

A New Introduction to Supply Chains and Supply Chain Management: Definitions and Theories Perspective

Assey Mbang Janvier-James

Glorious Sun School of Business and Management, Donghua University

Shanghai 200051, China

E-mail: asseyjanvier@hotmail.com

Received: August 23, 2011

Accepted: October 14, 2011

Published: January 1, 2012

doi:10.5539/ibr.v5n1p194

URL: <http://dx.doi.org/10.5539/ibr.v5n1p194>

Abstract

Supply Chain and Supply chain Management have played a significant role in corporate efficiency and have attracted the attention of numerous academicians over the last few years. Academic literature review discloses an important spurt in research in practice and theory of Supply Chain (SC) and Supply Chain Management (SCM). Connecting and informing on Supply Chain, Supply Chain Management and distribution Management characteristics have contributed to the Supply Chain integration. This integration has generated the approach of extended corporate and the supply chain is nowadays manifested as the cooperative supply chain across intercorporate borders to increase the value across of the whole supply chain.

This paper seeks to introduce supply Chain and Supply Chain Management. A Supply Chain and Supply Chain Management definition, theoretical, practical and measurement analysis are proposed. Several randomly selected refereed academic articles were methodically analyzed.

A number of key findings have arisen: the field is a comparatively new one; several researchers have different perception of the discipline; the consensus is lacking on the definition of the terms: the Supply Chain and Supply Chain Management are widely defined; contextual focus is mainly on the manufacturing industry; research methods employed are mostly theoretical conceptual; the findings also suggest that undertaking a theory view could make important contributions towards defining the scope of supply chains. The literature review in this research proposes critical lexicons that are mostly used in academic dissertation. These notions can be beneficial for academicians or organizations that are involved in Supply Chain Management business.

Keywords: Supply chain, Supply Chain Management, Supply chain management theories, Supply chain integration, performance, Efficiency measurements

1. Introduction

As a result of liberalization and the globalization of international trade, the production factors sourcing and consumer products from destinations across the world is enhancing the interdependence between producers and wholesalers on international Supply Chains. The effectiveness of those marine Supply Chains has also become crucial for favorable competition in the international markets that have arisen via the abolition of trade barrier (Fourie, Y., 2006). The distribution competitiveness in physical exchange with the rest of the world is now crucial for economic growth and development. This paper is aimed at presenting the development of Supply Chains and Supply Chain Management. It provides important definitions and theoretical analysis of both the Supply Chain and Supply Chain management.

2. Definition of Supply Chain and Supply Chain Management

2.1 Supply Chain

The development and functioning of Supply Chains have become important subjects for academicians with a resultant increase of definitions and phrases. Definitions that have been investigated for the intention of this thesis are as follows:

As reported by Beamon B. (1998), a Supply Chain is “a structured manufacturing process wherein raw materials are transformed into finished goods, then delivered to end customers”.

Tecc.com.au (2002) defines Supply Chain as “a chain starting with raw materials and finishing with the sale of the finished good”.

Bridgefield Group (2006) defines Supply Chain as “a connected set of resources and processes that starts with the raw materials sourcing and expands through the delivery of finished goods to the end consumer”.

Pienaar W. (2009b) defines Supply Chain as “a general description of the process integration involving organizations to transform raw materials into finished goods and to transport them to the end-user”.

The above definitions centralize on the core determinants of an effective Supply Chain. They connote the need for a provenance and a destination within which goods flow and accept the approach that overall Supply Chains start with resources (raw materials), combine a number of value adding activities and finish with the transfer of a finished goods to consumers.

The following definitions are more complicated. They include an extended view of a Supply Chain and integrate extra activities in the function of the Supply Chain.

Little, A. (1999) defines a Supply Chain as “the combined and coordinated flows of goods from origin to final destination, also the information flows that are linked with it”.

According to Chow, D. and Heaver, T. (1999), Supply Chain is the group of manufacturers, suppliers, distributors, retailers and transportation, information and other logistics management service providers that are engaged in providing goods to consumers. A Supply Chain comprises both the external and internal associates for the corporate.

Ayers, J. B. (2001) defines Supply Chain as life cycle processes involving physical goods, information, and financial flows whose objective is to satisfy end consumer requisites with goods and services from diverse, connected suppliers.

Mentzer, J., Witt, W. D., Keebler, J., Min, S., Nix, N., Smith, D. & Zacharia, Z. (2001) defines Supply Chain as a set of entities (eg. organizations or individuals) directly involved in the supply and distribution flows of goods, services, finances, and information from a source to a destination (customer).

The difference in approach between both definitions categories and the all-embracing descriptions combined in the latter render it very difficult to define a Supply Chain in practice if each of the definitions is to apply. Various systems of distribution organized to work through transport connections and nodes and recognized as Supply Chains in industry do not concede any of these definitions.

For the objective of this study, it is consented that the role Supply Chain is to add value to a product by transporting it from one location to another, throughout the good can be changed through processing.

2.2 Supply Chain Management

The connections and nodes in a Supply Chain achieve functions that contribute to the value of the goods transporting through the chain and thus its achievement. Any connection that does not carry out well reduces the overall effectiveness of the whole Supply Chain.

The notion of Supply Chain management as used in many research is usually linked with the globalization of producing and the penchant for manufacturers to source their inputs planetary, which necessitates management of profitable ways of regulating worldwide flows of inputs or outputs. The principal focus of market competition in such situations is not only between goods, but between the Supply Chains delivering the goods. As competition in international markets is progressively dependent upon the of arrival time of goods as well as their quality, coordination between suppliers and distributors has become an important characteristic of the Supply Chain. As the customer satisfaction is a crucial benchmark of the success of the Supply Chain, effective management of the linking processes is crucial (Trkman, P., Stemberger, M. and Jaklic, J., 2005). Additionally, market uncertainty necessitates Supply Chains to be easily flexible to changes in the situation of trade. Such flexibility in supply requires effective Supply Chain Management.

Supply Chain management is aimed at examining and managing Supply Chain networks. The rationale for this concept is the opportunity (alternative) for cost savings and better customer service. An important objective is to improve a corporate's competitiveness in the global marketplace in spite of hard competitive forces and promptly changing customer needs (Langley, C., Coyle, J., Gibson, B., Novack, R. and Bardi, E., 2008).

Numerous Supply Chain management definitions *have been presented in the academic literature*.

“Alberta efuture centre” asserts that Supply Chain Management (SCM) is the act of optimizing activities across the Supply Chain. Ayers, JB. (2001) reported that Supply Chain management is the maintenance ,planning, and Supply Chain processes activity for the satisfaction of consumers needs.

Ganeshan, R, and Harrison Terry P., (1995) has defined Supply Chain Management(SCM) as a chain of facilities and distribution alternatives that performs the functions of obtainment of products, transformation of these products into intermediate and finished goods, and the distribution of these finished goods to customers. Lee Hau L., and Corey Billington (1995) declare that Supply Chain Management (SCM) incorporates the integration of activities taking place among facilities network that acquire raw material, transform them into intermediate products and then final goods, and deliver goods to customers through a system of distribution. According to Christopher M. (1998) supply chain refers to the organizations network that are involved in the diverse processes and activities that generate value in the form of goods and services in the hands of the end customer. Supply Chain Management (SCM) is the “strategic and efficient coordination of the conventional business functions and the strategies across these business functions within a specific corporate and across businesses within a supply chain, for the aims of developing the long-term performance of the corporate and the supply chain as an entire.

According to Grant, D., Lambert, D., Stock, J. and Ellram, L. (2006), Supply Chain management refers to corporate business processes integration from end users through suppliers that provides information ,goods, and services that add value for customers.

The Supply Chain management (SCM) is defined by the Supply Chain Forum (SCF) as the integration of key business processes from end user through suppliers that provide goods, services and information that add value for customers.

The Supply Chain Management Professionals’ Council (2009) asserts that Supply Chain management (SCM) includes the designing and management of all activities involved in sourcing and purchasing, transformation, and all logistics management activities. Principally, it also includes coordination and partnership with network partners, which can be suppliers, mediators, third party service providers and customers. Fundamentally, Supply Chain management (SCM) coordinates supply and demand management within and across corporate

Even though all the definitions given above are satisfactory, most do not emphasize the importance of effectiveness in Supply Chain management (SCM). Thus for the aim of this paper, the following definitions were used as the foundation for developing the model for assessing Supply Chain effectiveness.

Little (1999) declares that Supply Chain management (SCM) aims at increasing value contribution to the customer while concurrently optimizing functional costs of the Supply Chain.Computerworld (2001) defines Supply Chain management (SCM) as the management that allows an organization to get the right products and services to the location they required on time, in the suitable quantity and at a satisfactory cost. Effectively managing this process involves supervising connections with customers, suppliers and controlling inventory, forecasting demand and getting regular feedback on what is occurring at every connection in the chain.

Kitsolutions (2003) defines Supply Chain management (SCM) as providing the right goods or services, to the right location, in the right quantity, at the right time and at the right cost.

According to Simchi-Levi, D., Kaminsky, P. & Simchi-Levi, E. (2003),Supply Chain management(SCM)refers to “a set of methods used to effectively coordinate suppliers, producers, depots, and stores, so that commodity is produced and distributed at the correct quantities, to the correct locations, and at the correct time, in order to reduce system costs while satisfying service level requirements. The fundamental notion of these definitions is that a Supply Chain must be controlled in order to be fast and trustworthy, cost-effective, and flexible enough to meet customers’ requirements.

Insert Figure 1 Here

Dependability/reliability is generally more crucial than speed in the Supply Chain and it is, then important to temperate global “velocity” with the need for dependability

Although, there are particular situations when “speed” is important in a Supply Chain and the “speed” pertinence can therefore not be disregarded. Speed is crucial in a Supply Chain under the following situations, when: the products are: spoilable, subject to rapid extinction, needed on short notice, valuable in connection to its mass, very expensive to manage. The demand for products is: changeable, occurs intermittently, better than the limited supply for short periods of time, cyclical. The following problems occur during distribution: risk of stealing, physical damage, high rates of interest for long transportation times, special care of the products is required while in transportation.

Cost is consistently crucial, while consumer satisfaction is important to continued business. Thus in building the model for assessing Supply Chain effectiveness, the factors used to establish the effectiveness of a Supply Chain are then speed, dependability/ reliability, cost and consumer satisfaction. If speed is not crucial to the Supply Chain under examination, it can clearly be count of the estimation.

Together with the product surging down the Supply Chain, information surges in both sides along the Supply Chain. For Supply Chains to function correctly, it is crucial that information surges smoothly along the Supply Chain and that the diverse corporates are ready to share information with one another

3. Supply Chain and Supply Chain Management Theories

3.1 General Supply Chain Model

The objective of developing the General Supply Chain Model (Caddy and H.1999) is to provide a complete understanding of supply chains, in terms of both their management and their operation. A literature review of supply chain and supply chain management frameworks and models disclose that there is not an already accepted general and extensive supply chain model (Caddy and H., 1999.). Supply chain models seem to focus on only one specific aspect of the supply chain: organization strategy, information technology and individual factors. While each of these aspects is considered important in its own right, each factor independently does not provide a comprehensive view of supply chains management. Combining the above cited aspects result in the development of a general supply chain model, in which each of the aspect provides a disconnected as well as connected combined contribution. The general models represented below integrate into the model the interplay among the three aspects. Diverse effects are generated given the characteristic and level of interplay. Furthermore, the characteristic and level of interplay would be uncertain on organizational culture, the condition in which the organization operates and the features of the supply chains used in the exchanges that happen among organizations.

Insert Figure 2 Here

3.2 Supply Chains and General Systems Theory

An assessment of an important number of existing and representative models of supply chain management shows that a developed stage of development of a supply chain model has not been achieved as yet. There is a convergence to a commonly accepted normative model of supply chains and management (Caddy and H.1999). Essentially, it is considered suitable that another strategy be adopted to use the principles and theories of general theory to make sure whether a more fundamental supply chain framework can be created. Moreover, the problem here is whether the use of general theory to this field would provide supplementary awareness in terms of the efficient management of supply chains. Ludwig von Bertalanffy (1969) developed approach about systems.

Systems with equivalent factors could still be distinct for the reason that a different adjustment of their factors often generating different interplay between the factors. In most cases natural world all the systems were open systems. A crucial general systems concept that have arisen from Ludwig von Bertalanffy(1969). Research is the theory of determinable boundary that divides a system from its environment.

Yourdon E. (1989) declared that in order for a system to be recognized a living system, it should include the following sub-systems: The duplicator; the boundary; the ingestor ; the distributor; the producer ;the matter-energy storage sub-system various sorts of matter-energy; the extruder ; the motor ;the supporter ; the input transducer ;the internal transducer ; the channel ;the decoder ; the associator ; the decider ; the encoder ; the output translator .

Yourdon E. (1989) adapted the Miller, J.G. (1978)'s work to the information systems field. In the process, Yourdon E. (1989) improved this discipline in terms of a higher order of appreciation of what the concept "information system" signifies. It would be a fascinating exercise to re-adapt Yourdon E. (1989)'s research on supply chains to determine if these sub-systems really exist and to assess the level of the contribution that each sub-system makes to the favorable development and management of a supply chain. In the case of the duplicator sub-system, even though the supply chain is an artificial construct, as such it does not reduplicate itself, supply chain lifetime are not inevitably ambiguous. As such, the following interrogations come to mind: What processes do corporates utilize to invigorate supply chains? What are the indexes that give information about supply chain obsolescence? The General Supply Chain Model indicates that supply chains change with time. With the actual condition of new information technology, nowadays supply chains are performed distinctively to the way they were performed some time ago. Furthermore, the nature of the connections among organizations within the supply chain would also be expected to improve over time.

Yourdon E. (1989) also debated the use of the following general systems theory principles to the discipline of information systems:

First principle: The more complex a system is the less compatible it is to changing environments.

Second principle: The larger the system, the more resources are necessitated to support that system.

Third principle: Systems generally include other systems, and are in themselves factors of larger systems.

Fourth principle: Systems develop, with apparent implications for the second principle.

It is recognized that these principles have application to the discipline of supply chain and supply chain management

3.3 Others Theory and Practice of Supply Chain Management

Many articles in connection with the theory and practice of Supply Chain Management (SCM) have been reported over the period of last 20 years, but the subject matter is still under important improvement and discussion. Richard Lamming (1996) has given a review on “lean supply chain” in which “Lean supply chain” has been defined as “beyond collaboration”. “Lean supply” is the system of procurement and supply chain management required to build lean production. Ben-Daya M., Hariga M. and Khurshed S. N. (2008) investigated the subject in specific context, i.e. the Industrial District (ID) that constitutes a specific production model where complex Supply Chain Networks (SCN) can be analyzed. Supply Chain collaboration may take on many forms in industrial districts (ID) and may produce many benefits.

Vaart and Pieter (2003) has pointed out the importance for an inter-disciplinary approach, integrating the relational and technical aspects from the corresponding fields of system dynamics and partnership in order to deliver better order replenishment performance. Gunasekaran and Ngai (2005) demonstrated that E-Business, product, and service-quality have an important direct impact on customer behavioral intentions to buy again. Balakrishnan and Cheng (2005) updated the approach based on software that provided solutions in complicated environments with several products and obstacle situations. Nagarajan and Sobic (2004) reviewed literature in connection with buyer-vendor organization models that have used quantity concession as organization mechanism under settled environment and categorized the diverse models.

Based on this approach of Supply Chain Management (SCM), the current literature was investigated, in order to identify the extent to which these fundamental elements were present in Supply Chain Management (SCM) academic research to date. A review of prior studies provides the foundation for how this review extends our appreciation of Supply Chain Management (SCM) research.

Burgess K., O. J. Singh and R. Koroglu (2006) reviewed 100 essays from 614 available articles found in the ABI/Inform Database across (1985 to 2003). Their sample addressed manufacturing and consumer products businesses, and the research articles reviewed by them addressed a more closely defined operations management approach to Supply Chain Management. They classified the essays into four categories: Descriptive features of Supply Chain Management, Definition issues, Theoretical concerns and Research technical issues. They found Supply Chain Management to be an approximately new field with growth in interest from analyst in the recent past. The significance of this research in opposite to Burgess K., O. J. Singh and R. Koroglu (2006) is that instead of sampling 100 essays from a pool of 614 over a 5 year period, I investigated 588 essays over 18 years. This provides a larger foundation from which to map out the evolution of the Supply Chain Management (SCM) field. It also helps to measures gaps in the literature, thereby underlining the importance and strength of this study.

Carter and Ellram (2003) examined the essays published in the Journal of Supply Chain Management for the period of 1965 to 1999. Their purpose was to offer a greater appreciation of the development of procurement and supply research over the first 35 years of the existence of the Journal of Supply Chain, and to provide counseling and recommendations for future supply management research. They demonstrated that nearly 90% of the journal essays under study consisted of literature, methodology, and exploratory studies. They further found that the use of hypothesis testing had increased significantly over the period of 1989-1999, yet they think that a greater use of hypothesis testing and the analytic method is advised as the Supply Chain Management discipline continued to develop. Carter and Ellram (2003) further advised more literature reviews leading to the introduction of analytical frameworks of supply management, and the use of complex research modeling methods.

They categorized the articles based on a adjustment of the classifications used by ISM, and proposed 32 classifications for clear classification, which has proved to be a achieved and has been used in prior literature reviews by many authors. The authors conclude that procurement and supply management are developing. It is important to note that the authors have regularly used the terms “procurement” and “supply” management, which talks a lot about the stage of development of the Supply Chain Management discipline.

Croom S., Romano P, and Giannakis M. (2000) has examined 84 studies on Supply Chain Management (SCM) in terms of level of analysis and research approaches, but the time period for their data collection is not clear. Their research represents an attempt to classify the Supply Chain Management (SCM) literature.

Important improvement has taken place both in the theory and practice of Supply chain Management since this attempt, making it important for reviews of current literature. Finally they depicted and classified the research techniques into two dimensions: empirical and theoretical do not provide the number of essays linked with each level of study.

Rungtusanatham M. J., Choi T. Y., D. G. Hollingworth, Z. Wu and C. Forza. (2003) achieved a review of 285 Supply Chain Management (SCM) articles published in six operations management journals during a period of 21 years (1980-2000). They reported the development of considerable changes in the last 5 years of their sample period, and those two subjects stood out as indicating fastest domination to eminence operations strategy and supply chain management.

They found that the Supply Chain Management (SCM) related essays increased considerably after 1990s, thereby indicating the increased interest of researchers in this discipline and speeding up development of this discipline. It indicates that Supply Chain Management (SCM) is a developing field, and offers many opportunities in research. Giunipero, Larry C., Hooker, Robert E.; Joseph-Matthews, Sacha; Yoon, Tom E.; Brudvig, Susan (2008) in a last ten years literature review of Supply Chain Management (SCM) reported that the literature is still very burst and even though many studies claim to debate supply chain issues, most of the current research only investigates one connection of the chain, or more mainly only focuses on one factor in the supply chain performance mix. They indicated that the Supply Chain Management (SCM) literature reviewed by them disclosed many gaps identified by them as: One-tier examination; Small sample sizes; Lack of longitudinal studies; Limited methodological analysis; and Limited global supply chain analysis.

In perspective of this discussion, the researchers deduced that a broader perspective of Supply Chain Management (SCM) is required in order to develop a wider unanimity and resolve the current conceptual and research approach confusion. In opposite to single journal review, or confined random review, this study surveys 30 academic journals and reviews 588 research published from 1991 to 2008, thereby covering the whole period of Supply Chain Management (SCM) evolution to its development as a strong field.

In summary, this study expands the prior literature reviews by:

- Focusing on diverse aspect Supply Chain Management work in academic journals.
- Reviewing the current 20 years period during which Supply Chain Management grew as an academic research and discipline in this field gained importance and enhanced significantly.
- Providing an examination of the research techniques, using an established subject classification scheme and reviewing academic publication and providing awareness in to the research methods and data analysis method used in academic literature.

4. Supply Chain Integration, Pull and Push Systems, Efficiency, Effectiveness, Productivity and Performance

4.1 Supply Chain Integration

Supply Chain integration considerably increases the capability of managers to define the proneness in the chain in order to impact improvements. However, without a trustworthy method to help managers in detecting obstacles along the Supply Chain, it becomes more complicated for managers to acquire the knowledge they want for benefiting fully from Supply Chain integration. It is with this objective clairvoyance that the model developed is at first designed.

Integrating the connections of the Supply Chain into a complete functioning system conceivably improves the flow of goods and information in the organization. That generates a more effective Supply Chain. Thus, regardless of whether a Supply Chain includes links operated by many service providers or it is under the control of a unique management connection, integration is favorable for the increase of effectiveness.

The objective of Supply Chain integration is to accommodate functions across the Supply Chain in consideration of improving performance.

There are mainly two types of integration, i.e. horizontal and vertical integration. Horizontal integration refers to the incorporation into a single corporate of several corporates involved in the similar level of production and sharing resources at that level, while vertical integration refers to the incorporation into a single corporate of several corporates involved in all aspects of a good's production from raw materials to distribution (Answers.com, 2006b).

The consent of specialists is that vertical Supply Chains integration can generate greater efficiency (Stonebraker and Liao, 2006) if it decreases an inadequately long Supply Chain in connection with insourcing and outsourcing decisions.

According to Panayides P. (2006) integration can provide agility along the Supply Chain.

According to the Agility Forum, agility refers to capacity of an organization to develop in a gradually changing, changeable business environment (Agility Forum, 1994). This definition shows that agility along a Supply Chain (SC) generates greater flexibility and greater levels of customer satisfaction.

Even though many academicians have emphasis the importance of Supply Chain integration, but the method to effectively assess integration is lacking in the literature. There is also a need for further examination into the extent to which organizations can and have been integrated along Supply Chains and the efficiency implications (Panayides P., 2006).

4.2 Push, Pull and Push-pull Systems

Push-based Supply Chain makes manufacture and distribution choices according to long-term predictions based on orders. Push-based Supply Chain has a long react time which can generate the inability to meet changing demand patterns and the product extinction or overdone inventories. (Simchi-Levi, D., Kaminsky, P. and Simchi-Levi, E., 2008).

In a *pull-based Supply Chain (SC)* manufacture and distribution are accommodated with valid customer demand. Effective information flow about customer demand minimizes inventories. Pull system allows lead time diminution due to better anticipation and diminishing in variability (Simchi-Levi, D., Kaminsky, P. and Simchi-Levi, E. 2008)

Thus, pull system minimizes inventories, improve the ability to manage resources, and reduces system costs compared to similar push system. On the other side, pull system is complicated to implement when lead times are long making reaction to demand information impracticable. In pull-based system it is commonly more complicated to take economic benefit in manufacturing and transportation since they are not designed far ahead in time. (Simchi-Levi, D., Kaminsky, P. and Simchi-Levi, E., 2008).

According to Simchi-Levi, D., Kaminsky, P. and Simchi-Levi, E.,(2008), *Push-pull-based Supply Chain* (strategies take benefits of both push and pull systems). The boundary between pull-based levels and push-based levels is known as “*push-pull boundary*”.

Insert Figure 3 Here

4.3 Effectiveness, Efficiency, Productivity and Performance

The expressions effectiveness, efficiency, productivity and performance are generally used correspondently in academic literature. But, their significations are different. In consideration of differentiate between the expressions and use them accurately, definitions found in academic literature are first examined. The definition used as an assumption for the consecutive research is then given for each expression.

Of the four expressions, the two that are mostly confounded are efficiency and effectiveness. Talley, W. (1994) emphasizes the functional goals of public transit corporates and states that these goals have been categorized either efficiency or effectiveness goals. He persists by providing definitions for both of these expressions. Effectiveness refers to how well the transit corporate provides service to the consumer, while efficiency refers to how well the transit corporate utilizes its accessible resources.

Chow, Heaver and Henriksson (1994) develop these definitions by adjoining their own definitions of the expressions efficiency and effectiveness. According to them, effectiveness refers to the extent to which a goal has been accomplished and efficiency refers to the degree to which resources have been used concisely. In other words, efficiency is “doing things correctly” and effectiveness is “doing the correct things” (Chow, D., Heaver, T. and Henriksson, L.1994).

As reported by Schenk R. (2007), value is the basis for economic efficiency. Efficient change is the change that enhances value and an inefficient change is the change that decreases value. A circumstance that is efficient may be ineffective when examined on different criterion. Schenk persists by asserting that efficiency is never perfect; it is always relative to some criteria.

The expression “effectiveness” will be used to depict the extent to which an aim is accomplished, while the expression “efficiency” will be used to depict the resource economy utilization in achieving goals when examined on particular identified criteria.

The significations of the expressions productivity and efficiency are also generally confounded with each other.

According to Bridgefield Group (2006) productivity refers to overall measurement founded on an output quantity generated by a given quantity of input. CPE Globalization Briefs declare that productivity is generally formulated as a ratio of outputs over inputs. Increased output as an effect of the similar amount of input indicates more efficient use of a given set of resources because of process improvements or other accomplishment.

In this study, productivity is considered as a measurement of efficiency.

The United States Agency for International Development (2009) defines “performance” as the current output and quality of work made. Even though this definition is considerably similar to that used for efficiency, it is crucial to

note the key differences. Performance assesses output, while efficiency assesses the method in which output is carried out. Performance measurement refers to the process of evaluating action, where measurement is the process of assessment and action leads to performance (Neely, A., Gregory, M. and Platts, M., 1995). Logistics performance measures are key indicators of the work carried out and the results achieved in an organizational unit (Forbes.com, 2006).

With the development of globalization many nations started to trade without restriction. Nations realized that they are more fortunate if they specialize in certain products and trade their surplus production for the other products they need. Through specialization corporate become more creative and the globe's limited economic resources are used more efficiently. Resources are scarce and therefore attention must be paid to use them efficiently. Because efficiency assesses the economy of resource utilization in achieving objectives when examined on particular identified criteria, it was decided that Supply Chain will be evaluated in terms of efficiency.

4.4 Supply Chain Efficiency

A Supply Chain efficient management has been gradually recognized as a key factor in characterizing good and service offerings and acquiring competitive advantage for corporates (Christopher, 1998).

It requires close integration of internal operational within corporate and efficient relationships with the external functions of members in the Supply Chain (Lee, 2000). It is also crucial that Supply Chains do not remain static, but rather develop continually based on the changing market and customer requirements (Little, 1999).

It is crucial to define Supply Chain efficiency in consideration of understanding what the model developed measurements. By associating the definitions for a Supply Chain and efficiency, the derivable definition of Supply Chain efficiency is the regulation on resource use founded on particular criteria while goods are moved from one location to another, in the path of which movement the goods may be changed through processing.

Performance of the whole Supply Chain is an essential factor in achieving an effective Supply Chain. It is therefore crucial to use the linked resources of the Supply Chain members in the most efficient technique possible to provide competitive and cost-effective goods and services. Wong, W., & Wong, K. (2007). defined Supply Chain as the efficiency which includes diverse performance measurements related to the Supply Chain members, also the coordination and integration of the performances of those associates.

The importance to develop efficiency in a Supply Chain has generated the development of approaches and techniques to assess Supply Chain efficiency. These approaches can be used to assess the levels of performance along Supply Chains and help their supervisors to identify deficiencies in order to improve the functioning of the Supply Chains.

Although there is a diversity of criterion that can be used to assess the Supply Chain efficiency, for the aim of this study the main criterion used are speed, reliability, and cost and customer satisfaction. While, speed, reliability, cost and customer satisfaction on their own are only measurements of effectiveness, when analyzed in terms of the impact they have on resource utilization in a Supply Chain they can be used to assess efficiency. For instance, if the reliability, speed, and other features of a connection in a Supply Chain satisfy the needs of its consumers at the lowest cost, that connection can be considered as efficient. The lowest cost would render the connection efficient for society. If only the lowest budgeting cost to the entire service provider is included, the connection would be efficient.

Economic efficiency refers to the situation where the trade-off between speed, reliability, and cost is also achieved perfectly and where no factor can lead to further development without influencing negatively on another factor.

There is a direct connection between cost and speed and cost and reliability. Accordingly, as reliability and speed increase, costs will generally augment and with a decrease in costs, reliability and speed will generally decrease. This signifies that a corporate has to make a compromise between the various criterions for Supply Chain efficiency. If these three components are seen in combination, then Supply Chain efficiency is achieved, if customer satisfaction is increased with the optimum combinations of reliability, speed, and costs. While, for instance, speed may increase in the Supply Chain, if the marginal costs required by the speed augment are in exuberance of the marginal consumer satisfaction achieved then the Supply Chain is not effective at the maximum speed.

5. Current Supply Chain Performance and Efficiency Measurements

5.1 Current Supply Chain Performance Measures

In the creation of a model to evaluate the Supply Chain efficiency, it is important to build the model accurately. Every model stage should be accurately built and each of model's function must be exhaustively examined to make sure that it achieves what it planned to do.

There is a distinction between a performance measurement and an efficiency measurement (performance assesses output, while efficiency assesses the method in which output is achieved). But, performance measures can be utilized in conjunction with efficiency measures to assess the Supply Chain efficiency.

According to Abu-Suleiman, Boardman and Priest (2004), performance measurements provide a basis to assess alternatives and identify decision criterion

The general information collected through performance measurements can be used to help the corporate in making correct decisions and aid to ensure that the corporate continues to expand its market position.

Abu-Suleiman, Boardman and Priest, (2004) reported that feedback is a fundamental part of any process. An efficient Supply Chain performance measurement system enables suitable controlling of business processes.

The feedback received is utilized to analyze current progress to projected or budgeted values, simplify benchmarking against manufacturing best practices, and to identify weak performance and improvement alternatives.

Finally, the performance measurement must direct employees towards higher productivity by stimulating and recompensing them for good performance (Kussing U., 2009). The performance measurement has to galvanize employees to strive towards greatness and in doing so determine weak parts in the Supply Chain.

The aims of a performance system are as follows (Rolstadas, 1995):

- It must support the decision-making process, by showing where to operate, how to operate, and by controlling the impact of implemented action plans.
- The system must control the impact of strategic plans, so that amendments can be made to guarantee the accomplishment of long-term goals.
- Performance measurement is necessary for internal objectives and for satisfying requirements from diverse external stakeholders.
- The system must have analytic properties, so that alarm can be given in advance of declining business performance.
- Performance measurement is a constituent of a constant improvement process.
- Measurement of improvement has a stimulative impact on the labor force of a business and is important to substantiate further effort in any amelioration process.
- The evaluation of performance is important for comparison and for identifying performance apertures
- Records must be kept of all corporate activities, and then they can be provided on request to suppliers and customers. A record of supplier performance can be used to provide input to their amelioration processes.

The above list of objectives should be considered during the development of a performance measurement system (Rolstadas, 1995).

5.2 Current Supply Chain Efficiency Measurements

Every components of the Supply Chain communicate to meet the needs of the sellers and the buyers of the goods transiting through the chain. Those components are interconnected and have a cause-and-effect link with one another. Thus for all component to achieve its maximum value and simultaneously contribute to the increase of the value of co-components in the Supply Chain there should be a high level of integration between the components (Qukula T., 2000). A poor connection in the Supply Chain has a negative impact on the performance of all the components over the Supply Chain. Accordingly the efficiency of each individual component must be measured in order to evaluation the efficiency of the whole Supply Chain. However, in order to augment the level of efficiency in the Supply Chain, it is crucial to be able to assess that level over all the connections. Spekman, R., Salmond, and D., Kamauff, J. (1994) assert that this presents a challenge for assessment (as the efficiency of Supply Chain cannot be assessed by evaluating single transactions, but only through the measurement of the efficiency of the transactions conjointly along the whole Supply Chain). Therefore, when conceiving a model for assessing Supply Chain efficiency, it is crucial to choose one that includes all appropriate transactions.

Little (1999) emphasizes another barrier to assessing Supply Chain efficiency; particularly, that the measurement of efficiency are not always used in a equitable way to reveal efficiency. Commonly, one measurement is over-stressed leading to erroneous overall measurement of the Supply Chain efficiency. Little (1999) continues by arguing that the risk of this increases when no unique body supervises the whole Supply Chain. Thus, when assessing the Supply

Chain, the technique conceived must assess each connection in terms of the exact proportionality of importance to the efficiency of the Supply Chain.

According to Kotler, P. (1984), from a marketing view, corporates achieve their objectives by satisfying their customers with considerable effectiveness and efficiency than their competitors. Accordingly corporates can benefit from assessing the level of effectiveness and efficiency throughout their whole Supply Chains.

Corporates deal in various products and Supply Chains exist for every product. Little (1999) denoted that Supply Chains in various sectors of industry have distinct features that vary within those sectors. Thus, Supply Chain design should acutely be accommodated both to the particular manufacturing and to the individual situations of each corporate (Little, 1999). It is also crucial that each service provider in a Supply Chain should use identical method for assessing efficiency in consideration of providing significant analyzing of the efficiency of the connections. Accordingly, when choosing a model for assessing Supply Chain efficiency, it is crucial that corporates choose a model that can be used throughout all the connections of the Supply Chain.

Another concern when assessing Supply Chain efficiency is the method for the development of the Supply Chain. Supply Chains that functions well for network throughput might become weak if responsiveness, flexibility, and measurability have not been planned into the system (Barloworld Logistics, 2005). Thus it is crucial to plan Supply Chains.

According to Potter, Mason, & Lalwani. (2002), the measurement used to determine efficiency must also be explicit in the nature of the information they examine. Generally quantitative measurement is the only ones used.

According to Lambert, D., & Pohlen, T. (2001). The absence of a broadly accepted definition for Supply Chain management and the complication related to overlapping Supply Chains make Supply Chain efficiency assessment complicated. Furthermore, the absence of Supply Chain orientation, the complication of capturing assessment across diverse connections, the indisposition to share information among corporates, and the incapacity to capture performance by product, customer, and Supply Chain make precise Supply Chain efficiency assessment more complicated. Another important contributor to the lack of significant Supply Chain efficiency measures is the inexistence of a technique for developing such measurements.

6. Summary and Conclusion

Supply Chains are a critical part of world trade. However, a Supply Chain in itself is insufficient. Only those that are efficient will succeed. In consideration of a Supply Chain to be efficient, it is crucial to understand its principal functions as well as the role played by each function in the Supply Chain's overall efficiency. Accomplishing this makes it facile to identify obstacles and impact the essential improvements.

The literature review in this study presents important jargons and theoretical approaches that are generally used in academic dissertation. In consideration of clarifying the research each expression is defined in the context where it is used throughout the article. The criterions on which the Supply Chain efficiency assessment is based are identified and crucial factors that must be considered when building an efficiency measurement are emphasized.

References

- Abu-Suleiman, A., Boardman, B., & Priest, J. (2004). A framework for an integrated Supply Chain Performance Management System. *Industrial Engineering Research Conference*. Houston:TX. Refereed Research Article and Presentation.
- Agility Forum. (1994). International symposium on fresh produce supply chain management. [Online] Available: <http://www.fao.org/AG/ags/subjects/en/agmarket/chiangmai/abstracts.pdf> (March 21, 2011).
- Answers.com (2006). Horizontal integration. [Online] Available: [http://www.answers.com/main/ntquery.jsessionid=4q9dhzg4cmr8?name=horizontal integration & curtab=2222_1 & sbid=lc06a](http://www.answers.com/main/ntquery.jsessionid=4q9dhzg4cmr8?name=horizontal+integration+&curtab=2222_1&sbid=lc06a) (June 13, 2011).
- Ayers, J. B. (2001). *Handbook of Supply Chain Management*. Boca Raton, Fla.: The St. Lucie Press/APICS Series on Resource Management.
- Balakrishnan J., & Cheng, C. H. (2005). The theory of constraints and the make-or-buy decision: an update and review. *The Journal of Supply Chain Management*, 41(1), 40-47. <http://dx.doi.org/10.1111/j.1745-493X.2005.tb00183.x>
- Barloworld Logistic. (2005). *Supply chain foresight 2005*.
- Beamon, B. (1998). Supply Chain design and analysis: Models and methods. [Online] Available: <http://www.damas.ift.ulaval.ca/~moyaux/coupfouet/beamon98.pdf> (July 21, 2011).

- Ben-Daya M., Hariga M., & Khurshed S. N. (2008). Economic production quantity model with a shifting production rate. *International Transactions in Operational Research*, 15(1), 87-101. <http://dx.doi.org/10.1111/j.1475-3995.2007.00620.x>
- Bridgefield Group. (2006). Bridgefield group erp/Supply Chain (SC) glossary. [Online] Available: <http://bridgefieldgroup.com/bridgefieldgroup/glos7.htm#P> (June 2, 2011).
- Burgess K., O. J. Singh, & R. Koroglu. (2006). Supply Chain Management: A Structured Literature Review and Implications for Future Research. *International Journal of Operations and Production Management*, 26(7), 703-729. <http://dx.doi.org/10.1108/01443570610672202>
- Caddy, I. H. (1999). Supply Chain and Supply Chain Management: Towards a Theoretical Foundation. *International Conference on Managing Enterprises*.
- Carter, C. R., & Ellram L. M. (2003). Thirty-Five Years of the Journal of Supply Chain Management: Where have We Been and where is We Going?" *The Journal of Supply Chain Management*, 39(2), 27-39. <http://dx.doi.org/10.1111/j.1745-493X.2003.tb00152.x>
- Christopher M. (1998). *Logistics & Supply Chain Management: Strategies for Reducing Costs and Improving Services*. London: Pitman Publishing.
- Chow, D., & Heaver, T. (1999). *Logistics strategies for North America*. (3rd ed.). Global Logistics and Distribution Planning.
- Chow, D., Heaver, T., & Henriksson, L. (1994). Logistics performance: Definition and measurement. *International Journal of Physical Distribution & Logistics Management*, 24(1), 17-28. <http://dx.doi.org/10.1108/09600039410055981>
- Computerworld. (2001). Supply chain management. [Online] Available: <http://www.computerworld.com/softwaretopics/erp/story/0,10801,66625,00.html>. (August 10, 2011).
- Council of Supply Chain Management Professionals. (2009). Supply Chain management/logistics management definitions. [Online] Available: <http://www.cscmp.org/Website/AboutCSCMP/Definitions/Definitions.asp>. (July 22, 2011).
- Croom, S., Romano P., & Giannakis, M. (2000). Supply Chain Management: an Analytical Framework for Critical Literature Review. *European Journal of Purchasing and Supply Management*, 6(1), 67-83. [http://dx.doi.org/10.1016/S0969-7012\(99\)00030-1](http://dx.doi.org/10.1016/S0969-7012(99)00030-1)
- Fourie, Y. (2006). Structuring South African Maritime Supply Chain (SC) s for Higher Efficiency. PhD dissertation, University of Johannesburg (S.A).
- Forbes.com. (2006). Logistics glossary. [Online] Available: http://www.forbes.com/fdc/logistics/glossary_d.shtml. (July 1, 2011).
- Ganeshan, R., & Harrison Terry P. (1995). *An Introduction to Supply Chain Management*. Department of Management Sciences and Information Systems.
- Giunipero, Larry C., Hooker, Robert E., Joseph-Matthews, Sacha; Yoon, Tom E., & Brudvig, Susan (2008), "A decade of SCM literature: past, present and future implications. *Journal of Supply Chain Management*, 144(4), 66-86.
- Gunasekarana, A., & Ngai E. W. T. (2005). Build-to-Order Supply Chain Management: Literature Review and Framework for Development. *Journal of Operations Management*, 23(5), 423-451. <http://dx.doi.org/10.1016/j.jom.2004.10.005>
- Grant, D., Lambert, D., Stock, J., & Ellram, L. (2006). *Fundamentals of Logistics Management, european Edn*. Berkshire: McGraw-Hill Book Co.
- KEYITSOLUTIONS. (2003). Scm (supply chain management) definition. [Online] Available: <http://www.keyitsolutions.com/supply-chain-management.htm> (June 28, 2011).
- Kotler, P. (1984). *Marketing Management Analysis, Planning and Control, Englewood Cliffs*. NJ: Prentice-Hall.
- Kussing, U. (2009). Chapter Controlling logistics performance. In W. J. Pienaar & J. J. *Business Logistics Management*. S. A.: Oxford University Press. Vogt, pp. 438-459.
- Lambert, D., & Pohlen, T. (2001). Supply chain metrics. *International Journal of Logistics Management*, 12(1), 1-19. <http://dx.doi.org/10.1108/09574090110806190>

- Lamming, R. (1996). Squaring Lean Supply with Supply Chain Management. *International Journal of Operations & Production Management*, 16(2). <http://dx.doi.org/10.1108/01443579610109910>
- Lee Hau L., & Corey Billington. (1995). The Evolution of Supply-Chain-Management Models and Practice at Hewlett-Packard. *Interfaces*, 25(5), 42-63. <http://dx.doi.org/10.1287/inte.25.5.42>
- Little, A. (1999). A European Supply Chain (SC) survey. [Online] Available: http://www.adlittle.be/insights/studies/pdf/european_supply_chain_survey.pdf. (July 15, 2011).
- Langley, C., Coyle, J., Gibson, B., Novack, R., & Bardi, E. (2008). *Managing Supply Chains: A Logistics Approach*. Canada: South-Western Cengage Learning.
- Ludwig von Bertalanffy. (1969). *General system theory; foundations, development, applications*. New York: G. Brazille.
- Miller, J. G. (1978). *Living Systems*. New York: McGraw-Hill.
- Mentzer, J., Witt, W. D., Keebler, J., Min, S., Nix, N., Smith, D., & Zacharia, Z. (2001). Defining Supply Chain (SC) management. *Journal of Business Logistics*, 22(2). <http://dx.doi.org/10.1002/j.2158-1592.2001.tb00001.x>
- Nagarajan M., & Sobie G. (2004). Stable Far sighted Coalitions in Competitive Markets. *MANAGEMENT SCIENCE*, 53(1), 29-45. <http://dx.doi.org/10.1287/mnsc.1060.0605>
- Neely, A., Gregory, M., & Platts, M. (1995). Performance measurement system design: A literature review and research agenda. *International Journal of Operations and Production Management*, 15(4). [Online] Available: <http://www.emeraldinsight.com/Insight/ViewContentServlet?Filename=Published/EmeraldFullTextArticle/Articles/0240150405.html>. (August 8, 2011).
- Panayides, P. (2006). Maritime logistics and global supply chains: Towards a research agenda. *Maritime Economics & Logistics*, 8(1), 3-18. <http://dx.doi.org/10.1057/palgrave.mel.9100147>
- Pienaar, W. (2009). *Introduction to Business Logistics*. Southern Africa: Oxford University.
- Potter, A., Mason, R., & Lalwani, C. (2002). Performance measurement in the supply chain for sustainable distribution. [Online] Available: <http://www.cf.ac.uk/carbs/lom/lerc/centre/staff>. (August 4, 2011)
- Qukula, T. (2000). *Analysis of the Efficiency of the Transport Logistics Supply Chain with Specific Reference to Liner Shipping in South Africa*. Stellenbosch: University of Stellenbosch.
- Rolstad as, A. (1995). *Performance management: A business process benchmarking approach*. London: Chapman and Hall.
- Rungtusanatham M. J., Choi T. Y., D. G., Hollingworth, Z. Wu, & C. Forza. (2003). Survey Research in Operations Management: Historical Analyses. *Journal of Operations Management*, 21(4), 475-488. [http://dx.doi.org/10.1016/S0272-6963\(03\)00020-2](http://dx.doi.org/10.1016/S0272-6963(03)00020-2)
- Schenk, R. (2007). What is economic efficiency? [Online] Available: <http://ingrimayne.com/econ/Efficiency/WhatIsEff.html>. (February 12, 2011).
- Simchi-Levi, D., Kaminsky, P., & Simchi-Levi, E. (2003). *Designing and Managing the supply chain Concepts, Strategies and Case studies*. New York: McGraw-Hill Publishing.
- Simchi-Levi, D., Kaminsky, P., & Simchi-Levi, E. (2008). *Designing and Managing the Supply Chain: Concepts, Strategies and Case Studies*. International Edition: McGraw-Hill.
- Spekman, R., Salmond, D., & Kamauff, J. (1994). At last procurement becomes strategic. *Long-Range Planning*, 27(2), 76-84. [http://dx.doi.org/10.1016/0024-6301\(94\)90211-9](http://dx.doi.org/10.1016/0024-6301(94)90211-9).
- Stonebraker, P., & Liao, J. (2006). Supply chain integration: exploring product and environmental contingencies. [Online] Available: <http://www.emeraldinsight.com/Insight/ViewContentServlet?Filename=Published/EmeraldFullTextArticle/Articles/1770110106.html>. (April 1, 2011).
- Talley, W. (1994). Performance indicators and port performance evaluation. *Logistics and Transport Review*, 30(4), 339-351.
- Tecc.com.au. (2002). [Online] Available: <http://www.tecc.com.au/tecc/guide/glossary.asp?letter=S>. (July 12, 2011).
- Trkman, P., Stemberger, M., & Jaklic, J. (2005). Information transfer in Supply Chain (SC) management. [Online] Available: <http://2005papers.iisit.org/I46f91Trkm.pdf>. (July 21, 2011).

US Agency for International Development. (2009). Glossary. [Online] Available: http://www.hciproject.org/methods_and_tools/hciglossary.html. (April 4, 2011).

Vaart T. V., & Pieter D. (2003). Buyer-focused operations as a supply chain strategy. *International Journal of Production and operation Management*, 26(1), 8-23.

Yourdon E. (1989). *Modern Structured Analysis*. New jersey: Yourdon Press, Prentice-Hall International.

Wong, W., & Wong, K. (2007). Supply chain performance measurement system using dea modeling, *Industrial Management & Data Systems* 107(3). [Online] Available: <http://emeraldinsight.com/Insight/ViewContentServlet;jsessionid=E57B39C6CE4796DA8D44590D80E6077B?File name=Published/EmeraldFullTextArticle/Articles/0291070304.html>. (August 10, 2011).

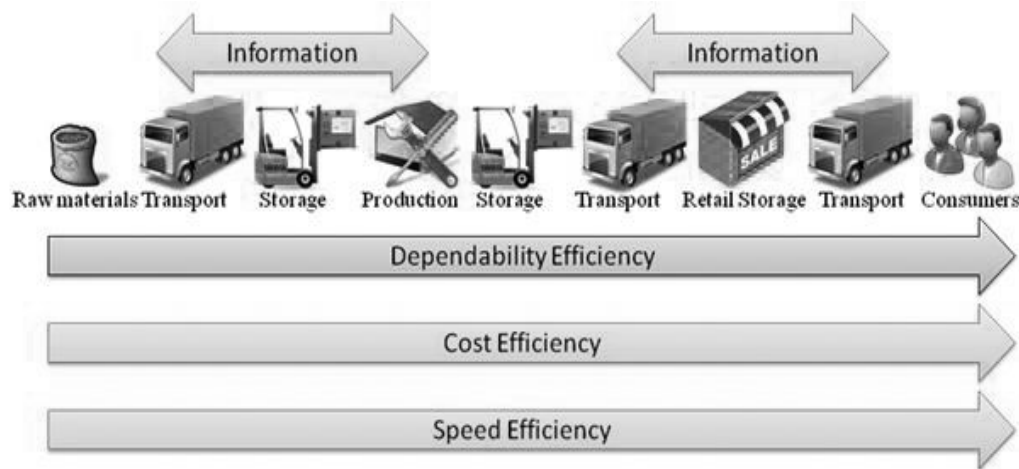


Figure 1. A design of a fundamental Supply Chain

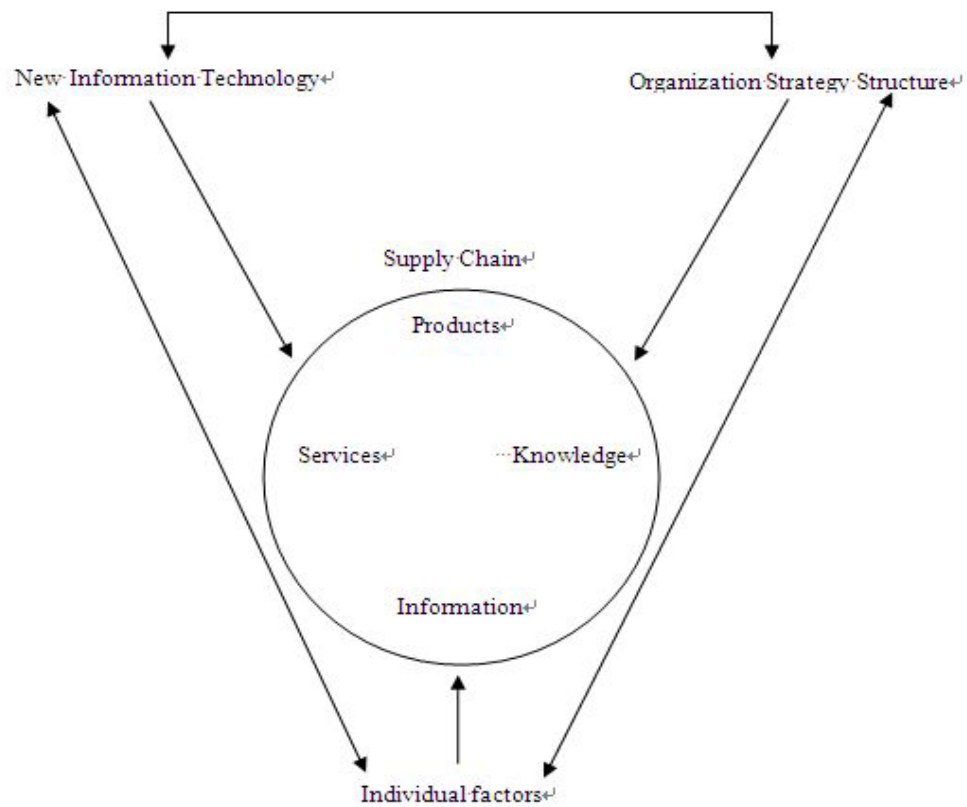


Figure 2. Source: Caddy and H. (1999)

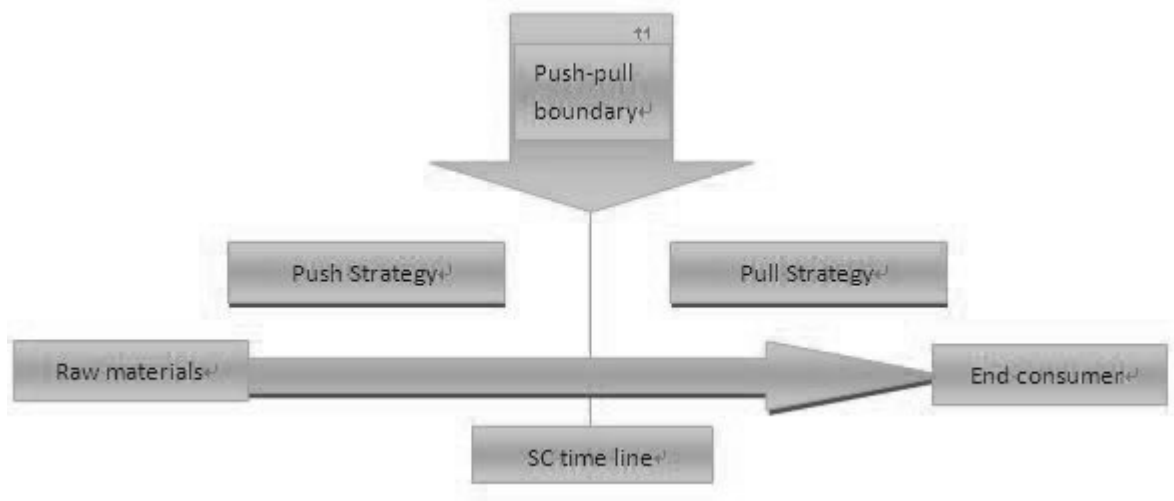


Figure 3. Push-pull based- Supply Chains
Source: Simchi-Levi, D., Kaminsky, P. and Simchi-Levi, E. (2008)