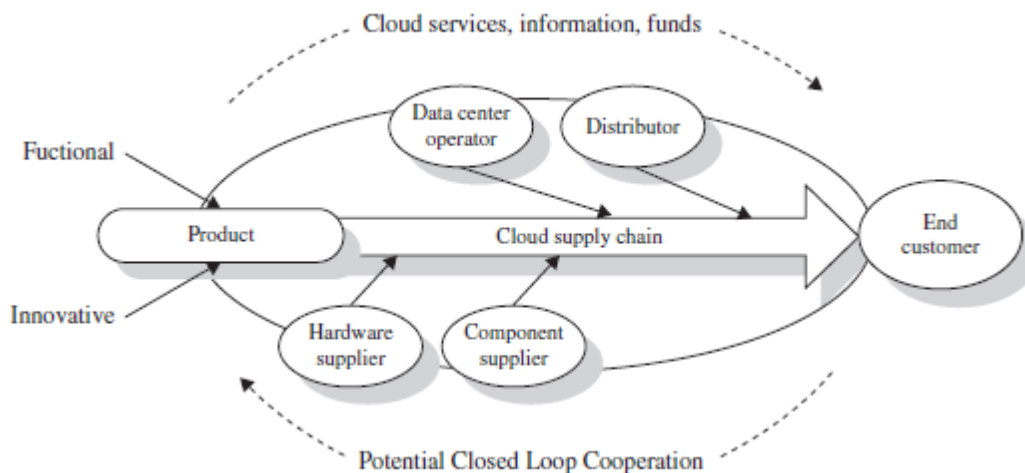

Figure 1. Cloud supply chain(C-SC)

Figure 1 also makes a distinction between innovative and functional products in the C-SC. Fisher classifies products primarily on the basis of their demand patterns into two categories: primarily functional or primarily innovative[12]. Due to their stability, functional products favor competition, which leads to low profit margins and, as a consequence of their properties, to low inventory costs, low product variety, low stockout

costs, and low obsolescence[12], [13]. Innovative products are characterized by additional (other) reasons for a customer in addition to basic needs that lead to purchase, unpredictable demand (that is high uncertainties, difficult to forecast and variable demand), and short product life cycles (typically 3 months to 1 year). Cloud services should fulfill basic needs of customers and favor competition due to their reproducibility. They however also show characteristics of innovative products as the demand is in general unpredictable (on-demand business model) and have due to adjustments to competitors and changing market requirements very short development circles. This mixed characterization is furthermore reflected when it comes to the classification of efficient vs. responsive Supply Chains. Whereas functional products would preferable go into efficient Supply Chains, the main aim of responsive Supply Chains fits the categorization of innovative product. Cachon and Fisher [13] show that within the supply chain the sharing of information (e.g. accounting and billing) is not the only contributor to SC cost, but it is the management and restructuring of services, information, and funds for an optimization of the chain that are expensive [14].

5. CONCLUSION

Our paper is the focus on reducing the unfamiliarity of cloud computing use in a supply chain and business strategies. Our main contribution thus lies in an empirical assessment of how cloud computing impacts supply chain performance and business strategies.

This paper does provide a first step in the direction of understanding the roles cloud computing have on supply chain performance and business strategies.

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