A Review of Advance Manufacturing Systems for their Strengths and Inability for Performance Measures

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Abstract: Advance Manufacturing is the networked information based technologies throughout the manufacturing. The Advance Manufacturing leads to a service oriented and resources sharing fundamental business transformation to demand-dynamic economics. It is keyed on customers, partners and the public; enterprise performance and variability management; real-time integrated computational materials engineering and rapid qualification, demand-driven supply chain services; and broad-based workforce involvement. The Advance Manufacturing technologies include Cloud manufacturing, Green manufacturing, Lean Manufacturing and Smart Manufacturing etc. Advance Manufacturing can better respond to national interests by facilitating global competitiveness, manufacturing innovation and exports, providing sustainable jobs, radically improving performance.

Key words: Smart Manufacturing, Performance-based enterprises, Demand-dynamics, Energy productivity, Sustainability.

1. Introduction

Advanced manufacturing technology is a computer and cloud based technology which is used to the improvement of manufacturing operations and thereby mutual growth of organisations competitiveness. Technologies such as cloud computing, cloud manufacturing, sustainable manufacturing, green manufacturing, computer aided design , computer-aided process planning , computer numerical control machines, flexible manufacturing cells/systems , computer-integrated manufacturing , smart manufacturing, and digital manufacturing provide adopting firms with the potential to market respond more quickly to fulfil customer needs and offer higher quality products with improved consistency and reliability. However, mere installation of these technologies does not guarantee that a firm will reap all the potential benefits. Results of several empirical studies indicate that while most firms achieve some benefits, many advance manufacturing technology projects are not fully exploiting the system capabilities (Boer et al., 1990; Beatty, 1990; Inman, 1991; Meredith, 1987, 1988, Upton, 1995).The process of implementing advanced manufacturing technology begins after the decision to commit funds for the new technology has been made.

This article (Nagar and Raj, 2012) investigates the driving power of the risks in the adoption of various advance manufacturing technologies. Firms adopting integrated technologies had exerted significantly higher levels of effort on strategic planning and team based project management and had also achieved higher levels of performance across a wider range of performance factors than other firms. Advance manufacturing can increase the effectiveness of manufacturing in terms of lead time, cost, flexibility, quality etc. The risks involved in advance manufacturing technology implementation affect project success have been studied.

2. Literature Review

In recent time, many manufacturers had implemented computer integrated manufacturing (CIM) to streamline the office, accounting, and production processes involved in manufacturing. CIM uses computers and communications networks to transform automated manufacturing systems into interconnected systems that cooperate across all organizations functions. Company that have successfully implemented CIM report several benefits: Faster purchasing processes, reduced business cycle, higher inventory turnover, faster response times and improved services [1].

While there exists of publications presenting the successful implementation of different manufacturing improvement strategies (Brown et al. 1994, Sohal et al. 1998, Bamber 1999, Henderson and Evans 2000, Antony and Banuelas 2002, Apte and Goh 2004, Chan et al. 2005) the experiences of the authors and those of the practitioners had worked and many initiatives fail to meet expectations and can fail to deliver any improvement at all. The existence of only partially successful and failed initiatives was supported by past and contemporary literature, an example of this being Redman and Grieves (1999), who noted that between 70–90% of TQM programmes implemented have failed [2].

The cloud computing infrastructure requires access to data anywhere, anytime at any device at a sufficient perceived quality of service. Many Western European countries, such as Denmark, have a high percentage of individuals (inhabitants and companies) that has access to broadband internet via cable, satellite and mobile. That gave a unique position in roll-out and deploying intelligent cloud based services that can be applied for a number of purposes. Broadband was defined as more than 2Mbps. Paper was the combination of **e-commerce, cloud computing and broadband infrastructure** has our focus, and its unique possibilities for the overall IT society. Services offered via cloud computing solutions will minimize the SMEs investment in own hardware (HW), software (SW) and maintenance. The focus was also the upgrade to a superior infrastructure that provides the platform for efficient cloud computing, for e-commerce, and beyond. The target was to lower one of the barriers: lack of IT competence and ignorance regarding the many new possibilities with modern e-Business [3].

In response to the requirement, the manufacturing processes had evolved from mass production technique, through its implementation on reconfigurable systems. The most difficult part of reconfigurable manufacturing systems (RMSs) was an understanding of the barriers related to their relative interdependencies. The article presented a conceptual framework of various barriers associated with RMSs along with their interdependencies. Using graph theory and matrix methods, the barriers of RMSs presented in the form of a single numerical index. The proposed model was quite versatile from the point of view that it provides an opportunity to integrate new barriers which could impact on manufacturing processes. In that work, an attempt had been made to develop a mathematical model of those barriers using graph theory and matrix methods. An index of barriers in RMS was proposed which evaluates the inhibiting power of these barriers [4].

Manufacturing firms consume energy and natural resources in highly unsustainable manner and release large amounts of green house gases leading to many economic, environmental and social problems from climate change to local waste disposal. Consciousness about these issues has led to a new manufacturing paradigm of environmentally conscious manufacturing (ECM). This paper aims at identifying the barriers to ECM, developing a model of these barriers using statistical analysis and testing the model using structural equation modelling technique. The result provided three types of barriers – internal, policy and economic. The results show that internal barriers are the root barriers and cause policy and economic barriers. It reflects that the barriers which were internal to the organisation should be mitigated first for effective implementation of ECM [5].

In the recent past time, environmental issues have been gained momentum because of rapid economic and industrial growth of highly populated developing/emerging nations which were posing serious environmental and social problems not only in their countries but also to the world. A growing number of organizations have begun or willing to work towards implementing Green Manufacturing (GM) in the nations. But the adoption of GM was a challenge for the organizations in the nations as motivating factors (drivers) were not facilitated and inhibiting factors (barriers) were not mitigated, which pose a heavy burden. Paper aimed to statistically analyze the drivers and barriers to GM implementation for developed and emerging nations so that the organizations can strategically focus on these factors to reach to a higher level of competitiveness [6].

Cloud computing has the potential to speed up IT adoption among SMEs in developing economies. Benefits of cloud computing were very appealing, the level of cloud adoption was still low among SMEs. The research aimed to identify the key enablers, barriers and other factors that influence cloud adoption among SMEs in Tamil Nadu by conducting empirical investigations. The author has been used TOE framework to identify and capture the factors that affect technology adoption. The author highlighted the cost benefits of using cloud infrastructure, scalability and agility of cloud services as the key enablers of cloud adoption. Broadband availability, high bandwidth cost and vendor lock-in were the main barrier for cloud adoption. Compatibility to existing system, complexity of the migration process, top management support, government policies and competitor pressure were the major organizational factors affecting cloud adoption among SMEs in Tamil Nadu [7].

In the context of cloud computing, the study of the paper aimed to understanding the impact of technical and security-related barriers on the organizational decision to adopt the cloud. The comparison of adopter and non-adopter sample reveals three potential adoption inhibitor, security, data privacy, and portability. The study underlines the importance of the technical and security perspectives for research investigating the adoption of technology which are as following: Technical, Security, Financial and Legal & Organizational [8].

3. Findings: Risk or Barriers and Enablers Table No. 2

S. No.	Enabler	Ref.	S. NO.	Barriers	Reference
1	Operational	Wilson et al 2015, Tsertou et al-2016	1	Technological /Technical	Attaran et al(1996), Expert opinion
2	Manufacturing Systems requirement	Nagar and Raj (2012), Tsertou et al-2016	2	Protection/Security	
3	Methodology followed	FTao et al 2011	3	Internet of Things/Broadband availability	
4	Work culture of the organization	Nagar and Raj (2012)	4	Cost/Finance/ high bandwidth costs	Nagar and Raj (2013), Attaran et al(1996)

5	Internet of Things	Nagar and Raj (2013), Nagar and Raj (2012), FTao et al 2011	5	Effectual / Legal/lack of awareness and expertise	Expert opinion, Attaran et al(1996), Mittal & Sangwan (2014)
6	Current Legislation		6	Organizing for cloud	Attaran et al(1996), Hicks & Matthews (2010), Mittal & Sangwan (2014)
7	Cloud Computing /Energy Star				

4. Conclusion

The manufacturing industries are afraid to adopt advance manufacturing (that is regularly upcoming and latest systems) because of the risks associated in their adoption. The model developed in the research, Nagar and Raj, 2012, provides tool to the management to develop suitable strategies to minimize these risks. The risk factors like risk of industrial development changes, risk of reliability of advance manufacturing technology, risk of applicability, risk of new technology development, risk of failure have less drive power and more dependency. The firms can only used the latest tool to face these failures only when they have required funds.

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