



The Agile Supply Chain

Competing in Volatile Markets

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Turbulent and volatile markets are becoming the norm as life cycles shorten and global economic and competitive forces create additional uncertainty. The risk attached to lengthy and slow-moving logistics “pipelines” has become unsustainable, forcing organizations to look again at how their supply chains are structured and managed. This paper suggests that the key to survival in these changed conditions is through “agility,” in particular by the creation of responsive supply chains. A distinction is drawn between the philosophies of “leanness” and “agility,” and the appropriate application of these ideas is discussed. © 2000 Elsevier Science Inc. All rights reserved.

INTRODUCTION

The importance of time as a competitive weapon has been recognized for some time [1]. 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 [2].

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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*.

WHAT IS AGILITY

Agility is a business-wide capability that embraces organizational structures, information systems, logistics processes, and, in particular, mindsets. A key characteristic of an agile organization is flexibility. Indeed, the origins of agility as a business concept lies in flexible manufacturing systems (FMS).

Initially, it was thought that the route to manufacturing flexibility was through automation to enable rapid change (i.e., reduced set-up times) and, thus, a greater responsiveness to changes in product mix or volume. Later, this idea of manufacturing flexibility was extended into the wider business context [3] and the concept of agility as an organizational orientation was born.

Agility should not be confused with *leanness*. Lean is about doing more with less. The term is often used in connection with lean manufacturing [4] to imply a “zero inventory” just-in-time approach. Paradoxically, many companies that have adopted lean manufacturing as a business practice are anything but agile in their supply

Agility is an important factor in supply chains.

chain. The car industry, in many ways, illustrates this conundrum. The origins of lean manufacturing can be traced to the Toyota Production System (TPS) [5], with its focus on the reduction and elimination of waste.

While the lessons learned from the TPS principles have had a profound impact on manufacturing practices in a wide range of industries around the world, it seems that the tendency has been for the benefits of lean thinking to be restricted to the factory. Thus, we encounter the paradoxical situation where vehicle manufacturing is extremely efficient with throughput time in the factory, typically down to 12 hours or less, yet inventory of finished vehicles can be as high as 2 months of sales—and still the customer has to wait for weeks or even months to get the car of his or her choice!

While leanness may be an element of agility in certain circumstances, by itself it will not enable the organization to meet the precise needs of the customer more rapidly. Webster's Dictionary makes the distinction clearly when it defines lean as "containing little fat," whereas agile is defined as "nimble."

There are certain conditions where a lean approach makes sense, in particular where demand is predictable and the requirement for variety is low and volume is high—the very conditions in which Toyota developed the lean philosophy. The problems arise when we attempt to implant that philosophy into situations where demand is less predictable: The requirement for variety is high and, consequently, volume at the individual stock keeping unit (SKU) level is low—a set of characteristics which is more typical of the Western automobile industry. In other

words, it could be argued that many firms have been misguided in their attempts to adopt a lean model in conditions to which is not suited.

Figure 1 suggests that the three critical dimensions of *variety*, *variability* (or predictability) and *volume* determine which approach—agile or lean—make greatest sense.

Agility might, therefore, be defined as the ability of an organization to respond rapidly to changes in demand, both in terms of volume and variety. The market conditions in which many companies find themselves are characterized by volatile and unpredictable demand; hence, the increased urgency of the search for agility.

THE ROUTES TO AGILITY

To be truly agile, a supply chain must possess a number of distinguishing characteristics, as suggested in Figure 2. The agile supply chain is *market sensitive*. Market sensitive means 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 on 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 on a paradigm that seeks to identify the optimal quantities of inventory and its spatial location. Complex formulae and algorithms exist to support this inventory-based business model. Paradoxically, we are now learning that once we

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Market sensitivity is essential.

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*. Process integration means collaborative working between buyers and suppliers, joint product development, common systems, and shared information. This form of cooperation 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, coordinate, 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.

HYBRID STRATEGIES ARE OFTEN APPROPRIATE

There will be occasions when a “pure” agile or a lean strategy might be appropriate for a supply chain. How-

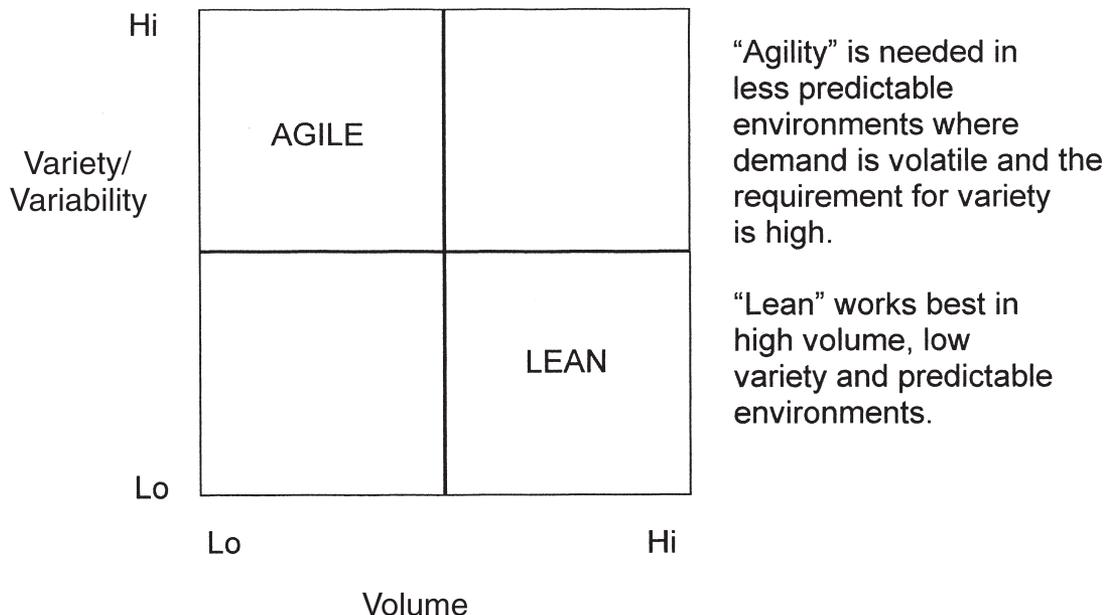


FIGURE 1. Agile or Lean.

Information technology is vital.

ever, 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 products where the converse is true. As Fisher points out [6], 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 [7]. Zara is one of Spain's most successful and most dynamic apparel companies, producing fashionable clothing that appeals to an international target market of those between the ages of 18 and 35. Zara's international market positioning places it in direct competition with some of the most skilled operations in the business, including Italian fash-

ion giant Benetton and U.S.-based Gap and The Limited. Zara's 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, Spain. 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 relevant to the lifestyles of the target customers. The team's understanding of fashion trends is further guided by regular inflows of electronic point of sale (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 United Kingdom, China, and The Netherlands, with most of the materials themselves coming from Mauritius, New Zealand, Australia, Morocco, China, India, Turkey, Korea, Italy, and Germany. Approximately 40% of the 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, local manufacturers can then quickly manufacture additional products.

Zara's manufacturing systems are similar in many ways to those developed and employed so successfully by Benetton in Northern Italy, but they are refined using ideas developed in conjunction with Toyota. Only those operations that enhance cost-efficiency through economies of scale (such as dyeing, cutting, labeling, and packaging) are conducted in-house. All other manufacturing activities, including the labor-intensive finishing stages,

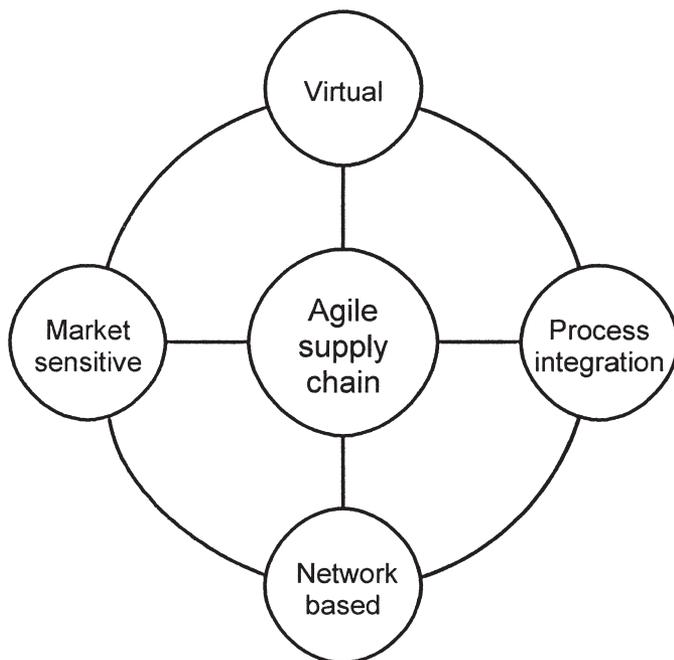


FIGURE 2. The agile supply chain.

Hybrid strategies are effective.

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, although production is kept always at a level slightly below expected sales to keep the stock moving. Zara has opted for undersupply, viewing it as a lesser evil than holding slow-moving or obsolete stock.

THE ROLE OF THE DE-COUPLING POINT

A major problem in most supply chains is their limited visibility of real demand. Because supply chains tend to be extended with multiple levels of inventory between the point of production and the final marketplace, they tend to be forecast-driven rather than demand-driven.

The point at which real demand penetrates upstream in a supply chain may be termed *the de-coupling point*. Pre-

viously, this idea has been termed *the order penetration point* [8]. However, the issue is not how far the order penetrates, but how far real demand is made visible. Orders are aggregations of demand, often delayed and distorted due to the actions and decisions of intermediaries [9]. On the other hand, demand reflects the ongoing requirement in the final market place as close to real-time as possible.

The de-coupling point should also dictate the form in which inventory is held. Thus, as in the uppermost example in Figure 3, demand penetrates right to the point of manufacture, and inventory is probably held in the form of components or materials. In the lowermost example, demand is only visible at the end of the chain. Hence, inventory will be in the form of finished product. The aim of the agile supply chain should be to carry inventory in a generic form—that is, standard semifinished products awaiting final assembly or localization. This is the concept of *postponement*, a vital element in any agile strategy.

Postponement, or delayed configuration, is based on the principle of seeking to design products using common platforms, components, or modules, but where the final assembly or customization does not take place until

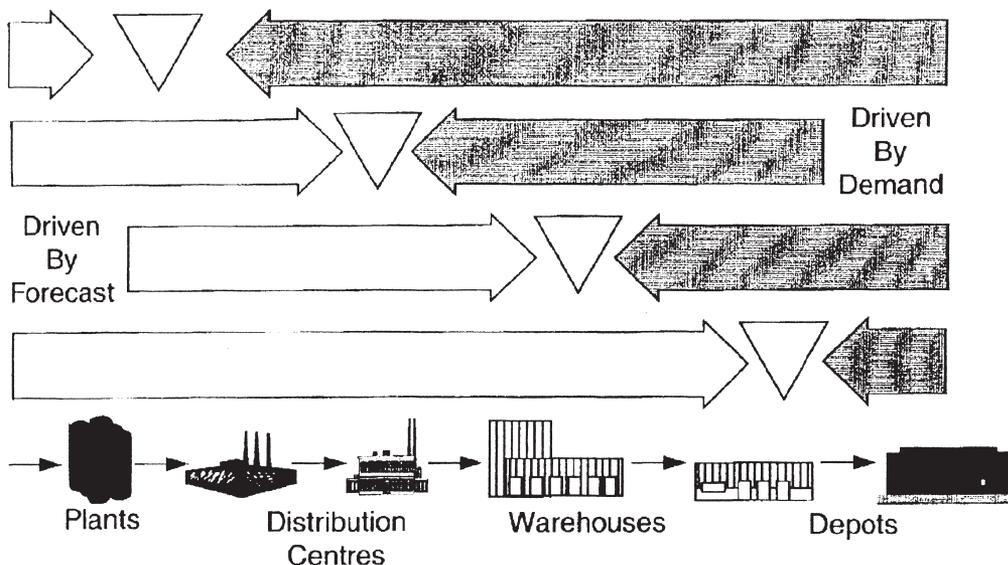


FIGURE 3. De-coupling points and strategic inventory.

Postponement is an important supply chain tactic.

the final market destination and/or customer requirement is known.

There are several advantages of the strategy of postponement [10]. First, inventory can be held at a generic level so that there will be fewer stock-keeping variants and, hence, less inventory in total. Second, because the inventory is generic, its flexibility is greater, meaning that the same components, modules, or platforms can be embodied in a variety of end products. Third, forecasting is easier at the generic level than at the level of the finished item. This last point is particularly relevant in global markets where local forecasts will be less accurate than a forecast for worldwide volume. Furthermore, the ability to customize products locally means that a higher level of variety may be offered at a lower total cost, enabling strategies of “mass customization” to be pursued.

The challenge to supply chain management (SCM) is to seek to develop “lean” strategies up to the de-coupling point, but “agile” strategies beyond that point. In other words, by using generic or modular inventory to postpone the final commitment, it should be possible to achieve volume-oriented economies of scale through product standardization. The flow of product up to the de-coupling point may well be forecast-driven; the flow of product after the de-coupling point should be demand-driven.

An important point to recognize is that there are actually two de-coupling points. The first is the one already referred to; i.e., the *material* de-coupling point, where strategic inventory is held in as generic a form as possible. This point ideally should lie as far *downstream* as possible in the supply chain and as close to the final market place as possible. The second de-coupling point is the *information* de-coupling point. The idea here is that this should lie as far *upstream* as possible in the supply chain—it is in effect the furthest point to which information on real final demand penetrates.

Mason-Jones, Naim, and Towill [11] have demonstrated through simulation the beneficial impact that information feedback can have on reducing upstream amplification and distortion of demand.

By managing these two de-coupling points, a powerful opportunity for agile response can be created. At the same time, the notorious “bullwhip,” or Forrester effect, [12, 13] can be reduced. Billington and Amaral [14] have suggested that while the combined effect of shared information in a supply chain and delayed configuration through postponement can significantly improve responsiveness, the effect of delayed configuration is actually greater than the impact created by shared information [15].

LEVERAGING SUPPLIER RELATIONS

One of the keys to achieving agile response to fast-changing markets lies upstream of the organization in the quality of supplier relationships. Often it is the lead time of in-bound suppliers that limits the ability of a manufacturer to respond rapidly to customer requirements. Similarly, new product introduction time can be dramatically reduced through the involvement of suppliers in the innovation process.

Still, today, many companies have not recognized the competitive advantage that can be derived from closer relationships with key suppliers [16]. Instead, there is often an arms-length, even adversarial, approach to managing the supplier base. To really leverage the opportunity for greater agility through closer supplier relationships requires a number of prerequisites.

One prerequisite is that it is inevitable that the supplier base be rationalized. It is not possible to create close relationships through process integration with multiple suppliers. Agile companies have sought to identify a limited number of “strategic” suppliers with whom they can work as partners through linked systems and processes. While the dangers of single sourcing need to be recognized, the advantages of having a network of key suppliers able to synchronize their production and deliveries with the requirements of the company are considerable. Opportunities for establishing information-based, paperless systems utilizing concepts of vendor-managed inventory (VMI), for example, are clearly greater

Leveraging in a supply chain is essential.

when both buyer and supplier see each other as vital links in a more competitive supply chain.

A second prerequisite for the creation of a more agile supplier base is a high level of shared information. In particular, there has to be clear visibility of downstream demand; data on real demand needs to be captured as far down the chain as possible and shared with upstream suppliers as well as the information systems technology to make the transfer of information possible. There needs to be a willingness amongst the partners to put aside any previous mistrust and instead to create an environment in which information can freely flow in both directions in the chain.

The final and perhaps most important prerequisite is the need for a high level of “connectivity” between the firm and its strategic suppliers. This implies not just the exchange of information on demand and inventory levels, but multiple, collaborative working relationships across the organizations at all levels. It is increasingly common today for companies to create supplier development teams that are cross-functional and, as such, are intended to interface with the equivalent customer’s management team within the supplying organization [17]. Figure 4 illustrates this concept.

REDUCING COMPLEXITY TO ENHANCE AGILITY

One of the biggest barriers to agility is the way that *complexity* tends to increase as companies grow and extend their marketing reach. Often, this complexity comes through product and brand proliferation, but it also can come through the organizational structures and management processes that have grown up over time [18].

The reduction of product complexity should be a major priority for marketing and logistics people working together. Product complexity includes not only design issues (e.g., the number of nonstandard components in a product) but also excessive variety that does not contribute to greater customer or consumer value. Procter & Gamble, for example, has in recent years focused on product range rationalization, pack standardization, and reduced promotional activity in order to attack complexity.

Complexity is caused also by the way in which organization structures and management processes are designed. One of the benefits of the business process re-engineering (BPR) movement has been that it has highlighted the need to reduce or eliminate the many nonvalue-adding activities that are inherent in traditional

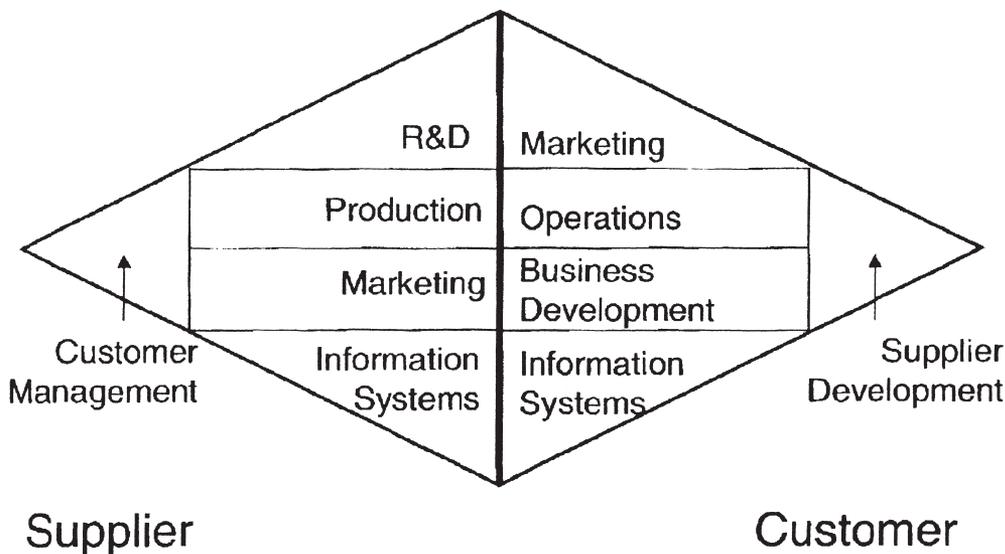


FIGURE 4. Building stronger partnerships through multiple linkages.

functionally-based business. Breaking down functional silos and regrouping around value-creating processes will help reduce organizational complexity. A further aid to complexity reduction and, hence, enhanced agility will be the development of a human resource strategy that leads to multi-skilling and encourages cross-functional working. Team-based management has been demonstrated [19] to be a highly effective facilitator of organizational agility.

CONCLUSIONS

Marketing management has not traditionally recognized the importance of logistics and SCM as a key element in gaining advantage in the marketplace. However, in today's more challenging business environment, where volatility and unpredictable demand have become the norm, it is essential that the importance of agility be recognized.

Leading companies are already implementing marketing strategies that are underpinned by a supply chain strategy designed with agility in mind. These are the organizations that will be best equipped for survival in the uncertain markets of the twenty-first century.

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