



## **Resilience Of Supply Chains In The Context Of Risks: The Case Of Global Supply Chains**

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### **Abstract**

The supply chain is more vulnerable and fragile in a context marked by a great competitive pressure, a volatile demand, a trend towards economies of scale and outsourcing. Risk management is thus an unavoidable and essential for the supply chain which has evolved into a network management based on value. The purpose of this paper is to make an inventory theory, the concepts of Supply Chain, Risk, risk management and resilience of Supply Chains. The ultimate goal is to initiate discussion on how a supply chain becomes more resilient through the practices of risk management.

**Keywords:** SupplyChain-RiskManagement-Risk-Resilience.

### **Introduction:**

The supply chain is more vulnerable and fragile in a context marked by high competitive pressure, volatile demand, a trend towards economies of scale and outsourcing. Risk management is thus an essential and critical issue for the supply chain has evolved towards managing value-based networks.

In the extended supply chain, increasing the organizational and operational complexity forcing companies to consider new vulnerabilities and risks. The risks are caused not only the external environment or the individual organization, but also the interactions in the network of supply chains (Juttner et al., 2003). Therefore, the risk horizon in supply chain management has grown considerably.

Yossi Sheffi According to (2005), resilience is an ability to rebound after a breakup. It is clear that the resilience of the supply chain aims to oppose the occurrence of risk, it is unclear how risk management works and how different organizations work together to strengthen the



resilience of the supply chain . The goal of our research is to better understand the effect of different measures to reduce risk.

The purpose of this paper is to take stock of the theoretical premises, the concepts of supply chain, risk, risk management, and resilience of Supply Chains. The ultimate goal is to initiate a reflection on how a supply chain becomes more resilient through practical risk management.

## **1. State Of Play In The Supply Chain Management**

In this first part we will try to put the item on the evolution of the concept of Supply Chain Management, in view of the different theoretical approaches that treated him. The goal is to emphasize its now important role in inter-organizational relationships, while putting the point on the diversity of these approaches.

### **1.1. SCM: The Maturity Of Inter-Organizational Relationships**

The logistics process was a tremendous upheaval in the past 50 years, first in intra-organizational perspective since it moved from a discipline management and technical operations of partial and disjointed local optimizations (years 50et 60) a management flow management by putting the item on the service (year 70 and 80), arriving at a strategic approach which advocates an integrated management of the entire chain (90 and 2000). It is this integration as the theoretical substrate philosophy Supply chain which paved the way to a concept that is currently much attention namely the Supply Chain Management.

In its inter-organizational dimension, the Supply Chain Management has made a break with the patterns of inter-firm relationships. Relationships that were approached in a confrontational often antagonistic perspective, and Williamson (1975) mentions two forms market and hierarchy, in line with discussions on Lelcer Market (1993) holds the transactional and relational model. But these approaches have failed to report and explain the appearance of procedural trends, collaborative practices, and shared in some inter-player relationships that Supply Chain Management, scaling up visions of a maturation these relationships, the real paradigm of inter-organizational relationships.

One reason why supply chain management has become a flagship concept, very fashionable, and who knows a craze among practitioners and interest increasingly growing by researchers and those from the early 90 (pioneering work of Christopher 1992, 1994), with a swarm of techniques and concepts which they are backed.

### **1.2 Status Report On The Theoretical Mobilizations In Supply Chain Management**

Given this diversity we will try to present very briefly the different theoretical approaches used in the study of Supply Chain Management before stating our position.

How well the difficulty of defining the concept of supply chain management, due to its multidimensional and polysemous (Mentzer and al (2001) have distinguished a hundred definitions), we will try to discuss some definitions that are part of several theoretical fields, and



that there is consensus in the academic world, and Ellram (1991) defined SCM as "a network of firms interacting to deliver a product or service to the end customer, involving a set of flows starting raw materials until the final delivery. "Christopher (1992) in turn defines supply chain management as a network of organizations that are engaged interactively in different processes and activities that produce value in the form of products and services for the end consumer. From these definitions we retain this will increasingly growing to supply chain management a business network for better value creation with an inclusive vision section, where competition is no longer the inter-level competition but rather a inter-chain.

Another definition, this time among the most cited, that of the Council of Supply Chain Management Professional, a North American association in logistics, where it is defined as "the planning and management of all activities related to the sourcing of procurement, processing and all logistics management activities. It also includes coordination and cooperation with chain partners can be suppliers, intermediaries, logistics providers and customers. In essence, Supply Chain Management integrates the management of supply and demand within and across companies "(CSCMP, 2007).

The common thread among the above mentioned definitions is that they are a form of SCM organization of logistics activities where there is integration of processes between these members. It takes the form of network organization (Paché and Paraponaris 2006), modular enterprise (Fabbe-Costes, 2005), or transactional business (Fréry, 1996), depending on the perspective adopted and intensity of relationships between members, This design refers to a action-oriented discipline and allows for implementation and operationalization more or less easy. Another wave of definitions considers the SCM as a management philosophy of the cross and integration. We retain the Cooper and Al (1997): The SCM is a philosophy that tends towards an integrated management of the entire flow of the distribution channel, "or that mentioned by Tan et al (1998) defines it as a management philosophy that reorients the traditional intra-organizational activities of trading partners towards a common optimization and efficiency target.

From this perspective, SCM is approached as a managerial philosophy, a systems approach that sees the supply chain as a single rather than fragments completely balkanized entity, operating a break with this Cartesian view that proceeds by decomposition to understand organizational phenomena.

In the analysis of supply chain management presented above, several frames of reference have been mobilized and are the most dominant approaches; the network approach (Paché and Paraponaris 2006) considers the SCM as a group of actors that constitute an organizational design that the intensity of relations requires consensus and trust between them, where the study of power relations , relations agency and transaction costs are exacerbated. We also identify a strategic management approach, which examines the SCM, as an approach to integrate policy process (Balambo, 2012; 2013)

Other theoretical approaches have been mobilized in the continuity of these functionalist approaches to study the SCM which fits more into the field of organizations. A theoretical framework which nevertheless remains marginalized is the sociological neo-institutional



theories, contrary to economic neo-institutional approaches (theories of transaction costs and agency theory) that have been widely studied (Livolsi, 2009).

In what remains we reach Ellram (1991) and Christopher (1992) in their consideration of the Supply Chain Management as a lattice form of work, analyzing the contribution of the risk-based approach to the consolidation and resilience Supply Chain.

## **2. The Global Supply Chain Management: What Role Of Risk Management ?**

### **2.1 "Risk Management": Evolution Of The Concept And Definition Elements**

What is the risk? The word risk appears to be commonly used to refer to either an event both in terms of probability of occurrence or consequences. In the literature, there is no real consensus language found, as there are a multitude of definitions of "risk". These definitions are often the subject of confusion, vary depending on the domain and the context in which the risk is considered. We propose that the risk is the impact (positive or negative) associated with the probability of occurrence of an event that alters the results expected of an entity. We chose this definition because it combines the elements we have presented above, but also by what it describes two essential dimension to the assessment of risk: the probability of occurrence and impact. This definition is similar to that of March and Shapira (1987), which is to our knowledge the most used in the literature, and also considers the impact of a risk is not always negative.

The concept of risk management is not new and has certainly made its appearance in the late 1950s in the United States in the financial sector in relation to insurance matters (Mayer N. Humbert JP, (2006), Tchankova, (2002)). Subsequently, the concept of risk management has been extended to other areas, including the environment, project management, marketing, and logistics, which particularly interests us.

If risk management is sometimes viewed as a "a buzzword," The inhabitant and Tinguely (2001) suggest that risk management as seen today is distinctly different from that represented there 50 years, in the sense that it has evolved from an approach that considers the risk that internal organizations, an approach that incorporates risk in a broader, more strategic view. This was driven by increased instability and uncertainty in the environments in which organizations must operate, and for many companies the idea of a stable external environment has ceased to exist (Tchankova, 2002). This environmental instability and volatility, mean that firms have become exposed to a variety of unpredictable risks. In this context, the question about the value of risk management does not arise. Moreover, its implementation is recommended by some reference works such as the work of the Basel Committee 2, and the International Organization for Standardization (ISO) launched since June 2005 a procedure for the implementation is the publication an ISO standard (ISO 31000, risk management, principles and guidelines for implementation) which is being finalized and should be recognized as the international framework for risk management.

Unlike the "risk", there seems to be a consensus on the definition of "risk management". We have chosen to present several definitions that show the convergence of conceptualizations of risk management.

Khan and Burnes (2007), adopted the definition of Fone and Young (2000) that "The management of risk should be considered as a function of the company seeking to identify assess



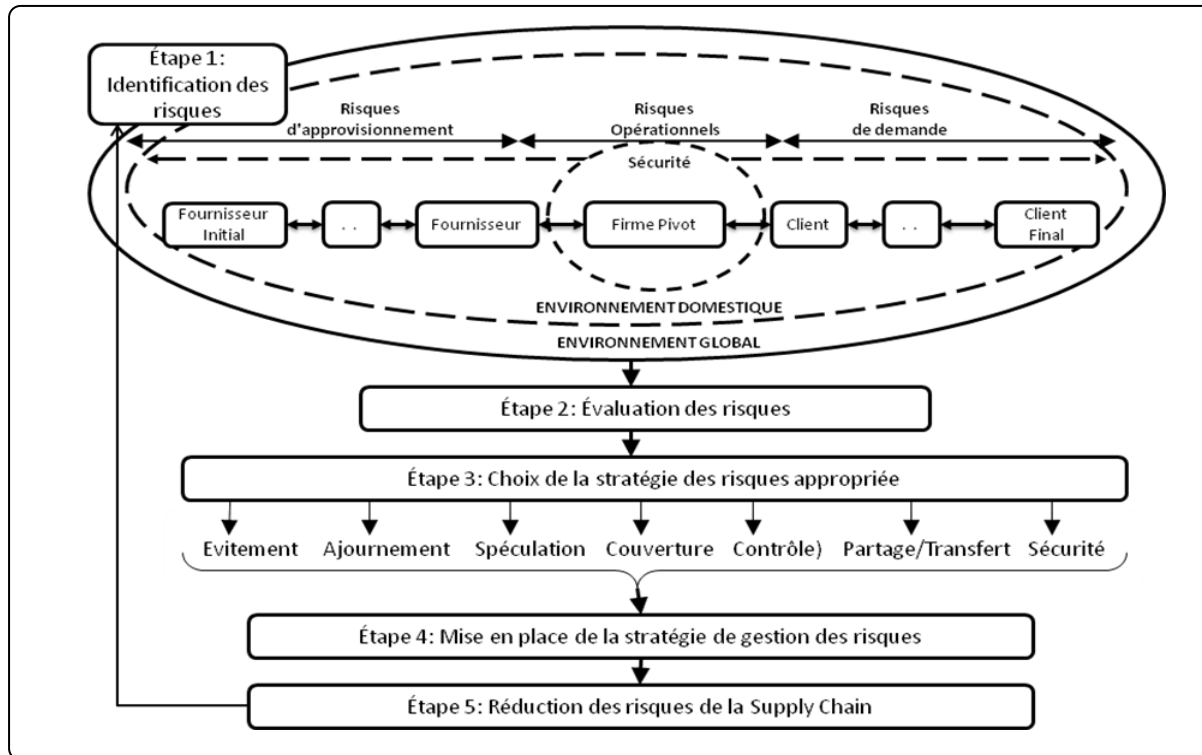
and manage risk in the context of the objectives general of the organization. "This definition goes beyond the concept of risk management come a simple management tool to set it as a function of whole-which must exist independently of the other functions of the organization. Harland et al (2003) suggest that "Risk management must incorporate scenario planning and the use of experts and studies Delphi groups, in addition to the prediction methods based on statistical forecasting" . It will depend on the attitude of the organization: an organization can take several positions towards risk: reactive, defensive, proactive and analytical. "

From these definitions, we can conclude that risk management is not necessarily synonymous dodge or risk avoidance, but that management will depend on the attitude that the organization chooses to adopt toward risk . Indeed, if companies are inevitably lead to cope with risk, what is important is to identify, evaluate and try to adopt the right attitude to these risks. In this sense, foreigner and Tinguely (2001) suggest that "Risk management is not about seeking gold Avoiding risk. It is about Optimizing Risk Exposures. "

## **2.2 Models Of Risk Management In Global Supply Chains**

In recent years, researchers have begun to explore how risk management models, derived from other disciplines can be applied in the context of supply chain (Harland and Brenchley (2001), Harland et al (2003), and Wendel Norman (2002)). Harland et al. (2003) proposed a grid to manage risk in a supply chain network composed of 6 phases: mapping the logistics network (or supply), risk identification, risk assessment, risk management, strategy formulation collaboration risk management in the network and finally the application of this strategy. The main limitation of this scheme is that it does not take into consideration the different perceptions that network actors have different risks they face Zsidisin (2003). For Stemmler (2007), the process of risk management generally includes the identification of the source of risk, analysis and evaluation of the impact of the risk, research measures, and finally, control risk. Another limitation that we can blame the two models (Harland et al. (2003) and Stemmler (2007), is the lack of mechanisms for monitoring and reviewing the different steps performed. Indeed, risk management, is an iterative process, cyclic and permanent, we must ensure the accuracy of evaluations, the relevance of the priorities and decisions as well as the effectiveness of the measures implemented.

Finally, Manuj and Mentzer (2008) proposed a risk-management model (Figure 1) in the global supply chain consisting of five phases. The model presented in the form of process consists of five iterative phases: Hazard Identification, Risk Assessment, Strategy selection of appropriate risk Implementation of the strategy risk management and finally Avoiding Supply Chain .



**Manuj et Mentzer (2008)**

The advantage of this model is that it considers that the process of risk management is not a sequential process in which an item only affects the next. It is a multi and iterative process by which any member has an immediate and direct impact on others. However, the peculiarity of this model is that it allows us to understand risk management as a whole. This feature translates to adopt different strategies depending on the context and the risks involved.

These contributions suggest that each model of risk management must be based on a logical sequence of determining the context involved and the risks it generates, to assess these risks and establish actions to reduce the importance in respect of the risk of the occurrence probability, or the impact or both. White (1995) suggests that different models of risk management proposed in the literature, tend to follow a three-phase approach consisting of: Hazard Identification: On the basis of an assessment of the context, its purpose is to identify all risks which are likely to occur. Risk Analysis: The goal is to understand and estimate the probability of occurrence and impact of the most significant risks. And finally, Risk Treatment: Its purpose is to determine the most appropriate to be implemented for each risk (or combination of risks) action as well as the most appropriate party to manage each identified risk.

However if this ambitious approach is of interest in the context of supply chain, its practical application is confronted? Obstacles. Manuj and Mentzer (2008) emphasize the difficulties associated with the increased complexity of global supply chains. To Harland et al. (2003), another difficulty concerns the identification and measurement of risk, not for a single player, but



for all players in the supply chain. The last obstacle is the cost of the process and measuring its impact on the performance of each player and the entire chain.

### **3. Resilience Of Supply Chain:**

#### **3.1 The Concept Of Resilience**

The Latin word *resilire*, which is the source of "resilience" is made from the verb *salire*, which means "jump" and the prefix "re" indicating movement backward. Hence the direction taken by the word in French or Middle Ages: recant, release of a contract by a sort of jump back. In the seventeenth century, the word retains the idea of jumping the reaction after a shock rebound (Tisseron, 2007).

According to "Le Petit Robert" in 2010 version, resilience is defined as:

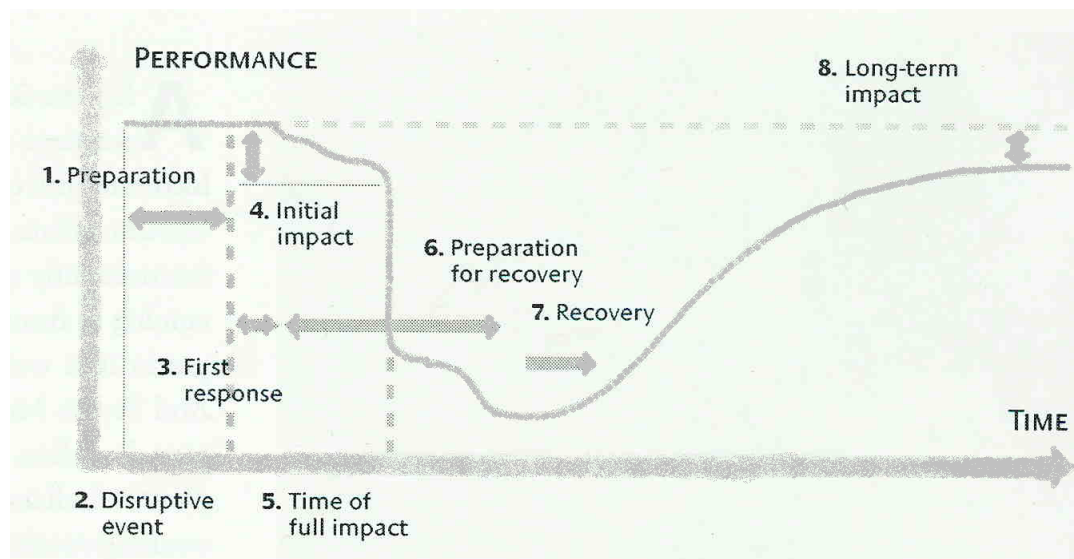
- ☐ Report absorbed kinetic energy necessary to cause breakage of a metal on the surface of the broken section.
- ☐ Ability to live, grow, overcoming the traumatic shocks of adversity.

In humanistic research, resilience is studied sociology as a human characteristic to survive the tests, allowing people to absorb the "future shock" and 'able Entirely of Adapting to new situations and difficulties' (Dubos, 1975). In psychology, resilience is a psychological phenomenon of taking note of her trauma to no longer live in depression (Cyrulnik 2001). For Garmezy (1993), resilience is the process, the ability or the result of a good adaptation despite the circumstances, challenges or threats. According Cyrulnik (1999), resilience is 'the ability to succeed, to live and to develop positively, in a socially acceptable manner, despite the stress or adversity that typically involve the serious risk of a negative outcome'.

On management science, the concept of resilience of the organization emerges first in the management of the crisis and the organization of high credibility (Bégin and Chabaud, 2010). In the article by Weick (1993), the analysis of resilience transferred from the individual to the organizational level and collective level. Lengnick-Hall and Beck (2005, 2009) define the resilience of the organization as "one's ability firm to absorb, respond to and capitalize on disruption from changes in the environment"

#### **3.2 The Concept Of Resilience In The Supply Chain**

Each break has a typical profile in terms of business performance. This performance is usually measured by revenue, margin, the level of productivity, quality of service, etc. The dynamic response of the company after the breakup can be demonstrated in the following diagram.



**Source: Sheffi et Rice 2005**

In this scheme, we find that the company is going through different phases that take some time before the return of the performance. In a context of intense competition, the company has a competitive advantage with a strong ability to succeed in this return and decrease the time. This ability to rebound from a breakup is the corporate resilience, particularly the resilience of the supply chain (Sheffi 2005).

In the area of managing the supply chain, the term "resilience" is the risk and vulnerability especially as the risks can not be completely prevented, controlled or eliminated (Peck 2006). According to Sheffi and Rice (2005), resilience is an ability to rebound after a breakup. Christopher and Peck (2004), resilience is "the capacity of a system to recover to its original or optimal level after a disturbance."

According to Waters (2008), a resilient supply chain is more vulnerable to the occurrence of risk. Sheffi (2005) gives a broader meaning: the resilient supply chain acquires not only an ability to manage risk, but what is more important, better positioning the competitors at the breakdown.

All these definitions agree on the fact that the resilience of the supply chain is the ability of organizations along the supply chain to renew their performance (productivity, continuity and / or the flow of goods or service) to the original level or return to the growth path after suffering a shock. The development of resilience optimizes actors, relationships, activities, and functions in the supply which is an interactive and interdependent system (Peck 2006) chain.

In addition, Christopher and Peck (2004) distinguish the concept of "resilience" to that of "robustness", expressing the last physical force. Some uncontrollable functions deviate towards risk, but robust system allows an expected with a slight delay (Genin et al, 2007) performance. Rather resilience means the capacity for flexibility and adaptability.



### **3.3 Characteristics Of Resilient Supply Chain**

Resilient supply chain is flexible, agile and adaptable. In particular, it is a proactive system. Waters (2007) has summarized seven key physical factors in the range of a resilient supply chain. These factors help us to gain a general understanding.

#### **1) Planning is consistent with the application**

This agreement is a basic principle of design of resilient supply chain. It often presents a schedule that takes into account the balance between resources, products and demand. Ignoring the request, for example, excessive production over demand or a long logistics procedure for a rush order, will hinder the flexibility, speed and resilience.

#### **2) parallel paths**

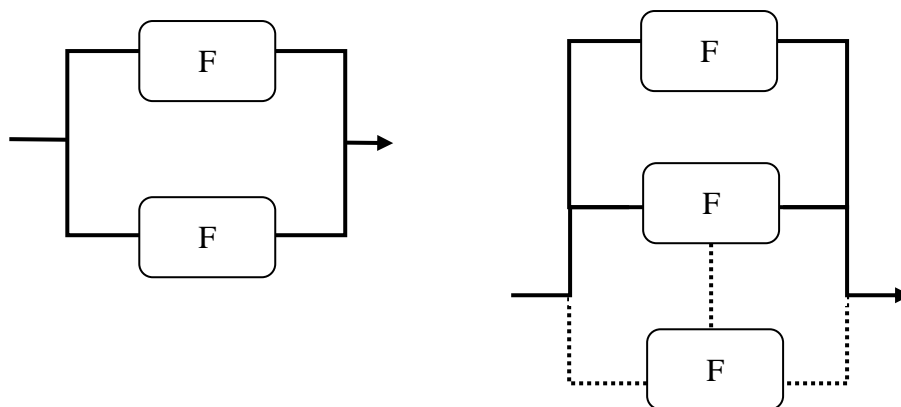
In a resilient supply chain, bypassing the break will be more achievable with two or more paths. Generally, there are typical measures like multiple sourcings several logistical channels to customers, outsourcing of an operation to different subcontractors or organizing them to make them work together in a internal operation. Once a part of the chain is affected by a breach, the organization will be opportunities and initiatives to break the deadlock.

#### **3) The shorter chain**

With limited quantity and of superior quality, as well as smaller geographic distances partnerships, short-chain leads to lower transport costs and compress delivery times of suppliers, especially in the face of rapid higher prices for labor and energy costs. In addition, the company offers flexibility and property have fewer defects.

#### **4) Reliable structure of the supply chain**

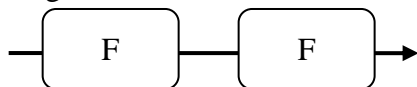
In a supply chain network, vulnerable links are not the result of the increasing amount of actors, but rather the complex way they are organized. Waters introduced a simple calculation to show the reliability of the chain structure or network. In this method, the reliability (F) is the rate of success (for example 0.9). The possibility of default equal to  $1 - 0.9 = 0.1$ . The following diagram shows a method of calculating the reliability of the combined elements.



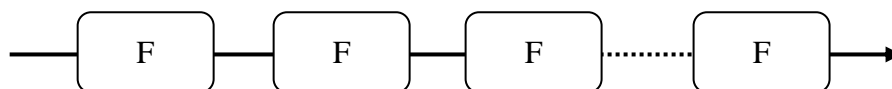
b)  $Fiabilité = 1 - (1 - F^2)$

a)  $Fiabilité = 1 - (1 - F)^n$

Figure 2.1 Parallel elements increase the reliability and reduce risk.

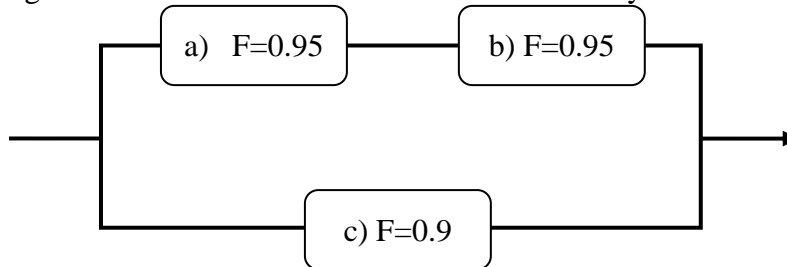


a)  $Fiabilité = F^2$



b)  $Fiabilité = F^n$

Figure 2.2 Elements in series reduce the reliability and increase the risk.



Calculation:

The elements a and b are combined in a series of reliability  $(0.95 \times 0.95) = 0.9025$ , therefore a possibility of failure  $(1 - 0.9025) = 0.0975$ ;

The element c a reliability of 0.9, so the possibility of default  $(1 - 0.9) = 0.1$ ;

The combined potential default of three elements is  $0.0975 \times 0.1 = 0.00975$ ; So the combined reliability  $(1 - 0.00975) = 0.99025$



### **5) The spare capacity**

In a supply chain, redundant inventories is effective for the immediate problems and enables more initiative now, and reduce risk. But of course, the stock increases the cost and problems in concealed operation. According to Sheffi (2005), spare capacity (redundancy capacity) is more important than the physical superfluous, especially for key links. It offers alternative tactics such as equipment and IT performance systems. Waters (2007) renamed this ability 'spare capacity'. According to him, the equipment, operations, means of transport and quantity of jobs must be alternative resulting from the 'spare capacity'

### **6) Agility**

Agility means the flexibility and efficiency of operations in response to rapid changes in demand or supply (Christopher and Peck 2004, Sheffi 2005, Waters 2007). Agility is related to the entire network as well as each individual. This is the case of short time, materials and standardized operations, rapid re-scheduling, possible displacement operations, flexible and flow driven by downstream suppliers.

### **7) The point of entry of the sales order**

That 'order penetration points' or 'customer order decoupling point ". According to Sharman (1984), the entry point of the application is defined 'as the point of the production process from which product specifications are fixed, and as the last point where stocks are maintained'. From this point of view, the system is drawn downstream; upstream processes are controlled by the forecasting and planning (APICS Dictionary, International Association for Operations Management, 11th Edition). In the further downstream where it installs the 'order penetration point "' customer better control operations and reduces inventory, time and vulnerability as well as possible (Waters 2007).

### **Conclusion:**

In this paper we first tried to make a point about the evolution of the concept of supply chain management and to better understand the concepts of risk, risk management and resilience in the context of supply chain. The purpose of our research is to an observable fact that we were able to do from the literature review. Indeed, it seems clear that if the work that focus on supply chain management in general and on global supply chains in particular, have experienced strong growth in recent years, scientists and professionals agree that there is little studies that can provide conceptual frameworks and empirical findings for better understanding and application of risk management in the context of supply chain. We tried to demonstrate how risk management can foster resilience in the supply chain. An inevitable conclusion is the lack of work on risk management in the Francophone Research in Logistics and Supply Chain Management, which appears naturally curious.



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