Empirical Approaches to Assess Manufacturing Agility

E

P. G. Saleeshya
Amrita Vishwa Vidyapeetham (University), India

INTRODUCTION

Agility as the term used herein is the ability of an enterprise to respond quickly and successfully to change. For a company to be agile it must be capable of operating profitably in a competitive environment of continuous and unpredictable change (Goldman et al, 1995). Agile manufacturing is a strategy that can create flexible or virtual organizations to meet increasing customer expectations (Huang et al, 2004). Agility is not only the outcome of technological achievement, advanced organizational and managerial structure and practice, but also a product of human abilities, skills and motivations. The technology employed by organizations must support the activities and tasks required in and between firms to continuously meet changing customer needs (Harm and Sirp, 2003). Implementation of agile manufacturing paradigm has been a major objective of many companies. It is important to know and assess the degree of agility of an organization process along with the companies' progress towards becoming an agile system (Gunasekaran, 2008, 1998 and Anirban et al,2009).

The research reported here consists of three phases. In the first stage, the focus was on understanding various issues related to agility in manufacturing systems. For this purpose, the literature available on agile manufacturing systems (AMS) was reviewed followed by a preliminary study of selected industries, which helped in identifying various factors which may be potentially responsible for making an organization agile. In the second stage, a need was felt to develop a hierarchical framework that captures various factors, which can be identified as enablers for enhancing the agility of an organization. This exercise was carried out with the help of a questionnaire developed, the framework, and Analytic Hierarchy Process (AHP), (Saaty.T.L1980).

In the third stage, a survey of Indian manufacturing industries was conducted to assess the extent to which, the factors identified responsible for realizing agility in an organization are present. The study carried out with the help of the cooperation obtained from twenty six major engineering companies categorized under five groups, as shown in Table 1. The results of the study clearly showed that these organizations are using different good management practices to enhance their agility, however they place varying emphasis on different factors identified as agility enablers. In the next stages, different models and methodologies such as: Objectivated Agility Realisation Model (OARM), Data Envelopment Analysis (DEA), Goal Programming (GP)…. were identified suitable, and applied for further analyses. The results obtained with the help of AHP and OARM (Prem Vrat et al 1998) based studies provided logical bases for comparing the 26 organizations under consideration in the view point of what can be related to agility.

We have also extended our studies to assess the agility of manufacturing supply chain (Second phase). This phase consists of two studies, the first study identifies six determinants of agility through an AHP and ISM based model. The second study concentrates on the role of the agility determinants to achieve various business performance indicators (BPI's) through regression analysis. The details of these are presented in the next chapter of this encyclopedia.

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Table 1. Hierarchical framework of enablers for agile manufacturing system

A. Strategic Management	B. Tactical Management	C. Operational Management
A1.Leadership	**B1.Partnership**	**C1.Source Management**
1.Support	1.Joint Ventures (JV)	1.Virtual Organization (VO)
2.Direction	2.Collaborations	2.Virtual Enterprises (VE)
3.Control	3.Affiliation	3.Vendor Management (VenM)
4.Identity	4.Information Technology (IT)	4.Market Research (MR)
5.Individual Initiative (II)	5.Information Sharing (IS)	5.Vendor Performance Measurement (VPM)
6.Communication Pattern (CP)		
A2.Organization Structure – OS	**B2.People Management – PM**	**C2.Process Management – PRM**
1.Decentralised	1.Employee involvement (EI)	1.Consolidation
2.Centralised	2.Training and education (T&E)	2.Elimination and Deferrals (E&D)
3.Strategic Business Units (SBU's)	3.Reward Systems (RS)	3.Automation
4.Cluster Approach (CA)	4.Employee Stock Organization (ESO)	4.Total Preventive Maintenance (TPM)
5.Autonomy	5.Total Quality Management (TQM)	5.Business Process Reengineering (BPR)
6.Voluntary retirement scheme (VRS)		6.Benchmarking (BM)
A3. Integration	**B3. Value Management – VM**	**C3. Delivery Management – DM**
1.Management by Objective (MBO)	1. Value Engineering (Vengg.)	1.Production Scheduling (PS)
2.Value Chain Management (VCM)	2.KAIZEN	2.Inventory Management (IM)
3.ISO-9000	3.Quality Control (QC)	3.Third Party Logistics (TPL)
4.Knowledge Management (KM)	4.Supply chain management (SCM)	4.Own Transport Facet (OTF)
5.Total Quality Management (TQM)	5.Waste reduction (WR)	5.Appointing Chasers (AC)
	6.Poka Yoke	6.Mobile Phone Service (MPS)
		7.Market MIS
A4. Customer Centered Paradigm (CCP)	**B4. Assurance Management – AM**	**C4. Response to Market Conditions – RMC**
1. Product Quality (P. Qlty.)	1.Total Quality Management (TQM)	1.Reconfigurability
2.Dependability of Service (D.Sr)	2.Total Preventive Maintenance (TPM)	2.Adaptability
3.Waste Reduction (WR)	3.Quality Function Deployment (QFD)	3.Workforce Flexibility (WE)
4.Timeliness	4.Quality Circle (QC)	4.Strategic Alliances (SA)
5.Flexibility	5.Failure mode and effect analysis (FMEA)	5.Technologies in Services (TIS)
6.Innovation	6.Fault tree analysis (FTA)	
7.Supply Chain Management (SCM)	7.Process capability (PC)	
8.Concurrent Engineering (CE)	8.Six Sigma	
	9.ISO 9000	
	10.Reliability Centered Maintenance (RCM)	

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