

Supply Chain Sustainability: Integration of the Modern Supply Chain

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Abstract—The world is changing in to a global village and the business strategies are changing dramatically with time. This has given rise to surging competition among companies resulting into formation of complex processes and systems. Thus competitive pressure has a great impact on supply chain and its sustainability. In this case study we have analyzed the major challenges of supply chain integration which is the calibration and coordination of a supply chain. The study suggests some key challenges such as lack of agility and supply chain visibility, inflexible capacity management, fleet, procurement and supplier management and the effect of bullwhip. The research methodology has been devised upon gaining expert opinions followed by questionnaire from industry experts and the students of the vary domain. Finally data analysis was conducted to evaluate the opinions and construct a viable solution for the cause of supply chain sustainability. The overall finding was that 77% of the responses collected to every answer had an agreement with the variables inefficiency leads an adverse effect on supply chain, suggesting that it's efficient management could lead to supply chain sustainability. The study has helped in hatching a solution in form of Platform as a Service (PaaS), for which the limitations and the new horizons are discussed in form of key recommendations. The final outcome suggested that PaaS can foster Supply Chain Sustainability.

Index Terms— Sustainability, Cloud computing, PaaS, Supply chain integration, Modern supply chain, Complex Processes

1. Introduction

Supply Chain complexity is a system of numerous parts which are interconnected; it is based upon structured system and is exposed to sensitive processes and increased competition around the globe. The organizations are working with greater collaboration and increased stakeholders; on the contrary it is creating hurdles for supply chain partners to develop a viable solution to stay as connected and integrated as possible

The new cloud computing technologies are enabling breakthrough innovations in supply chain management and integration. As a new innovation strategy in this new digital world and business community, cloud computing can have a dramatic impact on the supply chain integration model by enabling data and analytics like platform as a service. Cloud computing helps organizations realize major challenges and provide solutions of issues supply chain phases for sustainability. There are various problems pertaining to supply chain sustainability which may require attention and, a solution to it may hinder a lot of supply chain negativities and make supply chain more sustainable in the longer run.

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2. Problem Statement

The ongoing trend in the global supply chain is to maximize integration. Some of it is being attained through enhanced communication but there is still a need to further strengthen this phase. Enterprise Resource Planning platforms are already in place, however after deploying the problems start developing. First, they face the problems in training which eventually lead to improper knowledge and eventually loss in business.

There is a prevailing problem of sustainability and collaboration. Despite several efforts to deter the problems, this issue is still negatively affecting the supply chain. A possible cause of this could be improper management of this growing supply chain integration.

A study by Lee. Hau. L. Billington. Corey (1992)., *Managing Supply Chain Inventory*, suggests that most of the manufacturing enterprises are organized as networks but these networks require management and overall operational excellence. Another study by Douglas M. Lambert, Martha C. Cooper, Janus D. Pagh, (1998) *Supply Chain Management: Implementation Issues and Research Opportunities*, revealed that there lies a challenge to determine how to successfully implement supply chain management; hence there lies a room for improvement and an ample space for research. With increased competition and supply chain complexity there are growing variables affecting the supply chain sustainability, with such mass data revolving around the globe requires a solution to be devised for the supply chain sustainability. In the case presented we propose to examine the factors which lead an impact on supply chain sustainability. We have used qualitative approach to gather primary data.

3. Key Concepts

3.1 Lack of agility

The business of the 20th century characterizes shortage in product life cycles and an ongoing change and surged demand and supply uncertainty. These ongoing complexities have diverged companies to look towards supply chain agility which acts as a dominant force in creating a competitive advantage over their competitors. Absence of the vary key factory results in gaps between strategies, planning and execution.

3.2 Inflexible capacity management

The varying issues of the potential of a production, distribution, warehouse, or even transportation can cause real time effect on the supply chain sustainability. The complicated nature of connection in between these factors adds on to the complexity of the supply chain integration among partners. Incompetency at either of the node shall create a ripple effect in the entire supply chain.

3.3 Bullwhip Effect

In order to avoid the bullwhip effect it becomes the need of the hour for the organizations to assure maximum transmission of data and enhanced coordination but the lack of either would result in delays in order processing, shortage of inventory, order batching and others, hence a barrier to supply chain sustainability.

3.4 Inventory Management

Inventory solutions can help an organization attain customer satisfaction and improve the order point and minimize the inventory lead times. But on the contrary lead time, safety stock, process times are just a few problems under this domain. Most of the inventory problems come to surface just because of gaps in communication and unavailability of right data at the right time resulting in poor decision making.

3.5 Fleet Management

Human resource is one of the key assets of an organization, while tracking it has its own provocations. Therefore efficient handling of mass fleet requires quick data availability and proper utilization of that is needed. It is the core responsibility of the logistics department to ensure least cost possible hence an unproductive set of data must

be transformed into productive yet lucrative for the organization. But there is an upside down situation leading to supply chain instability.

3.6 Procurement

Problems relevant to procurement shall include accidental orders, damaged goods and over spending. This realm holds key position in an entire supply chain therefore attention to detailing must be ensured.

3.7 Supplier Management

With the globalization in place, need for a global supplier network is becoming common. But it requires reflexive decisions from the organization itself. There is also a pressure on manufacturers to produce high grade products, as number of returns are increasing day by day. Therefore managing all these complexities at a single platform without any error is creating challenges for supply chain sustainability.

3.8 Transparency of Global Supply Chain

With extended supply chains people are getting products made from around the world, this is generating greater interest in the authenticity of the products the customers are buying. It is becoming necessary to provide the tool which gives customers access to the information pertaining to the global supply chain. It is not only limited to the customers buy also the companies who are procuring various components from around the world needs to know how ethical and efficient their vendor is. This requires tracking technologies which can gauge the upstream and downstream relationships among key stakeholders.

3.9 Cloud Computing

It is defined as a means of storing and fetching of data and programs over the internet which are based upon high capacity servers rather than using the computer's hard drive or external data storage device.

3.10 Supply Chain Complexity

It is a system with a broad range of fluctuations. It may involve various counterparts of supply chain partners extending from vendors to third party logistics. The more the stakeholders involved the higher would be the supply chain complexity which needs organizational focus.

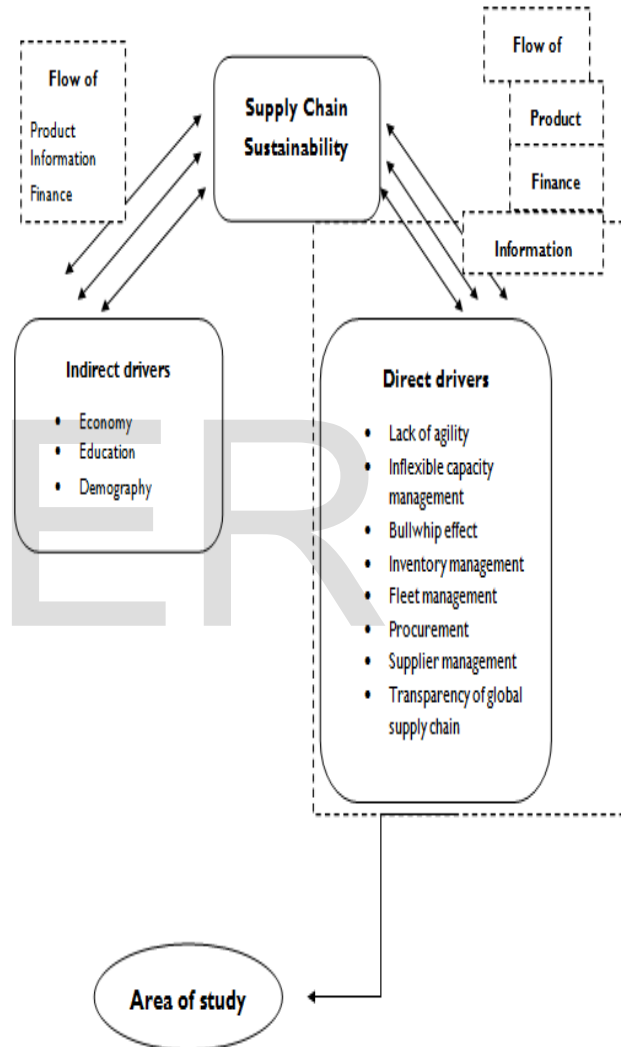
3.11 Up & Downstream Supply Chain

They are considered to be business terms which entail the company's position in a supply chain. The more nearer it is to the consumer; the firm would be downstream. Receiving raw materials or production is considered to be the upstream.

3.12 Supply Chain Sustainability

It is the perspective that goes towards the socially responsible supply chain. They help in the long term profitability of the organization.

4. Conceptual Framework



5. Research Design

The case study has used qualitative method of research under which testing was done work on a specific theory and model which could actually be applied in the real world. The research had key dilemmas which were unknown and required great attention. This form of study has helped in uncovering reasons and issues prevailing supply chain sustainability.

The data collection was made using 2 instruments

- 1- Questionnaire
- 2- Expert Opinion

The sample size selected was a small set of respondents as this genre required more from the field experts so for that reason interview was conducted with 10 industry experts who enlightened on the mentioned objective. Primary source of data collection was thoroughly practiced as preceding research data was merely unavailable in this realm.

The conceptual frame work is based upon the direct and indirect factors which may affect the supply chain sustainability. Since our topic of study was more towards direct drivers therefore that became the area of study. This framework suggests that the Supply Chain Sustainability being the dependant factor can be ensured if the independent variables are efficiently managed; Lack of agility, Inflexible capacity management, Bullwhip effect, Inventory management, Fleet management, Procurement, Supplier management and Transparency of global supply chain are all the independent factors under study.

6. Research Objective

The given design and background suggests that the research objective are to

- Identify key drivers of Supply Chain Sustainability
- Identify the underlying problems occurring due to supply chain instability
- Identify possible solutions to ensure Supply Chain Sustainability
- Devise various real time options to foster supply chain sustainability

7. Results

A research by Dr. Arthur Ahimbisibwe, Ronald Sebulime suggested that Supply chain agility is strengthen by supply chain alignment which is achieved by flexibility, alertness and decisiveness. This also has been found out by our finding where 60% of the people have agreed that Flexibility, Alertness and Decisiveness fosters supply chain sustainability while a few who held less than 2 years experience had slight agreement that is 32% of the total sample. On the contrary only a total of 8% were the candidates who were either neutral or did not agree with the statement that Flexibility, Alertness and Decisiveness foster supply chain sustainability.

A lot of the companies still do not have what has been called "insane data accessibility" by Google; which leads to limited level of agility. The findings suggest that more than half of the samples strongly agreed with the accessibility of data help in achieving supply chain sustainability while there were only 8% of the targeted samples who disagreed with the statement. Research suggests that agile ventures are investing heavily in this regard to help sustain their supply chain.

Another opinion by an expert, Amy Hill, claims to the fact that visible supply chain cuts the risk and improves speed to the market. Our findings are also agreeing the presented

fact that having a visible supply chain cuts the risk and improves speed to market, as 92% of the sample agreed with the stated fact. And the key aspect to enhance supply chain visibility is to provide the right opportunity and availability to precise data which includes content, events and transactions. Further ahead only 4% of the sample had slight disagreement with the statement that supply chain visibility is to provide controlled access and transparency, while 20% remained neutral due to the lack of exposure in this realm. The mere finding was that there was a massive agreement of 76%; hence deduced by the current findings and also an study by Amy Hill, the Chief Supply Chain Officer that supply chain visibility requires controlled access and transparency and if provided in a timely manner would help achieving the visibility.

Communication plays a pivotal role in the success of a supply chain visibility and efficiency, and as expected 92% of the sample agreed with the fact and it helps in identifying another opportunity for research upon the role of communication for supply chain efficiency.

The aspect of inflexible capacity management will impact lead time remained slightly vague as with the previous trend of strong agreement with the facts, the sample had slight agreement with the question that inflexible capacity management will impact lead time. This could be due to the unavailability of clear information or inappropriate question framework. A quarter remained neutral while 4% disagreed to the presented question. Therefore there still is a need for further research as to how inflexible capacity management can impact supply chain sustainability.

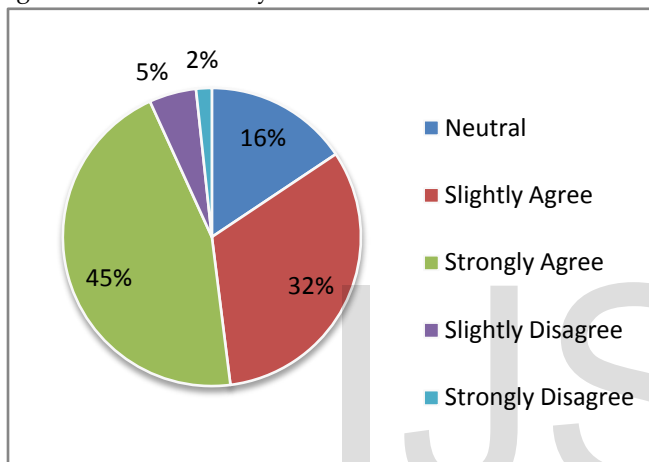
Bullwhip effect are the disruptions which are created in the supply chain, this however can be controlled by proper demand planning and inventory consumption. Our case has also agreed to a 72% of the sample leaning towards minimization of bullwhip effect. This is not only limited to inventory, but a research paper by Xun Wang & Stephen. M. Disney; The bullwhip effect: Progress, trends & direction, Vol 250, has laid emphasis upon the relationship of bullwhip effect with the lean production which is the reduction of wastage. This could also help in attaining supply chain sustainability in the environmental context.

Inventory accounts for more than 50% of the company's tied up cash; therefore efficiently managing this side of the supply chain would enable a sustainable supply chain. This inventory is either lying in the warehouse, in transit or even waiting for returns from the customer. A company an easily improve its financial performance if the cash tied up in inventory is cut loose, and this is well backed by our case finding, in which 52% of the people agreed to the mentioned statement. While 28% had slight agreement followed by only 12% of the people slightly disagreeing to

the fact that financial performance could be improved by reducing amount of inventory in a supply chain.

Fleet management serves as an important factor in determining the supply chain costs as it moves the entire transportation and the logistics cell of an organization. The key findings in this regard also remained to be 76% agreement to the factor that fleet management helps in controlling supply chain costs. Only a disagreement of 4% existed.

A mix response was generated to the regard that firms shall invest heavily in the fleet management system, on-board vehicle communication system and vehicle safety technology. 12% of the sample slightly disagreed, 28% had strong agreement with the same number for slight agreement followed by 32% of the neutral feedback. This



could mean that the organizations are still unaware of the available fleet management systems which could help in the supply chain sustainability.

A supplier plays a pivotal role in the context of the supply chain management; a delay from vendor could create a lasting impact on the entire supply chain. The overall finding also remained to be more than 90% agreement while 8% remained neutral. This suggests that the efficient management of the supplier relationship would help in creating a lucrative stance in the long run of supply chain sustainability.

Technology is shaping the new workplace and how the organization operates; customers are more information driven want to explore new technologies which can help them know the organization in a better manner. The output of this segment agreed that provenance data may be achieved by transparency a firm can create using new technology. It has grown to a noticeable level that consumers take interest in the origins and authenticity of the products and this could be achieved through availability of data publicly, which may foster supply chain sustainability. This was followed by another 65% of the sample, who revealed their interest in the origins of

sourcing and how it can shape their trust on the organization.

The empirical finding of the case was a 77% of the entire responses agreeing that the inefficient management of the variables would lead an adverse impact on the supply chain sustainability, if managed would create a balanced and sustainable supply chain. The study had a total of 7% of disagreement with the presented variables.

8. Recommendation

A sustainable supply chain is considered as a key factor nowadays, if an organization is looking to flourish. The findings remained that supply chain sustainability is dependent upon the variables like agility, transparency, availability of data, integration and others; therefore a viable solution in this regard requires attention. Our recommendation based upon the findings is leaned towards cloud computing, which is a growing market globally.

According to one research of global industry analytics, the global marketing of the cloud computing is going to reach US\$ 7.5 billion by 2020. Considering the growing trend of cloud computing and how Supply Chain Sustainability can be attained using the very concept we suggest Platform as a Service to help achieve the Supply Chain Sustainability.

The concept of PaaS (Platform as a Service) revolutionized the ways of business and navigates through complex IT challenges. PaaS does not replace any business infrastructure instead provides a new dimension to integration via a java development and other applications. For example Amazon web service and other PaaS providers support all the computing software's and make integration as easy as possible: user just need to log in and start the platform through web browser interface. Thus PaaS is seen by modern supply chain professional and researchers as the only tool to achieve end to end supply chain transformation. In the new era supply chain facing challenges like inefficient infrastructure, lack of agility, long lead times for application deployment, inventory management and many more.

The key platform service providers are Amazon, Apache, Microsoft and Google. The many forms include AWS Elastic Beanstalk, Windows Azure, Google App Engine, Apache Stratos and others. These PaaS provides direct connectivity among the key stakeholders of the supply chain. The inventory, procurement and fleet management could be done in a more precise manner and further

advancement will companies to track equipment as they move along the supply chain. This overall helps in achieving supply chain sustainability.

The objective of this paper is to plainly present how PaaS can be implemented by companies in supply chain management. Employing PaaS technology in supply chains can generate numerous advantages such as investment savings, simplification, as well as real-time visibility and transparency.

9. Conclusion & Limitations

Risks such as information security and lack of customization and as a result lack of competitive advantage should be taken into consideration. Another limitation that created hurdles in the research was the unavailability of the data and past research framework in this domain. But after all, the case study specifically showcases how platform as a service would be beneficial in supply chain.

Future research suggestions are also made comprising of how communication, fleet management and transparency of data can influence supply chain sustainability. In today's fiercely competitive and fast paced era of technology companies are looking forward for agile, savvy and customer focused supply chains. More or less every stakeholder is demanding extending from customer to the vendor. This sustainability could be achieved by deploying Platform as a Service which creates a win-win situation for every stakeholder involved.

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