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Full Length Research Paper

The concept of Integrating Virtual Group (VG) and Agile Supplier Selection (ASS)

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Agile Manufacturing (AM) is a new concept in manufacturing intended to improve the competitiveness of firms. In 21st century, businesses in order to overcome their competitors, should be able to handle challenges of demanding customers seeking high quality, low cost products and also become more flexible with their specific and rapid changing needs. One of the recent concepts in support of flexibility for factories is Virtual Group (VG). This concept enables the appropriate application of lean and agile concepts to be combined in a cellular manufacturing for different stages of production with in a factory. Flexibility of the supply chain in manufacturing counters the uncertainty in the decision parameters. A supply chain adapts the changes if it is flexible and agile in nature. Integration of appropriate Agile Suppliers Selection (ASS) and Virtual Group (VG) is proposed in this paper. It is argued that the concept of VG by its own is not sufficient for providing flexibility. Therefore, consideration should be taken towards other factors, such as supplier notices, affecting the factory production line in which VG are used. A combination concept comprising VG and supplier is considered in this model. The significance of this subject relies on the producers who confront variable and standard combination factors, as well as manufacture standard and special products. This paper classifies both VG and supplier groups based on the three concepts: Lean, Agile, and Leagile.

Keywords: Agile Manufacturing (AM), Virtual Group (VG), Agile Supplier Selection (ASS)

Introduction

Agile Manufacturing (AM)

Businesses are restructuring and re-engineering themselves in response to the challenges and demands of the 21st century. The 21st century businesses will have to overcome the challenges of demanding customers seeking high quality, low cost products, and responsive to their specific and rapidly changing needs (Gunasekaran 1999). Agility addresses new ways of running companies to meet these challenges.

Agility as a concept has been first introduced to be applied to the manufacturing function, where it was defined by Kidd (1994) as “agile manufacturing can be considered as the integration of organization, highly skilled and knowledgeable people, and advanced technologies, to achieve co-operation and innovation in response to the need to supply our customers with quality customized products”. Agility is being defined as the ability of an organization to respond rapidly to changes in

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Table1. Classification scheme for agile manufacturing

	Research topic	Research subtopics
Agile manufacturing	Product and manufacturing system design	
	Process planning	
	Production planning, scheduling and control	
	Facility design and location	Facility design
		Facility location
	Material handling and storage system	
	Information systems	
	Supply chain	Strategies
		Partner selection
	Human factors	
	Business practices and processes	Progress evaluation in several countries
		Business issue

demand, both in terms of volume and variety (Christopher, 2000).

Agile manufacturing (AM) is a new concept in manufacturing intended to improve the competitiveness of firms. Manufacturing processes based on AM are characterized by customer-supplier integrated process for product design, manufacturing, marketing, and support services. This needs decision-making at functional knowledge levels, stable unit costs, flexible manufacturing, easy access to integrated data, and modular production facilities. Agile manufacturing requires enriching of the customer, co-operating with competitors, organizing to manage change, uncertainty and complexity, and leveraging people and information (Gunasekaran 1999). Since the early 1980s, in pursuit of greater flexibility, elimination of excess in inventory, shortened lead-times, and advanced levels of quality in both products and customer service, industry analysts have popularized the terms “world-class manufacturing” and “lean production”. In the 1990s, industry leaders were trying to formulate a new paradigm for successful manufacturing enterprises in the 21st century; even though many manufacturing firms were still struggling to implement lean production concepts. In 1991, a group of more than 150 industry executives participated in a study. As a result, the Agile Manufacturing Enterprise Forum (AMEF), affiliated with the Iacocca Institute at Lehigh University, was formed and the concept of agile manufacturing proposed (Sanchezy and Hagiy 2001).

For many, “Lean manufacturing” and “Agile manufacturing” sound similar, but they are different. Lean manufacturing is a response to competitive pressures with limited resources. Agile manufacturing, on the other hand, is a response to complexity brought about by constant change. Lean is a collection of operational techniques focused on productive use of resources. Agility is an overall strategy focused on thriving in an unpredictable environment. In a similar sense, some researchers contrast flexible manufacturing systems (FMS) and agile manufacturing systems (AMS) according to the type of adaptation: FMS is reactive adaptation, while AMS is proactive adaptation (Sanchezy and Hagiy 2001). Table 1 illustrates the classification scheme for the survey on agile manufacturing systems. Nine major categories are defined (Luis and Hagiy, 2001).

One of the recent concepts in support of flexibility for factories is Virtual Group (VG). This concept enables the appropriate application of lean and agile concepts to be combined in cellular manufacturing for different stages of production within a factory. On the other hand improved supply chain performance implies that a supply chain is capable of quickly responding to the variations in the customer demand with effective cost reduction. This paper proposes the integration of appropriate Agile Suppliers Selection (ASS) and Virtual Group (VG). It argues that the concept of VG on its own is not sufficient for providing flexibility so agile supplier selection concept should be considered too.

VIRTUAL GROUP (VG)

Virtual Group (VG) was proposed by Prince and Kay (2003). VGs enable the appropriate application of lean and agile concepts to different stages of production within a factory. The VG concept seeks to identify groups of

Table2. Comparison of lean and agile in VG

Attributes	Lean	Agile
Strategy	Operational techniques focusing on productive use of resources.	overall strategy focused on thriving in an unpredictable environment
Competitive	Response to competitive pressures with limited resources	Response to complexity brought about by constant change
Cycle time	Normal production cycle time	Fast production cycle time
Demand	Stable	Fluctuating

machines and families of parts to which lean and agile manufacturing strategies can be applied.

Virtual cellular manufacturing (VCM) was proposed by McLean et al. (1983), as a way of improving the performance of cell-based manufacturing systems in turbulent environments and describes them as cellswhich are ‘‘not identifiable as a fixed physical grouping, but as data files and processes in a controller’’, which takes control of machines and “virtually” moves them from machine pools into virtual cells.

The Advantage that VCM has over CM is that cells are only temporary and as soon as the virtual cell has processed the job for which it was created, all the machines are released so they can be reassigned to a new cell.

The Disadvantage of VCM is that virtual cells do have drawbacks over traditional cellular manufacturing, which relate to the fact that the machines have not been moved and therefore cannot take advantage of dedicated material handling systems designed to deliver fast throughput times, low WIP, high quality and the ability to produce large volumes.

Hyer and Wemmerlov (1982) stated that it is possible to use ‘‘GT informally in a functional layout to schedule jobs without rearranging the shop floor to form cells’’. Kannan and Ghosh (1996) describe the application of VCM to functional layouts as a method of combining ‘‘the setup efficiency typically obtained by Group Technology (GT) cellular manufacturing (CM) systems with the routing flexibility of a job shop’’. The problem with the current view of virtual cells is the assumption that machines are already in a cellular layout or will be moved either into cells or a hybrid layout none of which may be true due to physical or financial constraints. VGs address the increasing pressures placed on manufacturers and are characterized by the identification of groups of machines that have the potential to form manufacturing cells.

The benefits of VGs are (1) Delivered in a number of ways (2) Improve the quality of scheduling as it becomes more dynamic while remaining focused on the objective of completing jobs on time. Table 2 shows comparison between lean and agile manufacturing in VG.

The formation of VGs of machines enables the most appropriate management strategy to be applied. In cases where a VG produces a complete product, it is possible that lean and agile concepts will be applied to different stages of production using a de-coupling point (Prince and Kay 2003). Figure1 illustrates how the Virtual Group concept is identified.

Agile Supplier Selection (ASS)

With the emergence of a business era that change as one of its major characteristics, manufacturing success and survival are becoming more and more difficult to ensure. The emphasis is on adaptability to changes in the business environment and on addressing market and customer needs proactively. Changes in the business environment due to varying needs of the customers lead to uncertainty in the decision parameters. Flexibility is needed in the supply chain to counter the uncertainty in the decision parameters. A supply chain adapts the changes if it is flexible and agile in nature (Agarwal et al. 2006).

Agility is a business-wide capability that embraces organizational structures, information systems, logistics processes and in particular, mindsets. Agility is being defined as the ability of an organization to respond rapidly to changes in demand, both in terms of volume and variety. The lean and agile paradigms, though distinctly different, can be and have been combined within successfully designed and operated total supply chains (Agarwal et al. 2006).

Agile supply is more pragmatically defined and closely associated with ‘quick response’, but is commonly referred to as a distinctly different paradigm to lean supply. Agile supply drivers are typified by innovative products and unstable demand, as commonly found in the fashion sensitive apparel industry. Whereas, with lean

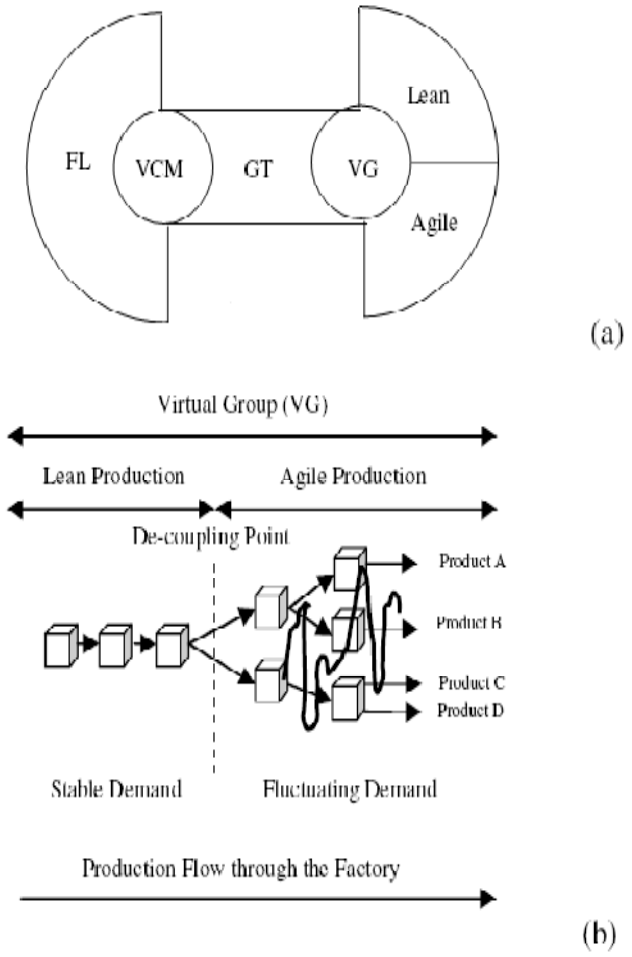
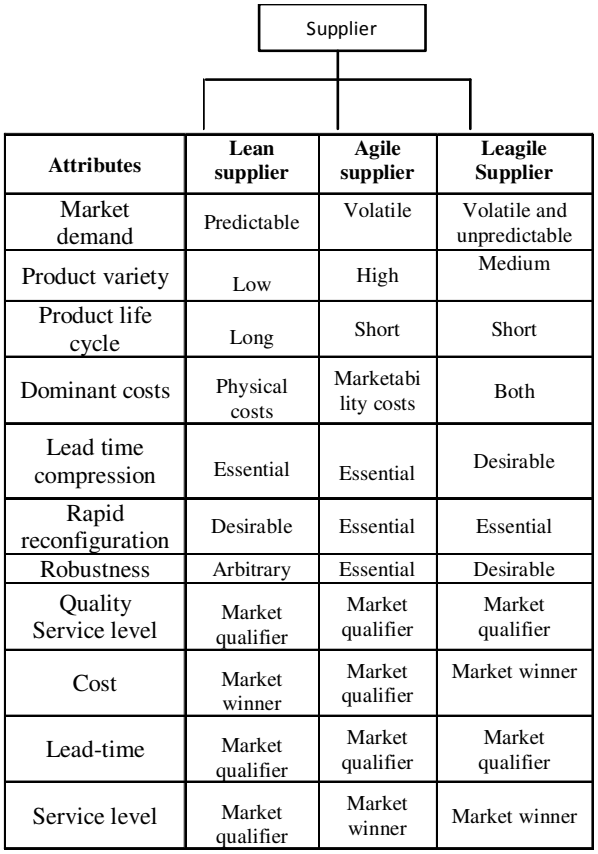


Figure1. (a) VG concept (b) Lean and agile concepts Prince and Kay (2003)

the focus is on eliminating waste and achieving low cost delivery of a standard and stable product, the agile paradigm focuses on the need to deliver a variety of products with uncertain demand (Stratton and Warburton, 2003).

Naylor et al. (1999) proposed that the lean and agile paradigms, although distinctly different, can be and have been combined successfully within total supply chains. The authors show how the need for agility and leanness depends upon the total supply chain strategy, particularly by considering market knowledge and positioning of the decoupling point (Sanchezy and Hagiy 2001).

Agarwal et.al. (2006) introduce new lean, agile and leaagile supplier chain model. The framework explores the relationship among lead-time, cost, quality and service level and the leanness and agility of a case supply chain in fast moving consumer goods business (FMCG). This frame model framework was for selection of a lean, agile and, leagile supplier. Figure 2 illustrates the comparison of attributes among lean, agile and leagile supply chain.



Attributes	Lean supplier	Agile supplier	Leagile Supplier
Market demand	Predictable	Volatile	Volatile and unpredictable
Product variety	Low	High	Medium
Product life cycle	Long	Short	Short
Dominant costs	Physical costs	Marketability costs	Both
Lead time compression	Essential	Essential	Desirable
Rapid reconfiguration	Desirable	Essential	Essential
Robustness	Arbitrary	Essential	Desirable
Quality Service level	Market qualifier	Market qualifier	Market qualifier
Cost	Market winner	Market qualifier	Market winner
Lead-time	Market qualifier	Market qualifier	Market qualifier
Service level	Market qualifier	Market winner	Market winner

Figure 2. Comparison of lean, agile and, leagile supply chain

Methodology

In this section, a framework for Agile Suppliers Selection (ASS) and Virtual Group (VG) is proposed. This conceptual model is based on the literature survey and its analysis. It can be seen, that most of the literature and related issues at present don't convey the concept of integration of ASS and VG. Here, solutions to the development of this vague model are identified.

At first, the gap involved between these two concepts (VG, ASS) is discussed. Considering the severe competition among industries resulting in huge number of demands, and the requirement of the factories to meet the dead-lines, compels then to use the mentioned combination factors. This paper is compiled because of the present lack of the combination model in industries. VG, alone, is not able to meet the requirements of the applicants, thus, lean and agile combined, should satisfy their demands. Conversely, care should be taken not to apply this combination for all the products, as confusion leading to the increase in cycle-time might occur. Therefore, care should be taken to the following points as shown in Figure 3: Identifying and classification of the production line based on the three concepts such as Lean, Agile and Leagile.

Identifying the row materials of each production line classifications. In case, they are provided directly from the supplier, go to step "7".

Developing criteria for supplier selection.

Sorting each criterion based on the three concepts.

Choosing lean, agile or leagile for the sake of supplier development model.

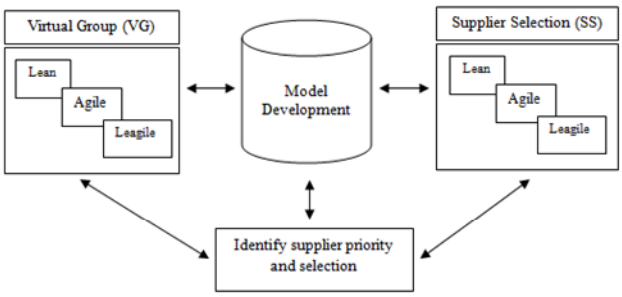


Figure 3. Conceptual model development

Grouping suppliers based on lean, agile and leagile, in each section of the production line.
Acquiring information from each production section for supplier selection (e.g. Lean production line), and subsequently selecting the best supplier for each section (e.g. Lean supplier)

DISCUSSION

This paper describes the value of virtual groups to functional layouts in terms of the ability to change the focus of management from being primarily concerned with processes to products, the benefit of which is to increase the importance of addressing customer demand at all stages of production. Also, the opportunities offered by VGs to enable functional layouts to achieve the relevant benefits of agile manufacturing and the prospect of lean and agile concepts have been discussed. The initial papers are described by (Prince and Kay, 2003) who described the development of the VG concept. The virtual group concept seeks to identify groups of machines and families of parts to which lean and agile manufacturing strategies can be applied.

On the other hand the beginning papers, compiled by Agarwal et al. (2006), indicate the proper suppliers selection, considering the three concepts (Lean, Agile, and Leagile). A framework is present by Agarwal et al. (2006), which encapsulates the market sensitiveness, process integration, information driver and flexibility measures of supply chain performance. The paper explores the relationship among lead-time, cost, quality, and service level and the leanness and agility of a case supply chain in fast moving consumer goods business. Flexibility of the supply chain in manufacturing counters the uncertainty in the decision parameters. A supply chain adapts to the changes if it is flexible and agile in nature. Suppliers are divided to three categories: lean, agile and leagile (Agarwal et al. 2006).

Applying these two concepts individually, cause a gap, making it impossible to retrieve effective results. Thus, this paper discusses the integration of the two models in order to obtain the optimum conclusion. Virtual Group on its own is not sufficient for supporting agile concept in companies. Although base on definitions of the lean, agile and VG, it is recommended to apply supplier

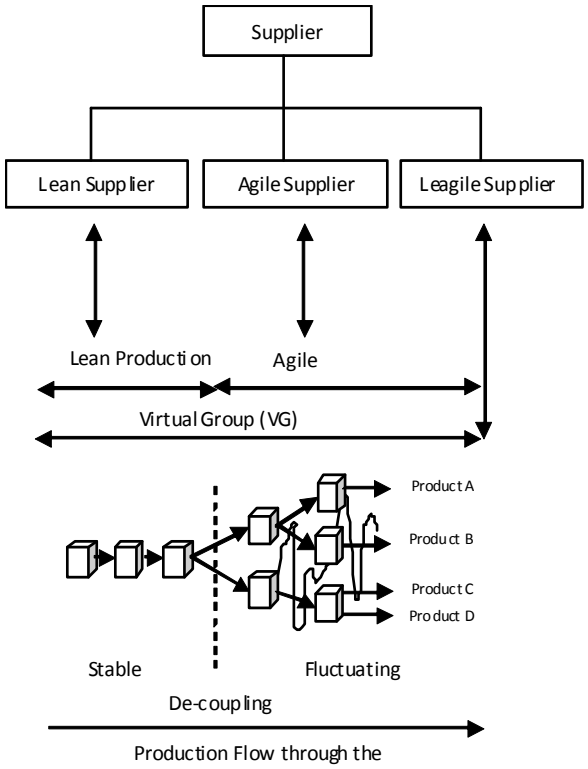


Figure4. Integration of Virtual Group (VG) and Supplier Selection (SS)

selection model for choosing lean, agile, and leagile suppliers which is illustrated in Figure 4.

Conclusion and Managerial implications

Agile manufacturing (AM) is a new concept in manufacturing intended to improve the competitiveness of firms. For increasing the agility two concepts in the area of production planning and supplier selection came to existence. Virtual Group (VG) is defined under the concept of production planning by Prince and Kay (2003). In supplier selection area Agarwal et al. (2006) introduced a new model (lean, agile and leagile) for supplier selection. Integration of appropriate Agile Suppliers Selection (ASS) and Virtual Group (VG) is proposed in this paper which indicates integration of these two concepts. Improved supply chain performance implies that a supply chain is capable of quickly responding to the variations in the customer demand with effective cost reduction. Leanness in a supply chain maximizes profits through cost reduction while agility maximizes profit through providing exactly what the customer requires. The leagile supply chain enables the upstream part of the chain to be cost-effective and the downstream part to achieve high service levels in a volatile market place. Based on these concepts, Lean

supplier selection is used when the market place demand is stable. Likewise for an unstable market place agile is applied. Also, when production life cycle is long, lean and when short agile is used. Moreover, when production line is “lean” long term, and when “agile” short term suppliers should be considered. Summing up, three concepts are important for agile suppliers: (1-responding, 2-flexibility, and 3-speed), and for lean suppliers: (1- trust, 2-collaboration and 3- cost). It is argued that the concept of VG by its own is not sufficient for providing flexibility, so agile supplier selection concept should be considered too.

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