Analysis of Agile Manufacturing Literature

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Abstract

Agile Manufacturing (AM) is a new manufacturing concept that is designed to improve the competitiveness of firms. Manufacturing/service processes based on AM are characterized by customer-supplier integrated processes for product design, manufacturing, marketing, and support services. Agile manufacturing requires inspiring the customer; cooperating with rivals; organizing to deal with change, vagueness and complexity; and leveraging people and information. In recent years, a number of research papers have been published in the area of AM. The term agility was coined in 1991. However, there are still some serious concerns that prevent companies from taking an entirely different direction to agile manufacturing. Considering the prospective weight of agile manufacturing in 21st century manufacturing, an attempt has been done in this paper to reconsider the definitions and strategies of AM.

Keywords: Agile Manufacturing, Virtual Manufacturing, OKP, Virtual Enterprise, Lean, Computer Aided Engineering.

INTRODUCTION

Businesses are streamlining and re-engineering themselves in response to the challenges and demands of the 21st century. The 21st century business has to overcome the challenge of customers looking for high-quality and low-cost products,
and be quick to respond to customer specific unique and rapidly changing demands (Bunce and Gould 1996). Agility requires the capability to survive, sustain and flourish in a competitive environment of continuous and unpredictable change by reacting quickly and effectively to changing markets, driven by customer-designed products and services (Cho et al. 1996). The key enablers of agile manufacturing include: (i) virtual enterprise formation tools/metrics; (ii) physically distributed manufacturing architecture and teams; (iii) rapid partnership formation tools/metrics; (iv) integrated product/production/business information system; (v) rapid prototyping; and (vi) electronic commerce (Gunasekaran 1998). Agility as a concept increases the dependence on speed of response to new market opportunities. Thus, it is more applicable to a One-of-a-Kind Product (OKP) than it is to goods products that compete primarily on price. Several research reports have been available on agile manufacturing. However, there has only been limited study on a in depth analysis of agile manufacturing, its applicability in real-life organizations, paradigm and technologies and on some future research directions that will help in the success of agility in manufacturing firms.

ANALYSIS OF THE STRATEGIES AND TECHNOLOGY ON AGILE MANUFACTURING

The literature available on AM can be grouped under the following categories: (i) tactical planning, (ii) product design, (iii) virtual enterprise, and (iv) automation and information Technology. Achievement of agility requires focus on tactical planning, product design, virtual enterprise and automation and IT.

1) TACTICAL PLANNING

Tactical planning for performance enhancement is gaining attention in all areas of manufacturing. The reason for this is that it takes into account the long-term interest of the company in shaping suitable business and outfitted policies. To achieve agility in manufacturing, several sub-strategies are needed, including virtual enterprise, rapid-partnership formation, rapid prototyping, and temporary partnership based on core competencies. Agile manufacturing can be accomplished through customer-integrated multidisciplinary teams, supply chain management, flexible manufacturing, computer-integrated information systems, and modular production design facilities (Abair 1997, Sharifi 1998). As the convolution of the market and production increases on a global scenario, new wholesale enterprise objectives, drivers, performance indicators and boundary conditions are being defined within the purview of agile manufacturing. This presents both a challenge and an opportunity to information technology and hence the communications industry is to play a major role in agility (Walters 1997). The importance of lean operation and becoming an agile enterprise -
in which the speed and suppleness at which a company functions match those of its technology-is generally accepted. Information technology is providing the means for companies to integrate better with their internal and external activities. Responsibility-based manufacturing (RBM) is a new concept of production that falls under the purview of the AM paradigm. In mass-customization environment, RBM allows most adjustments for process and product variety to take place dynamically and rapidly during production without the need for a separate system reconfiguration.

2) PRODUCT DESIGN

The agile manufacturing structure should be able to produce a variety of components at a reasonable cost and in a short time period. Lee (1998) formulated a design for agility rule. The design rule helps in reducing the manufacturing lead times in consecutive changes of product models. Along with changes in product models, machines are relocated considering the overall cost of material handling and reconfiguration. Medhat and Rook (1997) examined the role of enabling processes and techniques, such as Computer Aided Design (CAD) and Computer Aided Engineering (CAE), and formal methods, such as Design for Manufacture and Assembly, to achieve reduced product development cycles, while at the same time improving the quality of products. The authors stressed the execution plans and pitfalls and the challenges that the organization faces in adopting a Concurrent Engineering (CE) strategy.

3) VIRTUAL ENTERPRISE

A virtual organization is the culmination of balancing core competencies distributed among a number of cautiously chosen, but real organizations all with similar supply chains focusing on speed to market, cost lessening and quality (Abair 1995). Generally, a single organization may not be able to act in response quickly to changing market requirements. Temporary alliances or partnerships based on core competencies of firms helps in improving the flexibility and sensitivity of organization. However, co-ordination and integration could be problematic process. Appropriate procedure and methodology that involve communication, training, education, and goal deployment, must be adopted for an efficient coordination and integration of participating firms at different levels of cooperation (Gunasekaran 1998.1999a). Agile manufacturing add the strengths of qualified partners in a virtual organization to meet market demands. High level process planning is a procedure which helps designers to improve their design with respect to the capabilities of potential partners.
4) AUTOMATION AND INFORMATION TECHNOLOGY

Agile manufacturing needs intelligent sensing and decision-making systems capable of automatically performing many tasks which were before executed by human beings. Visual inspection is one such task where the need for effective automated visual inspection systems in AM environments is necessary (Enke and Dagli 1997). Agile manufacturing needs agile-enabling technologies such as virtual machine tools, flexible fixturing and agile design alternatives (Ashley 1997). Physically dispersed manufacturing environment demands high-level of communication system such as Internet, EDI and Electronic Commerce for exchanging information at various levels of manufacturing organizations. Flexible fixturing is an important technology in the integration of AMS and the lack of effective flexible fixturing can be a deterministic obstacle to implementation of agile manufacturing (Hong et al. 1996).

CONCLUSION

Two key features of manufacturing companies discussed in this paper are ‘Agility’- the ability of a company to effect changes in its systems, structure and organization- and ‘Responsiveness’. Manufacturing companies, even those which are operating under relatively stable conditions with good market positions, are facing fast and often surprising changes in their commercial environment. Being agile in such environments means being flexible, cost effective, productive and producing with steady high quality. Each company will respond in a particular and different way utilizing its own agile characteristics. The problem of identifying, analyzing and evaluating agility is not commonly accepted practical frame of reference or analytical structure exists.

REFERENCES


