

## TRANSFORMATION OF SUPPLY CHAIN MANAGEMENT CHALLENGES INTO BUSINESS OPPORTUNITIES

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### ABSTRACT

This paper discusses main challenges faced in managing supply chains in general, and those of E-Business environments in particular. Conceptual extensions and a guiding framework are proposed. Based on this framework, solutions are developed which help overcome main challenges faced in practice. Special emphasis has been given to the challenges resulting from uncertainty, complexity, and information systems.

The contribution thought is two folds: first, current challenges faced in managing supply chains are analyzed and categorized conceptually, according to their orientation. Secondly, a general framework to guide management practice is developed, and used to generate solutions that help overcome many of those challenges. The solutions proposed comprise both proactive and reactive strategies, and implementation guidelines.

**Key Words:** Supply Chain Management, Supply Chain Strategies, Management Framework.

### INTRODUCTION

Accelerated competition, continuous change in production and information technologies, pressure to reduce cost and penetrate new markets, are all factors that resulted in manufacturers spreading their operations worldwide, in many cases leaving them with more assets outside their own countries, and stretching further the supply chain (SC). A recent survey by Deloitte & Touche of 500 companies from USA and Europe conducted this summer revealed that despite globalization, most supply chain optimization is local, and focuses only on individual functions, facilities (such as plants and warehouses), services, and countries. Furthermore, this survey revealed that, key priorities as flexibility and customer service are becoming more difficult to achieve. Industries represented in this survey include: aerospace & defense, automotive, medical equipment, consumer products, process & chemicals, high technology, telecommunications, metal fabrication, and others.

This paper addresses the challenges and complexities faced in managing supply chains in general and those of global nature in particular. Our focus will be on how to overcome such challenges in a way that advances total supply chain performance, not just that of a particular firm or activities in the chain. A main premise adopted is that, supply chain success is measured in terms of the whole SC surplus, i.e., the total value added to all partners in the chain.

It should be noted that a focus on the profitability at only individual stages, may lead to reduction in the overall SC profits. SC performance is determined by

two main drivers, efficiency and responsiveness, e.g., Shopra and Meindl (2004). Efficiency translates into reduction in cost. Yet, responsiveness is multi-dimensional. It includes satisfying a wide range of qualities required, speed of response to customer needs and demands, providing a wide product varieties to meet different customer's requirements, using wide range of distribution channels, with increased service levels and rate of innovation. Different customer segments, and market places require different responsiveness and have different needs, and dynamics. This results in increasing the complexity faced in practice.

Our approach to overcome the challenges faced in managing SC and improving its performance, will be guided by the following main principles:

1. The only entity that puts money into a SC is the end customer.
2. Shifting costs and/or transferring problems along the chain will not advance SC performance, nor its firms' long range competitiveness. Hence, emphasis must be only on win-win solutions and outcomes.
3. The core of SCM is about maximization of the total value-added to all partners in the chain. Relevant measures here include: consumers' surplus, i.e., the difference between what consumers are willing to pay and the actual price they paid; producer's surplus, i.e., the difference between what producer's charge as price and the actual costs of the product; in addition to the intangible values and

those hard to quantify attributes, as service before and after sale, quality, speed of delivery, etc...

4. Performance of a SC is determined by the weakest link in that chain. Hence, a focused effort to improve such link will result in improving the whole SC. Every Partner in the chain should contribute to strengthening of the weakest node, as this means a win-win outcome for all.
5. SC performance is governed by both the “intra-firm”, and the “inter-firm” interfaces encountered.
6. Any organization has to put its own house in order first, before trying to fix the others’. Hence, a highest management priority should be placed on the Internal Supply Chain Management (ISCM), followed by SRM and CRM, i.e., Suppliers’ Relationship Management; Customer Relationship Management, respectively.
7. Principle 6 above also implies that effectiveness of ISCM is a necessary condition for advancing SRM, CRM, or both.

Conceptual characterization, and analysis of the main challenges faced in managing supply chains will follow in Part II. A general framework for dealing with these challenges is introduced in Part III. This framework is then used to provide solutions and actions in Part IV. We then conclude in Part V, by a summary and open questions for future research.

### CURRENT CHALLENGES

Supply Chain Management comprises many activities and interfaces, as illustrated in Figures 1 and 2.

Challenges faced in managing supply chains can be classified into four main categories, as illustrated in Figure 3.

#### Accumulated Operational Risks and Uncertainty

These include:

- a. The “Bullwhip” effect. This results from the fact that demand volatility a company faces increases the further upstream it resides in the SC. For example PC manufacturers face less demand volatility than semiconductor manufacturers, and those in turn face less demand volatility than those faced by the semiconductor Equipment Suppliers. This effect is denoted by some as the first law of supply chain dynamics, Fine (2000).

- b. Supply and Demand internal imbalance. This includes inconsistency between demand and supply of the same product at any point in the chain, (e.g. Levi, et.al., 2001; Lee, 2002) as well as, the inconsistency between demand rate of a product and the flow of supply of components and raw materials used for its production.

- c. Market- Based risks, as those triggered by competitors’ moves. For example: drastic reduction in price by some competitors, or aggressive advertising campaigns, or innovative customer service offerings.

- d. Industry-Based risks, including safety, health, and environmental hazards (SHE), Kleindorfer (2001). Such risks are significant in the process and chemical industries, iron & steel, and other hazard polluting activities.

#### Behaviorally-Based Challenges

Example of these include, achieving appropriate balance, and/or form of:

- a. Command vs. coordination.
- b. Control vs. cooperation.
- c. Trust vs. collaboration, see for example (Kumar 1996; Saad 2001; Saboth, et.al. 2002).
- d. Alliances.
- e. Creativity.

#### Continuous Complexity

This is resulting from:

- a. “intra-firm” interfaces. These include conflicts among the functional policy areas within a firm, e.g., conflicts between marketing, production, and finance, e.g., Saad (1990).

- b. “inter-firm” interfaces. These include goal conflict among different firms who are partners in the chain. For example, conflicts between a manufacturer and its supplier on one hand, and between the manufacturer and its distributors on the other hand.

- c. “time-based” challenges; i.e., those associated with balancing both the short range and long range goals and outcomes. It should be noted that in many instances achieving long range growth and sustainable competency require sacrifices in short range profits. Relatively high investments will be dedicated to R&D projects, where profitability is not likely to occur in the short run. Saad, et. al. (2000).

d. “information-based” challenges. These include all the difficulty associated with accessing the right information, at the right time, to be used effectively, by all parties along the chain. It should be noted that, while ERP, and computerized DSS contribute significantly in this vain specially in recent years; yet they resulted in negative side effects as well. At least relating to the issues of information incompatibility, and information overload. e.g., (Handfield 2001; Sengupta 2001). These will be addressed later in more detail.

e. The “interaction effects”, i.e., those resulting from the interaction among all affecting factors and parameters involved.

The more decision makers are able to understand this type of effects the better-off they are in terms of designing the appropriate schemes to generate the desired outcomes, both proactively, and reactively.

### **Dominant Strategic Challenges**

Example of these:

a. Technological change and its corresponding diffusion and spin-off effects along the chain. This reflects the amplification of the clock speed of the rate of change in technology as one moves further downstream in the SC. This effect is denoted by some, as the second law of SC dynamics (Fine, 2000, p. 217). For example PC manufacturers experience shorter product life cycle than the semiconductor manufacturers. Those in turn experience faster clock speed than the semiconductor equipment manufacturers.

b. Fragmented and incomplete performance measurements, Saad (2001). This results from conflicting goals among the different partners in the chain, and a focus on only their internal environment. Thus, no coherence exists in their adopted measures of performance. This represents a key challenge and a real stumbling block in practice which must be removed to be able to cooperate, align, and collaborate effectively among all SC partners for the betterment of the total SC surplus.

c. Globalization. The main challenge here is how to achieve the right balance between global coordination on the one hand, and local decentralization, on the other hand.

d. Supply Chain design. This constitutes a main determinant, if not the most important one, for competitiveness, and sustainable growth. It relates to what capabilities along the value chain to invest in, and

develop internally, and, which should be provided by external sources. This includes make vs. buy decisions, logistics, and transportation policies, and modes.

### **A GENERAL FRAMEWORK**

In order to overcome the challenges discussed above, a general framework to guide this effort is now developed.

The framework we propose consists of two main dimensions, each of which will be used as a basis for generating pertinent solutions and action guidelines.

The first dimension is ‘*proactive*’. It emphasizes preventive schemes of what can be done to avoid specific challenges or prevent their occurrence, as possible. For those unavoidable challenges, the focus here would be on mitigating their negative consequence, and transforming them into business opportunities and/or increased value to customer. The second dimension is ‘*reactive*’, i.e., it emphasizes readiness of the supply chain. The focus here is on how to increase the capacity of a Supply Chain to respond to the challenges faced individually, and collectively. This involves building strong Supply Chain enablers to absorb, overcome, or, transform the challenges faced to more benefits and higher value-added to Supply Chain partners. This dimension in turn is driven by two main factors, namely, the ability and the willingness, of all parties involved to contribute to such realization.

This dual dimensional framework is now used to develop appropriate strategic directions, and action guidelines to deal with the challenges faced.

### **SOLUTIONS AND GUIDELINES**

Drawing from the main challenges faced identified in Figure 3, and making use of the framework proposed above, specific solutions are now discussed. We shall focus our attention on three main challenges, those related to: operational uncertainty, complexity, and information.

First: Operational Risk and Uncertainty

To overcome operational problems resulting from uncertainty and volatility of demand which increase moving upward in a SC, and those resulting from unbalanced supply and demand at the firm level, and across the chain, solutions here may include:

### 1) Preemptive Schemes, as

a. Postponment. This is particularly effective to overcome uncertainty of demand. Producing first the relatively certain demand items, and the certain components of the uncertain demand items. Hence, postponing the production of those uncertain parts as possible to minimize the risks of overproduction and overproduction of those items. Thus, reducing the costs of both inventory, and lost sales, simultaneously.

b. Risk pooling. This can be realized by using central warehousing. This would result in areas experiencing overproduction will compensate for the underestimate of demand forecasts of other areas for the same product. Thus increasing the accuracy of total demand forecast, as well as the responsiveness level to the different market needs.

c. Dynamic Pricing. This can be practiced in different forms, e.g.,

i. Charging different price per unit for the same item, in different markets, and/or for different customer segments.

ii. Peak load pricing by different seasons.

iii. Charging a higher price, or a premium over the regular price to fulfill higher responsiveness requirements from customers (for speed, special packaging, and the like).

iv. Offering quantity discounts.

d. Encourage forward buying, and other mutually beneficial contractual agreements. These include contracts between the producer and distributors on one hand, and, between the producer and its suppliers on the other hand. For more detail, see Cachon (2002).

e. Adoption of ERP systems. This would reduce lead time, and increase speed and responsiveness to market needs.

f. Making use of ERP, and IT capabilities to increase flexibility of both products and processes. Thus, transform the uncertainty challenge to more system's agility and power, in terms of ability to capture more market share, and respond to wider market needs.

### 2) Responsive Solutions. These include:

a. Information sharing & coordination mechanisms. These would reduce the bullwhip effect, and goal conflict's impact, and increase the overall SC synergy, and adaptation to change.

b. Increase product modularity and commonality. This would maximize speed and scope of responsiveness to customer demand, as well as the agility to counter uncertainty effect. Shopra, et.al. (2004).

c. Increase product differentiation at minimum costs. Commonality, of products' components helps tremendously in achieving this goal.

d. Mass customization. This can be achieved by combining b and c above.

It should be noted that this strategy results in minimizing risk, and maximizing both economies of scale and economies of scope, simultaneously. Example of such effective solution is practiced at Dell corporation.

e. Cross docking. By making use of IT and E-Business in coordinating the schedule of suppliers' deliveries to coincide with pick-ups of the retailer's trucks for distribution to the different stores. This strategy has been initiated at Wall-Mart corporation, and proved great success in not only minimizing inventory costs, and transportation costs - by making use of full truck loads - but also in maximizing the speed of response to customer needs at the different store locations, and increased customer service simultaneously.

### Second: Complexity Challenges

Effective use of IT to achieve SC visibility is essential to overcome many complexity challenges. Full and timely information exchange, within a firm, and among the SC partners is a powerful tool that can be leveraged to using welfare economics principles, both proactively and reactively as follows:

1) Proactively; apply the 80/20 Pareto rule, where a few significant factors determine the majority of the outcome achieved. By focusing only on these significant few factors, management can maximize the total SC surplus realized, with least effort.

2) Reactively; seek the most efficient frontier. This is realized when no party can be better off any more without other(s), being worse-off. It must be noted here that, SC visibility facilitates goal alignment, build trust, and other necessary conditions for reaching this equilibrium frontier.

It should be noted that IT and E-Business are very useful enablers in practice. Yet, they result in other related challenges that deserve special attention in their own right. This is addressed next.

### Third: Information Challenges

While the use of IT and ERP systems constitute effective decision support systems, yet they create other challenges as well. Two main problems associated with IT and ERP usage cannot be overlooked. Namely, information overload, and incompatibility. We suggest ways to overcome these problems proactively, and reactively as follows.

- 1) Proactively. Reduce the need for more information as possible, both intra-firm, and inter-firm wise.

This can be achieved by:

- a. Creating a healthy slack.
- b. Simplifying forms and documents used.
- c. Assure compatibility of information systems and software packages used.
- d. Create autonomous groups and/or self directed teams for decision making and for problem solving; both intra-firm, and inter- firm wise.

- 2) Reactively; i.e., Increase the capacity of the SC to process more information. This can be accomplished through:

- a. SC visibility; i.e., transparency of information along the chain, for all parties.
- b. Provide the right incentives for win-win solutions. Different contracting options are useful mechanisms to achieve such outcome.
- c. Increase coordination and collaboration among all SC partners.
- d. Use both formal and informal channels of communication to maximize SC surplus.

It should be noted that a, c, and d above relate to increasing the ability of the chain, yet b relate to increasing the willingness needed from supply chain partners to overcome the underlying problems.

### SUMMARY AND CONCLUSIONS

This paper provided a general classification of the main challenges currently faced in managing supply chains. Four types have been discussed. These comprise: Operational risks & uncertainty, Behavioral challenges, Continuous and increasing complexity, and dominant Strategic challenges.

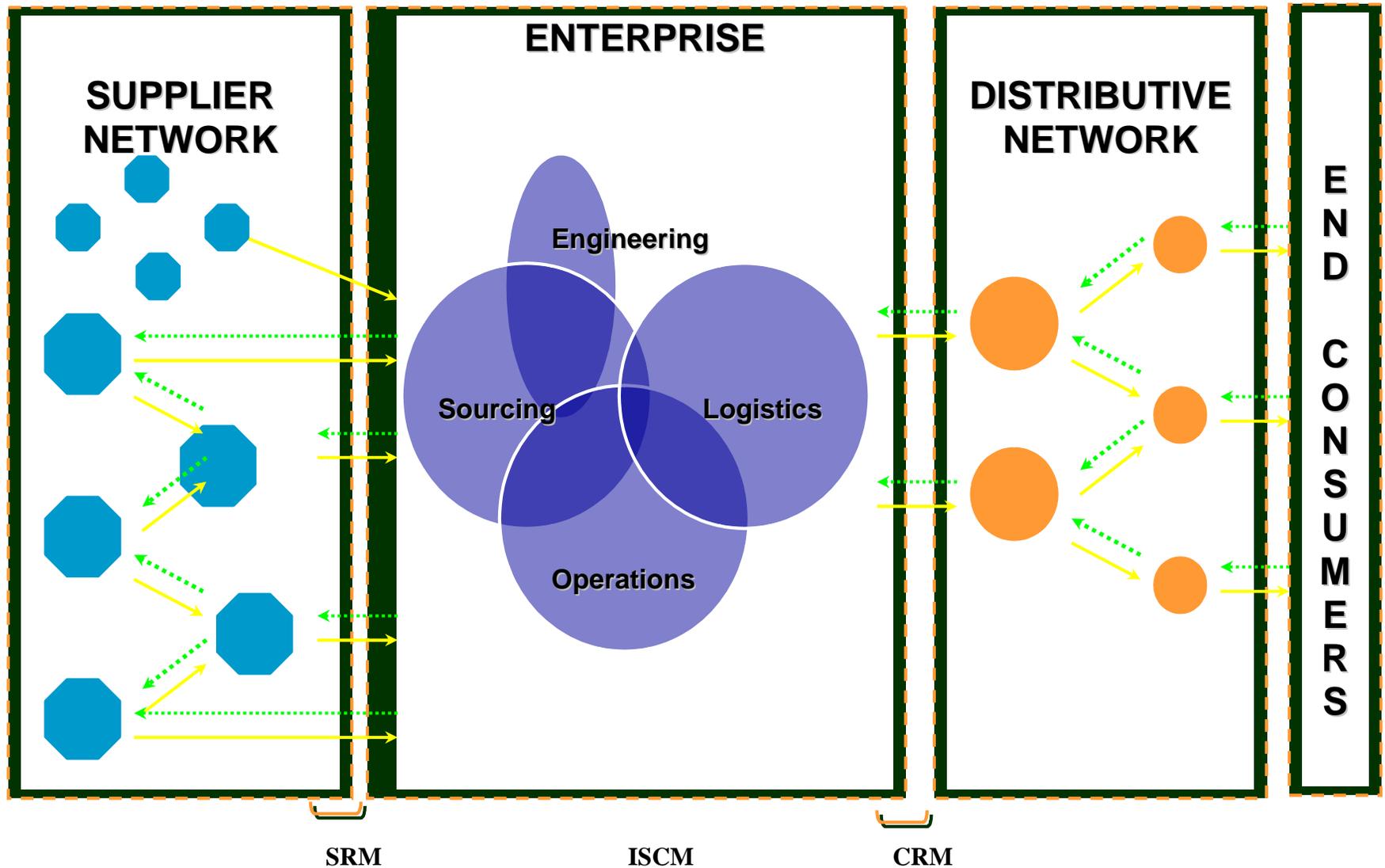
A conceptual framework has been developed, and used to overcome these challenges. It comprises two main dimensions: First; Proactive schemes that focus on preemption, avoidance, and mitigation of each of the risks faced and their negative consequences. Secondly; Responsive schemes that focus on the readiness of each firm in the chain to absorb, solve, and solve each challenge, once faced. The main theme here is, how to increase the capacity of a SC to overcome each challenge once encountered.

The framework proposed have been used to provide solutions and action guidelines to main challenges faced, with emphasis on those relating to uncertainty, complexity, and information.

Empirical testing of the framework, and solution proposed in real operating environments are logical next steps to follow, and pursue as future research issues.



Figure 1 - An Integrated Supply Chain



**Source:** Adopted with some modification from Monczka, R., R. Trent, and R. Handfield (2002). Purchasing and Supply Chain Management, 2<sup>nd</sup> ed., Cincinnati: South Western College Publishing-ITP Publishing Company.

Figure 2 – Supply Chain Management Activities

## Supplier

## Firm

## Customer

### SRM

! Source

! Negotiate

! Buy

! Design  
Collaboration

! Supply  
Collaboration

### ISCM

! Strategic Planning

! Demand Planning

! Supply Planning

! Fulfillment

! Field Service

### CRM

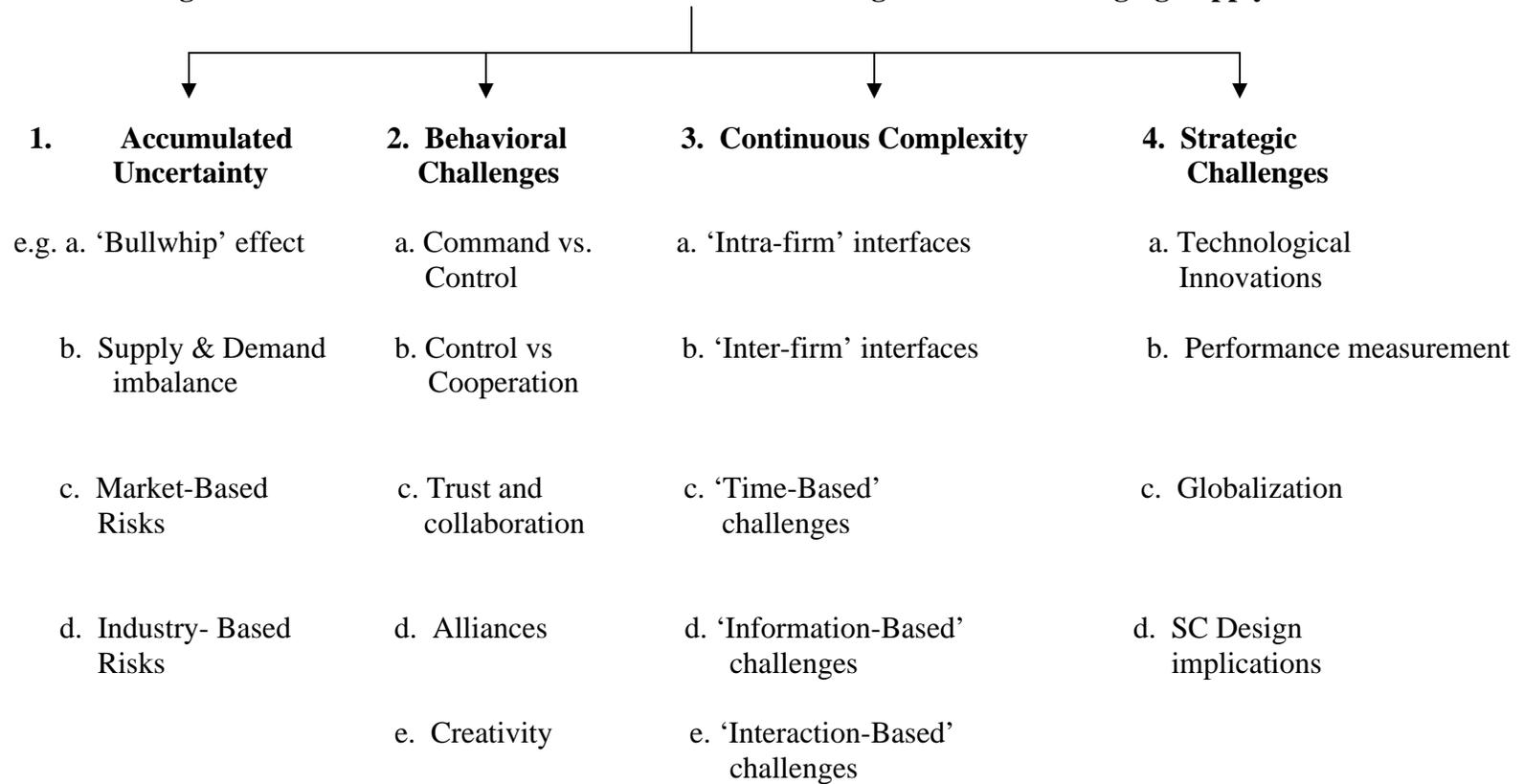
! Market

! Sell

! Call Center

! Order  
Management

**Figure 3 - A General “ABCD” Classification of Challenges Faced in Managing Supply Chains**



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