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# Title: Agility for flexible supply chains

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## ABSTRACT

*Business and economy are the backbones of each other. Change in one affects another. From the time business has become globalized, economy has begun to experience new and different aspects of business. Market and its volatility is another factor to introduce instability in business and to generate unpredictable circumstances in world economy.*

*Keeping all these points in mind, the paper has introduced the concept of agility in business and has explained the whole picture of business through agile supply chain. The paper reviews the concepts of agility and its role in supply chain through various research papers from different authors. Based on these papers, the paper communicates a message to SMEs for building agility ability to strengthen their competencies so as to sustain in the fluctuating market conditions and rapidly changing economic environment.*

*Further, the importance of agile supply chain is discussed at strategic level and matching supply chain strategies is emphasized with product type. Strategic decisions lead to governance of a firm that decides practices being followed in an enterprise with changing business paradigms. So, agility in supply chain is related with governance in the paper. Sustainability for an enterprise has its base on governance practices and supply chain is a key for better governance. In this reference, the role of agility and agile supply chain is highlighted for good governance. The paper concludes with the role of agility in business sustainability and thus, strongly advocating empowering of the enterprises with flexible supply chain to stand against every pulse of market fluctuations.*

## 1. Introduction

With the changing market scenario and international business patterns, enterprises now strive to survive in volatile market and unstable economic environment when customers have become center of the business and there is loosing significance of mass production of end product. According to the demand in market, enterprises are modifying their business processes and putting hard to optimize their economics. In such a state of affairs, large enterprises are dissolving into smaller enterprises; focusing on their respective core competencies to serve the customer in best possible and economic manner. This has resulted in better satisfaction to end consumers but on the other side, it has introduced some practices to optimize their profits which ultimately question on governance of business.

The paper highlights instability in market resulting in information gap and inefficient supply chains. In order to sustain in business, the concept of agility is introduced in the paper. Agility in business practices and flexibility in supply chain are communicated as key point for sustainability and better governance in the paper.

## 2. Instability in the supply chain

Supply management must be able to cope with the effects of demand instability but, for manufacturing companies, good supplier performance by itself does not mean that the whole supply chain is being properly managed. Even when problems relating to material availability are completely overcome, manufacturing may become a source of disturbance in the supply chain. Those disturbances in the production flow caused by frequent and unexpected changes in demand are called "turbulence". Bhattacharya *et al.* classify turbulence in five categories; design, volume, mix, schedule and process. Design turbulence relates to disturbances caused in the production flow by changes in product design. This kind of turbulence is very likely to occur when manufactured products have short life cycles or go through numerous design changes within their life cycle. This is precisely the case in mass customized markets such as those the automotive industry is tending to.

Volume turbulence is a consequence of changes in total production volumes and usually occurs in the form of capacity constraints or materials shortage. Manufacturing has to work with very short planning horizons and consequently may be prone to volume turbulence. Because products in mass customized markets have short life cycles it is difficult to buffer variations in demand (even when they are expected) by building stocks. This is a particular problem in tiered supply chains as seen in major sectors like automotive and aerospace. An Original Equipment Manufacturer (OEM) may have problems in the supply chain due to an aggregation/reduction of demand lower down in the supply chain. For example a fourth or fifth tier supplier will see overall demand from the OEM coming from different second or third tier suppliers. They may well see their demand change massively as a result of changes emanating from the OEM, even though the OEM is not visible to them as a customer.

Mix turbulence relates to the disturbances caused not by a change in the total production volume (which in this case can even remain quite steady) but by a change in the distribution of the volumes of the different products (or product models) manufactured in the same facility. Changes in the mix of products may lead to changes in loading among the different machining cells. If a machining cell is subject to a sudden increase in its inputs, and is not able to respond with a corresponding increase in its processing rates, it may become a bottleneck causing mix turbulence.

The difficulty of managing a complex an entity as the supply chain has pushed organizations to adopt initiatives such as concurrent engineering and late configuration, which attempt to remove some of the causes of turbulence, and thus reduce costs and time-to-solution. At production level, late configuration may be used to reduce mix turbulence. In this case most of the parts and subassemblies are manufactured and assembled on a made-to-stock basis. However, the final customer specified product is manufactured on a make-to-order basis. These techniques are effective to some degree in the elimination of turbulence. However, design solutions have their limits, and by dividing the process into a standard and a configuration stage, manufacturing turbulence is pushed forward rather than eliminated. As manufacturing companies strive to offer a wider range of product configurations in order to please each customer individually they will be constantly threatened by design, volume or mix turbulence. The most usual alternative to cope with manufacturing turbulence is by building stocks. Nevertheless, besides being a costly

option it can also be extremely risky when applied to mass customized markets, where most of the products have short life cycles.

## 3. Agility and the agile supply chain

Supply chain problems and market conditions have attracted the mind of enterprises towards agility in supply chain. Also, the technological advancements have also been found it right to be implemented.

Agility is the basis for achieving competitive advantage in changing market conditions. Its origins can be traced to an industry-led, federally-funded program, the Agile Manufacturing Enterprise Forum (operating as the Agility Forum) at Lehigh University, Pennsylvania. In 1995, Steven Goldman and his Agility Forum colleagues drew international attention to agility through their book *Agile Competitors and Virtual Organizations*. This book focused on "agile product development" in market conditions of increased complexity and increased urgency, and particularly the capabilities required by manufacturers to:

- Enrich the customer (through a greater variety of value-adding, short-lifetime, bespoke or customized goods and services).
- Master change (created by changing market conditions, including the actions of competitors, and internally-created by the need to develop a variety of customer-enriching products)
- Leverage resources (make every part of the organization contribute to its competitive advantage).
- Co-operate to compete (access the complementary resources of the supply chain and alliance partners). The authors further propose regarding the supply chain as a customer-supplier relationship.
- A customer is no longer the recipient in a one-time transaction but a subscriber to the solutions of a supplier.
- A supplier no longer hands over goods in response to an order but is a long-term supporter or partner of the customer.
- A sale is no longer a one-time event, but an on-going transfer of products and services, and of payment, between the supplier and customer.

This view is consistent with that of regarding the supply chain as being more than the exchange of data and information, and requiring higher levels of human knowledge and expertise to color its operations. Viewing agile production as involving (but by no means limited to) the management of supply chain relationships, Goldman *et al.* draw attention to the need for that relationship to be balanced over three dimensions: the enrichment of the customer by the supplier; the reward of the supplier by the customer; and the linkage of business processes between the two. At the least integrating level of each dimension, a (non-agile) supply chain relationship would involve enrichment through the delivery of simple standardized parts; reward through payment of unit price; and linkage through mail, fax and phone. At the most integrated level, an (agile) supply chain relationship would involve enrichment by the supplier providing a solution that is easily integrated by the customer, and which adds

value to the customer's customer; reward of the supplier through shared risk and revenue; and business linkage based on highly-integrated business processes using today's telecommunications tools. Thus, according to Goldman *et al.*, a fully-agile supply chain is as much to do with business relationships and technology as it is to do with production process.

Goldman *et al.* set out a strategic blueprint for an agile manufacturing process, while also demonstrating that such a process could only survive in an enterprise that was itself agile. More recently, Metes *et al.* addressed agility at the whole-enterprise level. Their book *Agile Networking* identified how business processes built upon Internet and intranet networking provided capabilities required by the truly agile enterprise. Among a number of other networking-based processes that enable agility, these authors refer specifically to change proficiency and agile networked alliances. In discussing change proficiency, Metes *et al.* outline an agile capability most fully developed by Dove. Change proficiency is an analysis of a producer's proficiency in eight "Change Proficiency Domains": Creation, capacity, capability, reconfiguration, migration, performance, improvement and recovery. Through this analysis, fully defined by Dove, it is possible for any producer, or, in this instance, a supply chain or member within it, to optimize its ability to respond to change. Agile networked alliances are network-enabled relationships between organizations that can be formed and dissolved rapidly, but while in operation enable an affiliation between parties that is focused on enriching customers, mastering change, leveraging (all parties') resources, and thus co-operating to compete for mutual commercial benefit. While not identified as such by Metes *at al.*, an agile networked alliance within a supply chain could be viewed as an agile supply chain. Rather than vertical, dualistic, clustered, or regional, as described earlier, an agile supply chain would be based on relationships exhibiting a high-level balance of enrichment, reward and linkage as defined by Goldman *et al*. and incorporating knowledge and expertise as argued here. It would display high levels of change proficiency as fully explored by Dove. Members would also display Metes *et al*.'s criteria for membership of an agile networked alliance: the proficiency, culture and the technology for open, inter-company networking; a mature appreciation of the intellectual assets that can and cannot be disclosed; and the ability to operate rapid decision-making and approval processes - including those needed to establish and dissolve the network.

**The Agile Supply Chain: Competing in Volatile Markets**

The importance of time as a competitive weapon has been recognized for supply chains. The ability to be able to meet the demands of customers for ever-shorter delivery times and to ensure that supply can be synchronized to meet the peaks and troughs of demand is clearly of critical importance in this era of time-based competition. To become more responsive to the needs of the market requires more than speed, it also requires a high level of maneuverability that today has come to be termed *agility*.

## 4. Agile Supply Chain Attributes

Agility is applied when the attributes of the market place are fashion and volatile in the short-term (Mason-Jones et al 2000a). More specifically, agile supply chains satisfy needs in customized market segments that change rapidly, so they offer customized products and wide product range under a very unpredictable demand.

Therefore, the focus of this sort of supply chain is availability and their profit margins are high. Christopher (2000) emphasized that agility in individual companies can be considerably hindered by the degree of complexity in terms of brands, products, structures and management processes. Therefore, in order to achieve supply chain agility, companies must change dynamically alongside with the market changes, and should reduce as possible the unnecessary complexity of their systems. It is important to determine the impact of complexity and rigidity, under an agile environment, on Green Logistics performance.

- **Agility Ability**

Is 'agility' just the latest buzz-word to engulf the IT world, or is it something that is needed to be taken seriously in order to do the day-to-day jobs? Whether you call it 'flexibility' or 'agility', the concept is crucial to the rapidly changing, revenue-focused enterprise of today. It is needed to understand and to demonstrate agility, because if they don't, not only will the bonuses not be forthcoming, but also they are unlikely to survive in their current roles.

Agility is the ability to develop solutions that don't rely on large, new packages and then to market those solutions to stakeholders in a way that gets quick and effective buy-in. With globalised competition, we have seen how supply chain experts Dell and Wal-mart have crushed their competition. They've set new benchmarks to cope with the ever-shorter time-to-market cycles facing their industries. They have done it by placing an emphasis on encouraging and empowering their people to think innovatively and work cross-functionally. In recruiting agile CIOs, it has been found people with depth not only in technology or in a particular industry, but who also have a blend of skills such as:

- A deep curiosity about the business's customers – who they are, what they want and more particularly, what they are going to demand in the next few years as a result of technological advances.
- An understanding about what's happening externally and the intellectual content to drive massive transformation, to have a "seat at the table" and to push the thinking of the businesses leadership team. The agile CIO must turn "on a dime" and be aware of competitors and marketplace changes.
- The ability to create an agile team around them. The agile CIO has the creativity, the vision, the leadership and the management skills to inspire and motivate others. Their team needs to be flexible, cross-functional and cross-border to lead innovation and drive implementation. This translates into business and development plans that focus on motivating people to think beyond traditional paradigms and come up with new ways of driving productivity and customer satisfaction.
- Financial expertise. In order to work more closely with the CEO and leaders of the business internally, agile CIO's must be laser-focused on financial results and have the requisite financial skills to interpret business outcomes. In order to compete against rivals cranking out new products and services in ever-shorter time cycles, they must know how to align IT priorities with people, customers, and process.

In terms of execution, today's agile CIO needs to be aware of "concurrent engineering". This is all about scenario planning and reducing the design-to-execution

cycle. Instead of taking consequential steps that pause and wait for one thing to happen before another can begin, projects can be kicked off with a “rolling start” where research is already under way as other parts of the build process are being put into place. A corporation today also needs to be ready to make long-term deals with key suppliers – which naturally imply a long-term commitment to customers. The supplier can then be brought more into line with the company’s schedules and supply chain requirements to cut cost and speed up execution.

- **Virtual Teaming**

Recent developments in communication and information technology, coupled with an increased need to coordinate organizational activities across geographically dispersed locations, have led to the development and use of virtual teams. The term virtual team is defined by Henry & Hartzler as follows:

"*Groups of people who work closely together even though they are geographically separated and may reside in different time zones in various parts of the world.”* Also as "*cross-functional workgroups brought together to tackle a project for a finite period of time through a combination of technologies*." And “*members may occasionally meet face-to-face, but this is clearly the exception due to the physical separation of their “home” location.*”

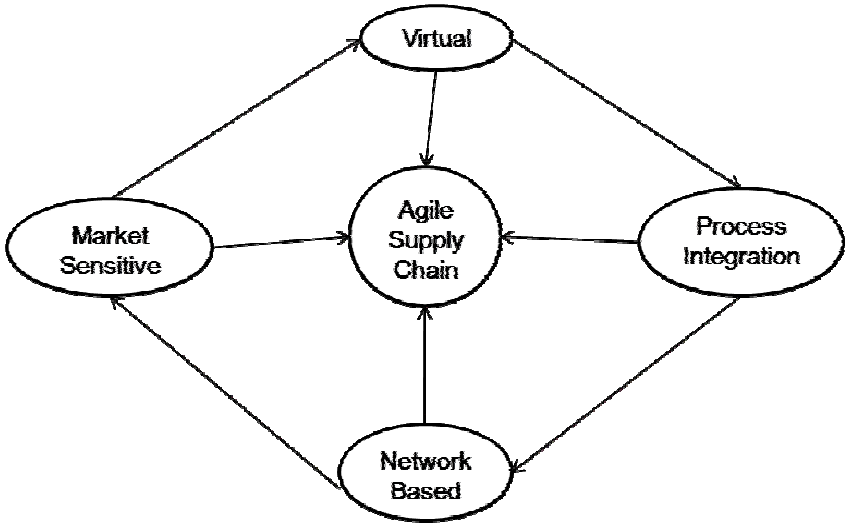
Virtual teaming eliminates the necessity for physical co-location thus enabling manufacturers to rapidly and continuously collaborate with suppliers world-wide irrespective of geographical constraints. To achieve high levels of performance, virtual teaming requires the coordinated development of people, process and technology.

The design, manufacture and delivery of a product requires ever-higher levels of knowledge and expertise within the supply chain - above and beyond the exchange of information and data - if turbulence in tiered supply chains is to be fully overcome. The agility philosophy goes so far as proposing that successful, agile, supply chains are built on rich relationships amongst all parties: certainly embodying knowledge and expertise. Virtual teaming is the most appropriate framework and mechanism in which to examine how such rich relationships - and the exchange of knowledge and expertise - can be created across a distributed supply chain. In principle, virtual teaming could allow joint commitment, feelings of mutuality, trust and creativity, and rapid decision-making to operate within a supply chain, regardless of the geographical location of its members. For this to be possible, however, a virtual team needs to be built by concentrating on process, teaming and technology factors. However experience from other IT-based initiatives is that technology will be concentrated on to the exclusion of other factors. Data from the two sources shown here supports this contention. However, if implemented correctly, virtual teaming could be a significant innovation in effective management of an agile supply chain.

## 5. The routes to agility

To be truly agile, a supply chain must possess a number of distinguishing characteristics as figure suggests. Firstly, the agile supply chain is *market sensitive*. By market sensitive is meant that the supply chain is capable of reading and responding to real demand. Most organizations are forecast-driven rather than demand-driven. In other words because they have little direct feed-forward from the

marketplace by way of data on actual customer requirements they are forced to make forecasts based upon past sales or shipments and convert these forecasts into inventory. The breakthroughs of the last decade in the form of Efficient Consumer Response (ECR) and the use of information technology to capture data on demand direct from the point-of-sale or point-of-use are now transforming the organization's ability to hear the voice of the market and to respond directly to it.




The use of information technology to share data between buyers and suppliers is, in effect, creating a *virtual* supply chain. Virtual supply chains are information based rather than inventory based.

Conventional logistics systems are based upon a paradigm that seeks to identify the optimal quantities of inventory ands its spatial location. Complex formulae and algorithms exist to support this inventory-based business model. Paradoxically, what we are now learning is that once we have visibility of demand through shared information, the premise upon which these formulae are based no longer holds. Electronic Data Interchange (EDI) and now the Internet have enabled partners in the supply chain to act upon the same data i.e. real demand, rather than be dependent upon the distorted and noisy picture that emerges when orders are transmitted from one step to another in an extended chain.

Shared information between supply chain partners can only be fully leveraged through *process integration*. By process integration is meant collaborative working between buyers and suppliers, joint product development, common systems and shared information. This form of co-operation in the supply chain is becoming ever more prevalent as companies focus on managing their core competencies and outsource all other activities. In this new world a greater reliance on suppliers and alliance partners becomes inevitable and, hence, a new style of relationship is essential. In the extended enterprise, as it is often called, there can be no boundaries and an ethos of trust and commitment must prevail. Along with process integration comes joint strategy determination, buyer-supplier teams, transparency of information and even open-book accounting.

This idea of the supply chain as a confederation of partners linked together as a *network* provides the fourth ingredient of agility. There is a growing recognition that individual businesses no longer compete as stand-alone entities but rather as supply chains. We are now entering the era of network competition. where the prizes will go

to those organizations who can better structure, co-ordinate and manage the relationships with their partners in a network committed to better, closer and more agile relationships with their final customers. It can be argued that in today's challenging global markets, the route to sustainable advantage lies in being able to leverage the respective strengths and competencies of network partners to achieve greater responsiveness to market needs.

## 6. Agile supply chain at strategic level

At a strategic level, an agile supply chain can be described. However, to describe the strategic model does not help in creating a mechanism that implements it. We believe that virtual teaming, a new working arrangement that incorporates technology, process, and human factors, offers the means of coordinating and controlling an agile supply chain. Our argument is that virtual teaming offers a new model and direction for minimizing supply chain turbulence. Its principal virtue is that it permits human collaboration regardless of location. This means that the delay and disturbance to communication that is caused by supply chain members being geographically separated can be overcome. Indeed, a successful agile supply chain based on virtual teaming principles would operate more like a continuous collaboration between members, rather than episodic meetings. Such collaboration supplies the strategic oversight and flexibility - based on knowledge and expertise - necessary to be effective in dealing with the complexity resulting from supply chain turbulence. That collaboration also leads to greater responsiveness in solving supply chain problems. It provides the means to operate a regional network, as described by Porter, regardless of the geographical distribution of its members.

**The 'Lean' vs 'Agile' Debate**

There are concerns about the longer-term value of leanness. One of the themes which have emerged and which we have since developed is how the concept of agility relates to that of leanness. Five major differences in emphasis have emerged:

*What is the primary goal?* For agility, it is to focus on meeting end customer demand instantaneously. For leanness, the goal is to eliminate waste from the supply chain. 'This is an absolute rather than a relative standard which can provide the essential North Star for any organization' (Womack and Jones, 1996).

*How do the linkages work?* Agility is associated with the concept of the virtual supply chain, where partners are reconfigured according to new market opportunities. Leanness is associated with long-term supply chain partnerships which are strengthened over time. In the more extreme form, such as the Japanese *keiretsu* system, the supply chain is modeled on long-term partnerships reinforced by cross-shareholdings.

*How is performance measured?* The key measures of agility are based on customer-facing metrics such as orders met on time in full. Leanness typically emphasizes *world class* measures of performance based on quality and productivity. If your operations are lean, the thinking goes, and then your products will win orders in the market place from non-world class competitors.

*How is work organized?* Agility emphasizes the need for self management for those who work in the process. 'We need to develop people who are capable of taking risks and responding immediately to new opportunities'. Leanness emphasizes the

need for work standardization, that is, to do it the same way the same time every time. While leanness also emphasizes continuous improvement, this must be carried out within an overall 'frozen', disciplined environment.

*How is work planned and controlled?* Agility emphasizes the need for immediate interpretation of customer demand and instantaneous response. This means that inventory reduction and capacity utilization are not the primary goals. Leanness emphasizes the need to protect the operations core by a fixed period in the planning cycle to help balance resources, synchronize material movements and reduce waste.

This is not to suggest that the concept of agility should replace that of leanness. Rather, agility is a better long term strategy for a supply chain to cope with turbulence in mass markets referred to above. Here, leanness should be viewed as an enabler to agility. And some markets will remain as commodity-oriented, where the lean emphasis on waste reduction and continuous improvement help to deliver the year-on-year price reductions such markets demand.

**Hybrid strategies are often appropriate**

There will be occasions when either a pure agile or lean strategy might be appropriate for a supply chain. However there will often be situations where a combination of the two may be appropriate i.e. a hybrid strategy.

Hybrid supply chain strategies recognize that within a mixed portfolio of products and markets there will be some products where demand is stable and predictable and some where the converse is true. As Fisher has pointed out it is important that the characteristics of demand are recognized in the design of supply chains. However, it is not necessarily the case that a supply chain should be either lean or agile. Instead a supply chain may need to be lean for part of the time and agile for the rest. Zara the Spanish fashion company provides a good example of this hybrid supply chain strategy.

Zara is one of Spain's most successful and dynamic apparel companies, producing fashionable clothing to appeal to an international target market of 18 to 35 year-olds. Zara's international market positioning places it in direct competition with some of the most skilled operations in the business; including Italian fashion giant Benetton and US-based The Gap and The Limited. Its rapid growth and on-going success in such a fiercely competitive environment is in fact a testament to its ability to establish an agile supply chain which still incorporates many lean characteristics. The pursuit of this hybrid strategy has enabled Zara to develop one of the most effective quick-response systems in its industry.

The whole process of supplying goods to the stores begins with cross-functional teams - comprising fashion, commercial and retail specialists - working within Zara's Design Department at the company's headquarters in La Coruña. The designs reflect the latest in international fashion trends, with inspiration gleaned through visits to fashion shows, competitors. Stores, university campuses, pubs, cafes and clubs, plus any other venues or events deemed to be relevant to the lifestyles of the target customers. The team's understanding of fashion trends is further guided by regular inflows of EPOS data and other information from all of the company's stores and sites around the world.

Raw materials are procured through the company's buying offices in the UK, China and The Netherlands, with most of the materials themselves coming in from Mauritius, New Zealand, Australia, Morocco, China, India, Turkey, Korea, Italy and

Germany. Approximately 40% of garments - those with the broadest and least transient appeal – are imported as finished goods from low-cost manufacturing centers in the Far East. The rest are produced by quick-response in Spain, using Zara's own highly automated factories and a network of smaller contractors. Material or fabric is also held in greige. i.e. undyed and unprinted and if demand for a particular garment turns out to be higher than expected then local manufacturers can quickly manufacture additional product. Zara's manufacturing systems are similar in many ways to those developed and employed so successfully by Benetton in Northern Italy, but refined using ideas developed in conjunction with Toyota. Only those operations which enhance cost-efficiency through economies of scale are conducted in-house (such as dying, cutting, labeling and packaging). All other manufacturing activities, including the labor-intensive finishing stages are completed by networks of more than 300 small subcontractors, each specializing in one particular part of the production process or garment type. These subcontractors work exclusively for Zara's parent, Inditex SA. In return they receive the necessary technological, financial and logistical support required to achieve stringent time and quality targets. The system is flexible enough to cope with sudden changes in demand, though production is always kept at a level slightly below expected sales, to keep stock moving. Zara has opted for undersupply, viewing it as a lesser evil than holding slow-moving or obsolete stock.

**Matching supply chain strategies with product type**

Many organizations have adopted the lean thinking paradigm (Womack and Jones 1994) in their drive to optimize performance and improve competitive position. Recently, the agile manufacturing paradigm has been highlighted as an alternative to leanness (Richards 1996). It has also been suggested that agility is the next step after leanness. This could mean that, once leanness has been achieved, an enterprise should strive for agility or even that agility should be the goal of an enterprise and leanness as a primary objective should be forgotten. These discussions oversimplify the situation as they fail to take into consideration the generic product type and hence the business environment and response requirements needed to match adequately supply chain design to the required structure. The following definitions relate the agile and lean paradigms to supply chain strategies and were developed to emphasize the distinguishing features of each (Naylor *et al*. 1999).

- **Agility** means using market knowledge and a virtual corporation to exploit opportunities in a *volatile* marketplace
- **Leanness** means developing a value stream to eliminate all waste, including time, and to ensure a *level* schedule

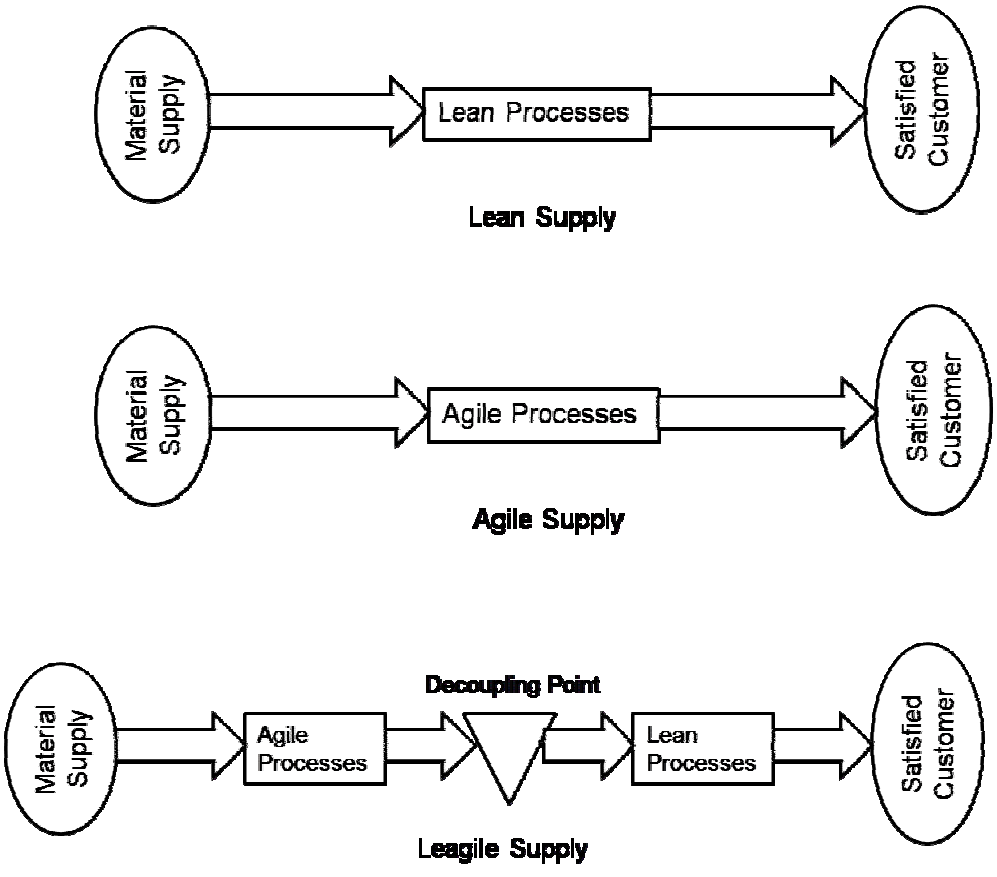
It should be noted that what may be regarded as `waste' in lean production may conversely be essential in agile production. As McHugh *et al*. (1995) have emphasized, one example is the question of capacity requirements. In lean production, the customer buys specific products, whereas in agile production the customer reserves capacity that may additionally need to be made available at very short notice. As can be seen from the above definitions, the commodities are very well suited to the lean environment as demand is relatively predictable and therefore facilitates the level schedule requirements necessary for a lean supply chain (Suzaki 1987). Conversely the characteristics of fashion products are more suited to the agile environment where the unpredictability of the demand is accepted as a business risk and the strategy is developed to optimize performance in such an arena. A blanket approach across the whole supply chain may, however, not be appropriate. Leanness and agility can

sometimes be combined with the strategic use of a decoupling point, thereby capitalizing on the benefits of both paradigms as shown in figures.

Thus, there are some instances where there is an economic justification for engineering a `Leagile' supply chain, thereby getting the best of both worlds. This combined approach is known as `Leagility' and, as a consequence, the supply chain can thereby adopt a lean manufacturing approach upstream, enabling a level schedule and opening up an opportunity to drive down costs upstream while simultaneously still ensuring that downstream of the de-coupling point there is an agile response capable of delivering to an unpredictable marketplace. The formal definitions required are as follows.

`**Leagile i**s the combination of the lean and agile paradigms within a total supply chain strategy by positioning the decoupling point so as to best suit the need for responding to a volatile demand downstream yet providing level scheduling upstream from the marketplace.' (Naylor *et al*. 1997)

**The decoupling point** is the point in the material flow streams to which the customer's order penetrates. It is here where order-driven and the forecast-driven activities meet. As a rule, the decoupling point coincides with an important stock point ± in control terms a main stock point ± from which the customer has to be supplied.' (Hoekstra and Romme 1992)




**Minimize uncertainty to maximize competitive advantage**

Despite the differences in the types of market uncertainty present in the lean, agile and leagile paradigms, the Bullwhip mechanism and resultant detrimental system induced uncertainties are the same for all the approaches. Therefore, it does not matter which paradigm is adopted, the system-induced uncertainty effects can still seriously hamper the effectiveness of the strategy. Therefore, it is crucial that system-induced uncertainty is reduced to ensure that the performance opportunities available via implementing a particular strategy are fully realized.

Classifying supply chain design and operations according to the Lean, Agile and Leagile Paradigms enables us to match the supply chain type according to marketplace need. These results in three fundamental designs illustrated in the real world by mechanical precision products (lean); carpet manufacture (agile); and electronics products (leagile). Such a classification proves clear rules for supply chain engineering for each market segment. This enables us to apply lean principles, agile principles and leagile principles according to the real needs of the specific supply chain. However, for all three supply chain types it is essential to remove system-induced uncertainty, as typified by the `Bullwhip' effect. Leagile supply chains already exist in the real world. What is important is to recognize when the new paradigm is the best way forward for a particular supply chain so that it may be appropriately engineered from the outset.

## 7. The supply chain: A key link for better governance

Globalization has given rise to a kind of economic "culture shock" and international business is one of the principal sufferers. Tens of thousands of companies are trying to conduct business in a global mosaic of legal, regulatory, business and social environments. Operating in all of these environments and responding to their diverse expectations of corporate behavior is a formidable challenge, in particular as public (and market) pressure becomes more intense. Many companies have taken positive steps by introducing corporate codes, embracing multilateral principles and so on, yet, according to participants at a recent roundtable on the OECD Guidelines for Multinational Enterprises there is much more to do. Take a recent study of the results of audits of 300 supplier establishments operating in developing countries that was financed and published by a group of leading French retailers. In the view of Neil Kearney of International Textile, Garment and Leather Workers' Federation "the details make grim reading" – children under 13 hard at work, non-compliance with minimum wage laws, working weeks of "86 hours or more", "inadequate" occupational health and safety conditions, "endemic" abuse of workers' rights, including suppliers using physical force to prevent workers from exercising their right to organize. Other documents highlighted obstacles to organizing labor unions and the presence of children in the supply chains of major agri-food companies. These are probably exceptional cases and most good corporations would not tolerate them, but where they exist, all would agree they must be taken seriously.

Business generally argues that the key lies in better supply chain management to alleviate poverty and improve respect of human rights; others see tighter regulation and surveillance as the only way to achieve progress. Deborah White of Proctor and Gamble said the business community was committed to finding answers, and while André Driessen from the Confederation of Netherlands Industries and Employers underscored the business sector's willingness to co-operate with unions, NGOs and

governments to search for solutions, Stephen Canner of the US Council for International Business noted that governments have to act too as "there are limits to what companies can and cannot do". Others countered that while governments clearly had an important job to do, lack of government responsibility "is not an excuse for lack of corporate responsibility".

Can domestic law help? Yes, but it is not enough. Some countries like China, as Serena Lillywhite from Brotherhood of Saint Laurence, an NGO that inherited a small business, noted, set certain labor standards and rules that matched those of many OECD countries, but their enforcement was lacking. International declarations on labor and human rights, and standards and principles such as those from the OECD help to fill that vacuum, as do corporate codes of conduct and other private standards issued by labor unions and NGOs. Business representatives stressed their view that corporate responsibility in the supply chain could not extend to "taking on" other companies' problems – in particular, their legal or regulatory responsibilities.

Companies exist as discrete units for reasons of economic efficiency and legal accountability. In any case, it is not economically or logistically feasible for all enterprises to monitor and audit all their suppliers. This position sparked a reaction. Carol Pier of Human Rights Watch argued that when companies fail to use their influence over their suppliers' regarding respect of labor rights, these companies are complicit in those human rights violations. Ineke Zeldenrust of the Clean Clothes Campaign was pragmatic in stressing responsible supply chain management and the need to "break it down … and look at how it (supply chain management) can be operationalized."

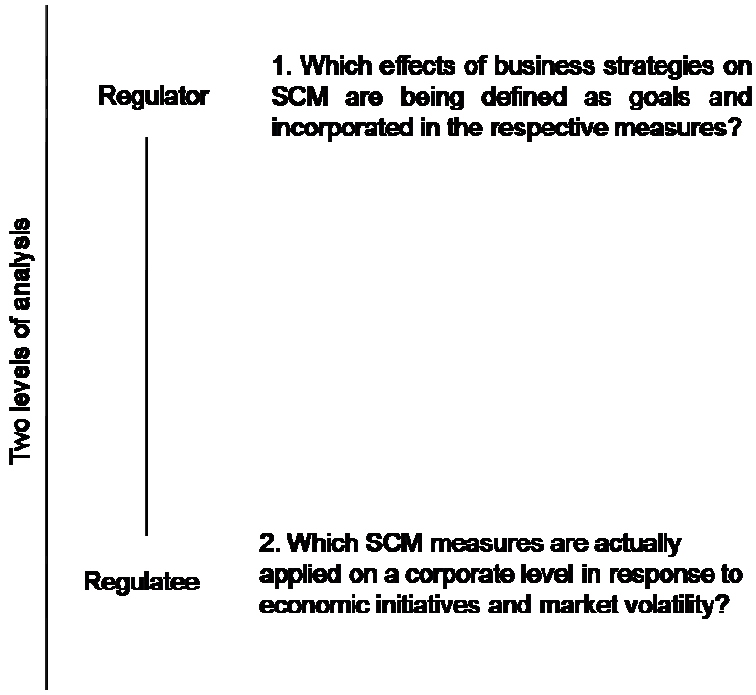
## 8. Global Restructuring and Supply Chain Governance: Challenges to Firms and Regions

- **Outsourcing and the Growing Importance of Suppliers**
  - OEMs focus on "core competencies"
    - Meet global competition
    - Respond flexibly to volatile markets
    - Accelerated pace of technological innovation
    - Increased complexity of production
  - Outsourcing and decentralization of production
    - More and more value is added *outside* the OEMs
    - OEMs increasingly seek to partner with independent suppliers
    - Suppliers more likely to be responsible for *all* aspects of key components, including technology and design
    - But SMEs often lack the capabilities to meet resulting new demands
- **From Capacity to Specialized Subcontracting**
  - A *relative* shift
    - *Capacity subcontracting*: the OEM retains substantial internal capacity, sources to meet demand peaks

- *Specialized subcontracting*: the OEM becomes reliant – at least in the short and medium term – on the subcontractors' specialized technology, expertise, and/or skills.

- **OEM Procurement Strategies: Common Goals, but How to Get There?**
  - Goals: enhance flexibility and reduce cost for rapid market response
    - Increased reliance on (fewer) suppliers to perform operations formerly done in-house
    - Improved supplier performance: price, quality, delivery, lead times
  - Competing pathways
    - Modularization vs. the persistence of integrated design
    - Collaboration, open information sharing and joint exploration of goals, backed up by new training services to suppliers
    - "Build-to-print", old school arms-length relationships
    - Supplier segmentation or hedging strategies?

## 9. Governance and SCM - Emerging questions and their answers




The last few decades have witnessed a dramatic shift in the manner in which business is conducted around the world. Firms have shifted away from a hierarchical, one-dimensional supply chain entity to a fragmented network in favor of strategic partnerships with external entities. This global phenomenon causes ripple effects throughout the old supply network. Many businesses, facing challenges that

accompany such change, are struggling to compete in this new landscape. On the other hand, the fragmentation creates opportunities for whole new set of supply chain services. We conjecture that such a fragmented state will not be sustainable as there is a creation of information gap among entities and transparency is not maintained. Every one looks for its safer side which diverts the business towards uneconomical side. In past days, the business was done based on forecasted data for a long term and historical facts. Now, this fragmentation has forced enterprises to think on agile side of the business. Short term forecasting and following the changes in market forces will drive the business towards economical side and will provide strength to sustain in an unstable environment.

This defragmentation has resulted into cost control efforts leading to low cost labor, violation of corporate codes, violation of minimum wage laws, working weeks of “86 hours or more”, “inadequate” occupational health and safety conditions, “endemic” abuse of workers’ rights, including suppliers using physical force to prevent workers from exercising their right to organize. Apart from these, environmental care has been continuously ignored and to cut down their costs, a number of enterprises have been polluting environment. At times, when the world is talking about global warming and climate change issues, supply chain governance can present innovative solutions for the enterprises to stand against challenges of market volatility and economic fluctuations.

It has been believed that there will be a period of disintegration followed by reintegration facilitated by an independent third party, the mini-maestro.

## 10.Conclusion

As the process of disintegration and reintegration continues, it is becoming clear that the emerging aggregate players will become companies of the future. These mini-maestros are required to bring innovation and efficiency to the network by orchestrating the flow of goods, and information between multiple entities and by dynamically reconfiguration the network to cope up with market changes and economic fluctuations. Much of the competition in the business world will center on gaining and maintaining the orchestration role for a value chain or industry. Clearly, becoming part of the network is essential; yet becoming the conductor of the network will be even more critical. Looking forward, it is important to understand the impact these aggregators have on the local economies where they operate. Such an insight is instrumental in comprehending the development of trust, quality of service and sustainability in networks made up of small businesses in developing markets. With this research, we are able to relate market and economic fluctuations with agility in business. Also we are able to highlight the responsibilities of enterprises for having better supply chain governance in order to stay economical and efficient. In order to avoid over generalization, future research could focus on a comprehensive framework for mini-maestros from the viewpoint of the impact on local economies. To accomplish this, there needs to be a thorough understanding of the nature, strength and evolution of the local companies that grew out of relationships with the aggregator, the expectation and perception of both, evidence and measures of economic contribution to firms and local communities, and finally, the rules of engagement and disengagement set forth.

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- Agile Supply Chain Research Centre
- http://www.cranfield.ac.uk/som/cclt/agile1.htm
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