Smart Technologies on Supply Chain Management

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Abstract: *Modern supply chains have access to more information and technologies than before, to creat a new digitial supply chain management. Supply chain management is the management of the flow of goods and services and includes all processes that transform raw materials into final products. The digital supply chain has grown on the use of "smart technologies", such as Cloud Computing, Internet of Things (IOT), Big data and Block Chain Technologies (BCT). This paper discusses how to improve supply chain quality management by adopting smart technologies.*

Keywords: supply chain management, smart technologies, big data, block chain, cloud computin, Internet of Things.

1. Supply Chain Management

Supply chain management (SCM) is a phenomenon that has grown in importance to the business community because of its ability to reduce the risk and uncertainty associated with international business operations. The supply chain management (SCM) implementation in an manufacturing organization achieves competitive advantage and strategic fit over other manufacturing organizations. [7] A supply chain (SC) includes all the activities, functions and facilities involved in the flow and transformation of goods and services from the material stage to the customer [3]. Supply chain is all activities involved directly or indirectly in completing a customer's order. A basic supply chain mainly consist of 5 stepes.

- supplier
- manufacturer
- distributor
- retailer
- customer

Through practical overview the concept of supply chain management emerged from some alteration in the area of manufacturing such as increase of cost, decrease in inventory, product life cycle and globalization of business [8].
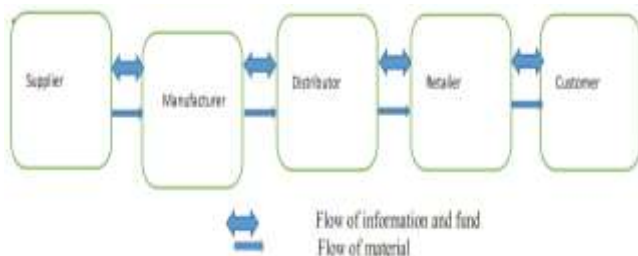

Figure 1. A basic Supply Chain

Supply chain management is made up of a few components that are very important as well as critical to the system. The followingall discuss each of the components in brief.

A. Planning

Before the beginning of the entire supply chain, it is essential to finalise the strategies and put them into place. Checking the demand for the product or service, checking the viability, costing, profit, and manpower etc., are vital. Planning helps to identify the demand and supply trends in the market and this, in turn, helps to create a successful supply chain management system.

B. Information

Information is crucial in a knowledge-based world economy, and ignorance about any aspect of business may actually spell doom for the prospects of the business.

C. Source

Suppliers play a very crucial role in supply chain management systems. Products and services sold to the end user are created with the help of different sets of raw materials. If a supplier is unable to supply on time, and within the stipulated budget, the business is bound to suffer losses and gain a negative reputation.

D. Inventory

For a highly effective supply chain management system it is essential that an inventory is kept and thoroughly maintained. An inventory means the ready list of items, raw materials and other essentials required for the product or service.

E. Production

Production is one among the most important aspects of this system. It is only possible when all the other components of the supply chain are in tandem with each other. For the process of

production to start it is essential that proper planning and supply of goods, as well as the inventory, are well maintained.

F. Location

Any business, that wants to survive as well as flourish, needs a location which is profitable for the business. A business cannot survive if it has to share an already scarce raw material with the community.

G. Transportation

Transportation is vital in terms of carrying raw materials to the manufacturing unit and delivering the final product to the market.

F. Return of goods

Among the various components that create a strong supply chain is the facility for the return of faulty/malfunctioning goods, along with a highly responsive consumer grievance redress unit [12]. The eight components discussed here are interdependent and ensure a smooth supply chain management system. It ensures the success and reputation of a business. A business must focus on all these components in order to create a flawless supply chain.

A supply chain comprises many elements of several types, these elements and the interrelationships are substantial for the complexity that occurs in the system. Complexity is directly related to interdependence, variety that represents dynamical behavior of a system, and uncertainty in a supply chain that prevails due to the lack of knowledge about the whole system [2]. Therefore, supply chains face many challenges including complexity, uncertainty, cost, and vulnerable problems. Supply chains management should be smart enough in order to overcome these problems.

2. Smart Technologies

These following smart technologies have the potential to enable the users to improve the supply chain management.

1. Cloud computing
2. Big Data Analytics
3. Block Chain Technology (BCT)
4. Internet of Things (IOT)

3. Cloud computing in SCM

Cloud computing refers to the provision of IT infrastructure, operating software, middleware and applications hosted within a datacenter and accessed by the end user via the Internet. Cloud computing can be classified into; private, public, hybrid, and community cloud.

Public cloud - is allocated for open use by general public, it can be managed by multiple partners besides a company and it exists externally on the premises of the cloud provider. In

public cloud: the end user can get an inexpensive setup since a third party provider covers the application costs. [9]

Hybrid cloud - is combination of two or more different cloud infrastructuresIn a hybrid cloud, a company can employ its private cloud and it can be scaled out to a public cloud when local capacity is used up [11].

Community cloud - is assigned for organizations that share common matters, such as security requirements or regulatory compliance. It can be managed by one or more parties of the community [9].

Cloud Computing comprises three different models named as follows:

- Infrastructure as a Service (IaaS)
- Platform as a Service (PsaS)
- Software as a Service (SaaS)

(IaaS) model is a platform that can benefit equipment's in the form of servers, hardware, storage-space, at pay per use service. In this service model, a cloud provider offers from virtual or physical machines to load balancers, raw storage, networks and firewalls. Users do not control the basic cloud infrastructure but can control, storage, operating systems, and employed applications [9]. In (PaaS), cloud providers host a computing environment including, database, operating system, programming language, and execution environment where users develop and implement applications [11].

(SaaS) model is a software delivery model that provides on demand access to software applications. Users neither control cloud infrastructure including network, servers, operating systems, storage, nor individual application capabilities [9].

Cloud computing technology offers efficient solutions for companies. The amount of data of organizations increases rapidly. It is becoming more complicated to keep up to speed with smart solutions for companies that want to develop their business instead of spending in technologies.
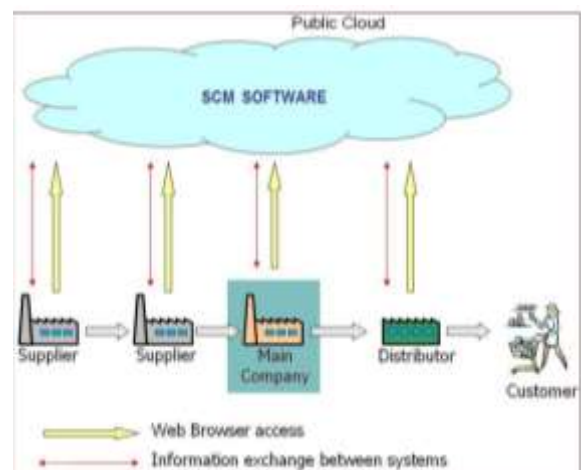

Figure 2: Cloud computing to integrate processes in the supply chain

Figure 2 shows a software for managing the supply chain installed "in the clouds", being this a public cloud. According to the concept of public cloud, the system would be offered as

a service through a specialist provider, which will have the responsibility for the system management and maintenance. This supplier does not need to be a business partner of the supply chain, but only a service provider. The supply chain members would hold access to the system simply through a web browser and will have the possibility to exchange the data from this software to their existing management systems.

4. Internet of Things (IoT)

Internet of Things (IoT) represents an advancement in technological innovation connecting objects and devices through Internet [1]. The network of objects (e.g. devices, vehicles, machines, containers), embedded with sensors and software has the potential to collect and communicate data over Internet [5]. In traditional supply chain management systems there exist several problems such as overstocking, delivery delays and stock out.

These problems returns to several factors such as complexity and uncertainty which exist in real supply chains. In order to overcome these drawbacks of supply chain management systems, IOT is applied in SCM systems in this research.
The internet of things [IOT] enables anytime, anywhere, anything and any media communications. The IOT can be applied in any aspect of lives as in Figure 3. The smart devices of IOT enables supply chain companies to reduce cost which results from acquisition process of knowledge [10].

[4] presents the contribution by generic ICT driven digitally enabled supply chain integration significantly associated with supply chain performance and in turn the performance of the retail firm. From organisational capability theory perspective, the adoption of IoT helps achieving organisational integration capability. Implementation of IoT helps organizations to enhance their capabilities to integrate the suppliers, customers and intra-organizational logistics processes.
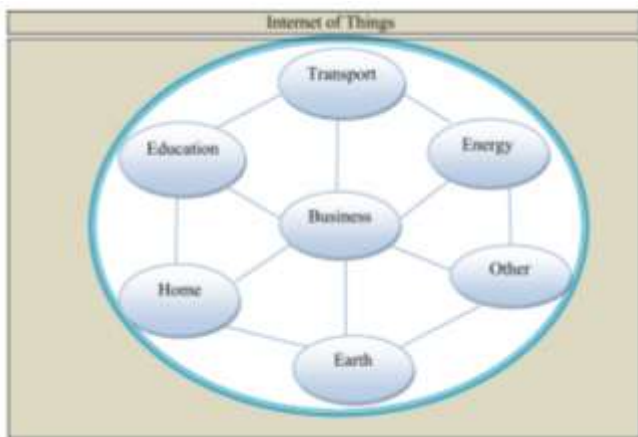

Figure 3. Internet of things applications fields.

5. Big Data Analytics

Big Data Analytics involves the use of advanced analytics techniques to extract valuable knowledge from vast amounts of data, facilitating data-driven decision-making. Big Data Analytics consists of three different levels of analytics. Each level of analytics has a different role and desired outcome. Big Data can be characterized by the five Vs that are defined as velocity, volume, veracity, variety, and value. Velocity describes the large amounts of data generated at an excessive speed. Volume refers to the vast amount of data generated every second. Veracity refers to the truthfulness or accuracy of the data. Variety means Big Data comes from a great variety of sources. Value implies the ability to turn the Big Data into business value [13]. The five components (Vs) of Big Data are shown in Figure 4.
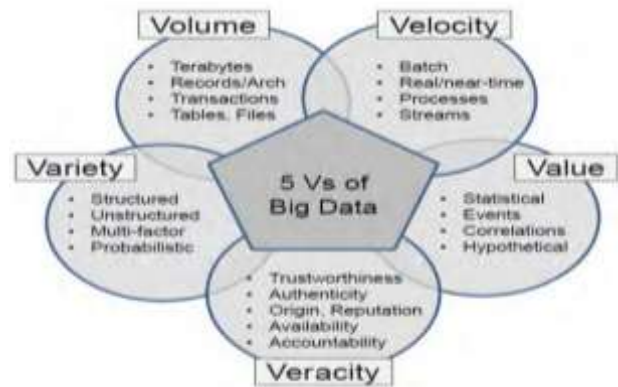

Figure 4. The 5 Vs of Big Data

Supply Chain is a significant contributor to Big Data wherein the diveirsity of information is large. Big data analytics is playing an instrumental role in improving supply chain mangement. It resolves several pain points at strategic, operational, and tactical levels. Big data is making an impact on all supply chain activities. It ranges from improving delivery times to identifying ways to reduce the communication gap between manufacturers and suppliers. Big data analytics reports enable decision-makers to achieve operaational effiency and monitor performance to improve productivity [14]. Big Data helps in solving problems in a diversity of business fields, but operations and sales are on the top [6].

6. Block Chain Technology (BCT)

Blockchain is an internet-based technology that is prized for its ability to publicly validate, record, and distribute transactions in immutable, encrypted ledgers. The technology was invented to support transactions in bitcoin, a digital cryptocurrency that operates independently from a central bank. In essence, blockchain technology provides the platform for creating and distributing the ledger, or record, of every bitcoin

transaction to thousands, if not millions, of computers linked to networks in all parts of the world.

Blockchain is one of the key innovative technologies revolutionizing digital supply chain management. As supply chains grow more complex in nature, involve diverse stakeholders, and mainly rely on a number of external intermediaries, blockchain emerged as a strong contender for de-tangling all the data exchanges happening within the supplychain exosystem. [14].

7. Conclusion

This paper presented smart technologies; Cloud Computing, Big Data Analytics, Internet of Things (IoT), and Blockchain on supply chain management from many papers. Smart technologies helps to obtain   valuable knowledge from enormous   amounts of data, facilitating data-driven and decision-making. And also, supply chain management improved by using these technologies to reduce cost productivity, transportation , data storage cost and service. The future research will develop smart supply chain model that combines integrates Cloud Computing, Big Data Analytics, Internet of Things (IoT), and Blockchain technology.

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