

An Assessment of Advanced Manufacturing Technologies Implementation in Manufacturing Enterprises

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ABSTRACT

The implementation of AMTs (Advanced Manufacturing Technologies) has always been the high interest and core issue for the manufacturing enterprises to get rapid production for global market place. The developed countries have achieved its competitive advantage by implementing this unique model of technologies with full range of systems. In developing countries, the implementation of such technologies is not much common due to so many reasons, (political, social, economical and technical) but entrepreneurs of growing economies are contemplating to reshape long term strategy to adopt Computer systems oriented technologies in their manufacturing companies to meet the growing needs of their indigenous market on one hand and to make a place in the international market on the other. Although, very few manufacturing organization do meet the global market requirements. But there is still lot of efforts to be taken for world class competition. An attempt has been made in this paper to develop a conceptual model taking in to account the three parameters such as, Direct, Indirect and Administrative AMTs. This research work further attempts to present an empirical data analysis conducted in the manufacturing enterprises in province of Sindh, Pakistan. The overall indigenous progress of manufacturing enterprises as according to the data collected from 60 companies reveals that the AMTs systems are partially understood and practiced that is also one of the cause towards slow progress of national exchequer.

Key Words: Implementation AMTs, Manufacturing Enterprises, Empirical Data Analysis, Pakistan.

1. INTRODUCTION

In the manufacturing perspective, AMTs has achieved widespread recognition and acceptance by the manufacturing enterprises throughout the globe with diverse aspects of its implementation for rapid quality production. These sets of technologies have rendered profound output in quick, easy and fast production, depending upon its type, nature, use and adequate operational systems facilities. In this regard, researchers

have vigorously analyzed its various operating units for production while incorporating highly automated and sophisticated systems in their manufacturing organizations [1-3].

In developing economies, the use of AMT based or related technologies are not so much common due to various reasons such as political, social, economical and technical.

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Entrepreneurs of such growing economies are thoroughly and enthusiastically contemplating to re assess and reshape their long term manufacturing strategy to step ahead for adopting computer systems based methodologies and technologies in their manufacturing companies to meet the growing needs of their indigenous market on one hand and make a place in the international market on the other. Although, very few manufacturing organization do meet the global market requirements.

AMT is often viewed as a set of those manufacturing based process technologies that are used with the assistance of computers to store and manipulate useful data and information for production and service purpose [4-5]. AMT generally offers various packages of information based systems with automated manufacturing related systems which have made great breakthrough during the last two decades in the area of information technologies [6] due to these systems production life cycles are reduced dramatically [7]. AMT is considered as rapid solution to the problems after its introduction in the area of manufacturing , however, it (AMT) has not been seriously taken in to developing countries [8]. This set of technologies are considered as solution to the problems after its introduction in to the manufacturing [9].

In Manufacturing perspective, AMT may best be defined as a set of those computer affiliated or based technologies which include the CAD (Computer Aided Design), AS/RS (Automated Storage and Retrieval Systems), AMHS (Automated Material Handling System), AGVs (Automated Guided Vehicles), BC (Bar Coding), RP (Rapid Prototyping), MRP-I (Material Requirement Planning), DNC (Distributed Numerical Control Machines), Robots, FMS (Flexible Manufacturing Systems), CNS (Computer Numerical Control) machines, SPC (Statistical Processing Control), MRP-II (Manufacturing Resource Planning), ERP (Enterprises Resources Planning), ABC (Activity Based Costing) and AO (Office Automation). Schorder and Sohal [10] and Beaumont, et. al., [11] have very accurately described that "selection, implementation, and management of AMT are highly significant and a major

responsibility and vision of managers in SMEs," as well as for large scale manufacturing enterprises, [12]. It has an integral role for quality and flexibility improvement, [13].

In the previous studies, conducted by Youssef, [14], Boyer, et. al. [15] and Sohal and Millen [16] have mainly focused AMT on the developed economies for their benefits and implementation. In the literature review, these systems have been the core subject for the scholars to address the diverse aspects of their operational systems to improve their performance and customer's satisfaction. Nowadays these AMT systems are getting widely acceptance in the developing countries [8]. Implementation and its long term benefits for the growing economies have not been brought in the literature at large scale as indicated by Sohal, [17] Efstathiades, et. al. [18]. The research emphasized on the planning and infrastructure variables which consist of worker empowerment, quality leadership software based integration, environmental scanning, linking business and business strategies, time horizon for planning, team based project management and technology consistency [19]. It is essential for the entrepreneurs to reshape their manufacturing strategy to adopt computer based environment [20]. The major theme of this research is to study the overall AMTs status which means whether this set of technologies is implemented in the manufacturing enterprises in the province of Sindh. This research work indicates that the AMT systems have been partially implemented in the companies however; these systems require large investment because of their heavy cost [21].

2. AMTS IMPLEMENTED IN MANUFACTURING ENTERPRISES

AMT systems are generally regarded as those manufacturing systems which are implemented in the manufacturing units engaged in the hardware and software based environment for the optimum use of resources. Following systems are randomly discussed as under.

Computer Aided Design: In engineering perspective, The term CAD is described as, software based electronic geometrical designing tool that can be used with the assistance of computers to get product as per specification [22].

Computerized Numerical Control Machines: CNC machines are generally regarded as control device engaged in production lines to maintain the quality production [23] this device has become the backbone of manufacturing operations carried out in industries.

Automated Storage and Retrivel System: This system typically assist the computer for the storage of materials under a defined degree of automation for a certain period of time. The typical materials are raw materials, inventory systems, rework and scrap, tools, fixtures, and spare parts.

Statistical Process Control: In the manufacturing processes, SPC is widely used for statistical techniques to measure and analyze the variation in processes. The main object of SPC is to overall monitor quality of operations and products in order to maintain processes to fixed targets.

Robots: It is an a product of electronic devices which operate like human under the specified given instruction. It has also become an integral part of industrial production without use of laborous work.

Automated Material and Handling System: By using this system, material, tools and other inventories can be moved to various locations of production or from warehouses to the delivery outlets.

2.1 Development of Theoretical Model

The theoretical model or framework as shown in Fig. 1 usually helps the stakeholders/researchers to carryout the work in the systematic and logical manner in order to develop the appropriate relationship amongst the several identified variables to address their complex problems. Although during its developing process, lot of brainstorming will be required to careful arrangement of the variables of research work.

3. RESEARCH METHODOLOGY

A total no of 200 Hyderabad and Karachi based companies were mailed the questionnaire but due to the code of conduct, the names/addresses of the studied enterprises could not be disclosed in this research. The questionnaire was developed from the literature review to get feedback for Ph.D. resaerch work. It was then sent to the various companies by courier service. However, few industries were also personally visited by the researchers only when companies failed to respond in this regard. The response rate of stakeholders is shown in Fig. 2.

While analysing the questionnaires received from the companies it was found that were filled by the Enteprenurs, Production Engineers, Managers, Supervisors and Trainee Engineers. The method for data analysis used in this work is Two point likert scale as implemented and not Implemented and M.S Excel was used as statistical tool.

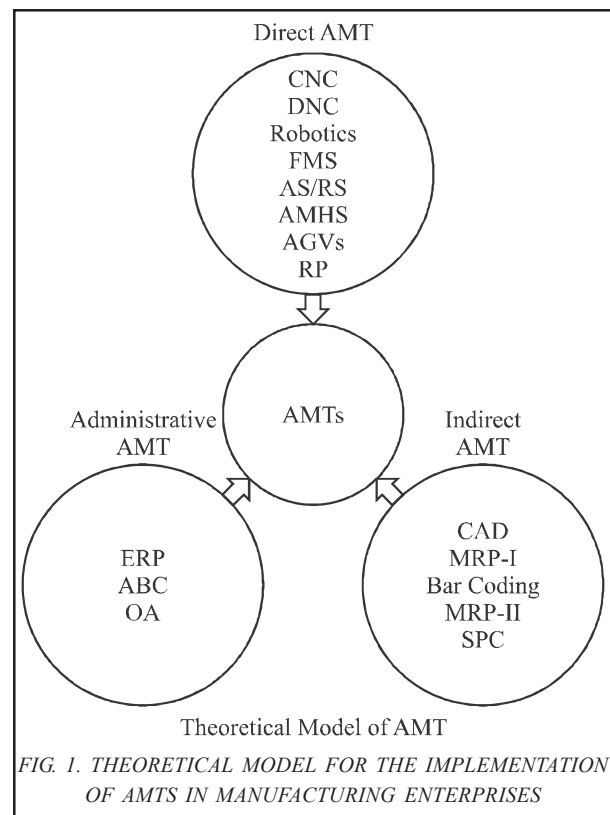


FIG. 1. THEORETICAL MODEL FOR THE IMPLEMENTATION OF AMTS IN MANUFACTURING ENTERPRISES

The data of 60 companies were gathered and selected as small, medium to large scale, the companies having the employee's strength from fifty to five hundred or more have initially been taken. The variables listed here have proved the positive and reasonable output in previous research carried out by Ramamurthy [24], Boyer, et. al. [25] and Smal and Yasin. [26]. Presently, this work extends the pervious work in the context of the developing countries. The collection of data is one of the most painstaking tasks for the researchers to get extract information from the manufacturing enterprises, because companies have misperception about the data gathering process and they assume it as spying activity, wastage of time or transferring

of technological methods of one manufacturing unit to another. Organizations provided data are shown in the Table 1.

4. EMPIRICAL DATA ANALYSIS

The empirical data analysis has been conducted keeping in view the three parameters of AMT such as Direct AMTs, In Direct AMTs and Administrative AMTs as mentioned in the conceptual model in Section 3, so as to investigate the over all its implementation in the computer based environment of various indigenous manufacturing enterprises. Each parameter is discussed as under:

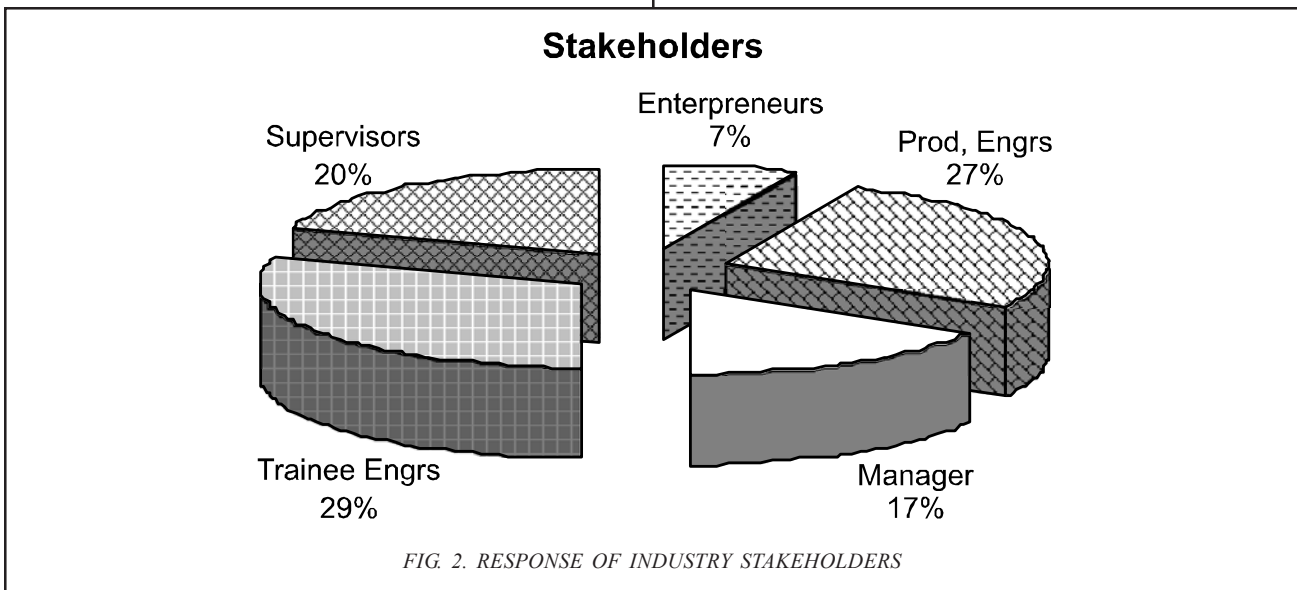


TABLE 1. BACK GROUND OF THE COMPANIES

No.	Type of Companies	Age of Companies (years)	AMTs (Implementation)	Number of Employees
1.	Sugar Industries	10-40	Direct AMT Use In Direct AMT Use Administrative AMT Use	50-500
2.	Electrical Industries	10-30		50-100
3.	Food Processing Industries	10-20		50-100
4.	Metal and Steel Industries	10-40		50-300
5.	Confectionary Industries	5-15		20-200
6.	Cooking Oil Industries	20-40		50-500
7.	Cement Factories	05-30		50-500
8.	Chemical Industries	10-30		20-100
9.	Auto Parts Industries	10-20		50-200
10.	Tobacco	10-40		300-400

4.1 Direct AMTs

Direct AMTs are those computer based (software and hardware) systems which are generally flexible in nature and can be changed even on floor shop to change the drawings and over all its operating nature as desired by the system engineers or system operator.

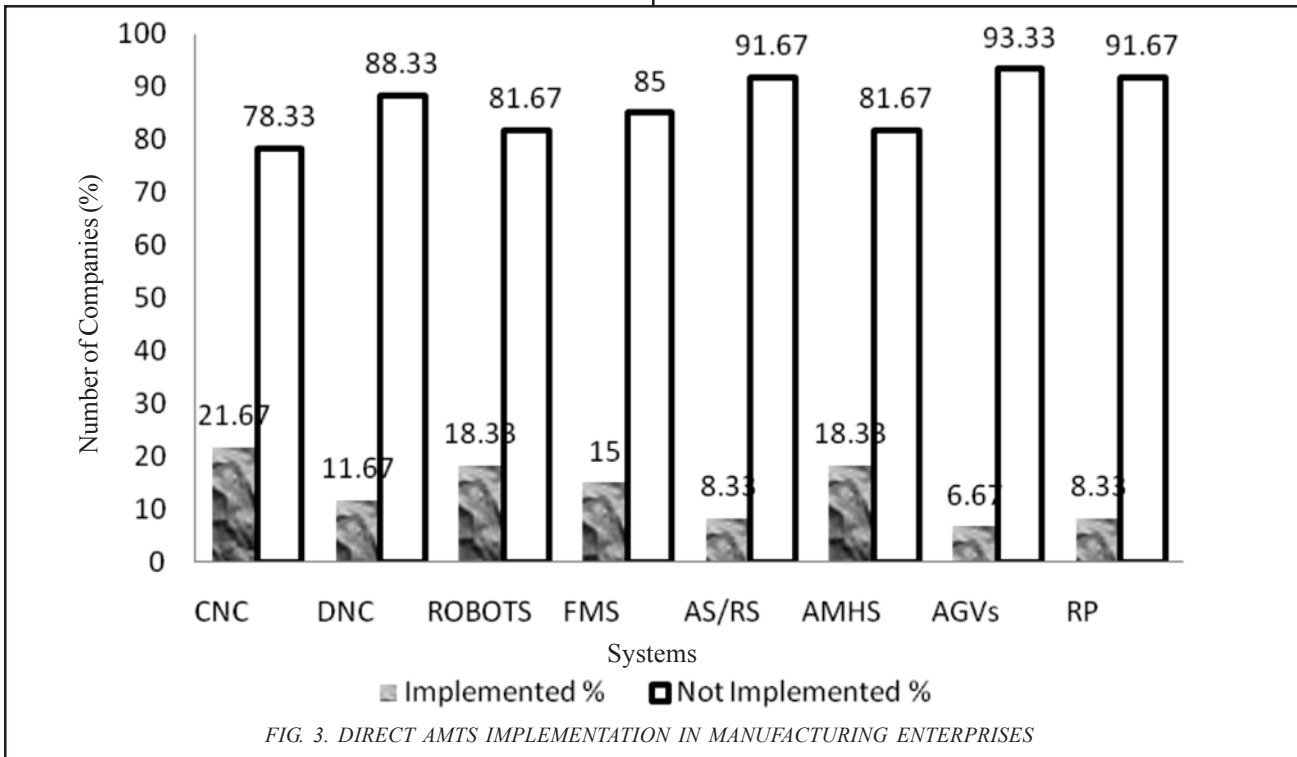
The manufacturing companies were asked give their response about the Direct AMT implementation. A total no of 60 responses of small, medium to large scale industries were received regarding Direct AMT implementation. The 21.67% of the companies were of the opinion that their companies have implemented CNC system where as rest of the company's i.e 78.33% have declined of its implementation without assigning any reason. 11.67% companies have indicated that in their organization DNC system is functional and 88.33% companies have not given any priority to this system. Similarly Robotics system with 18.33% is used and 81.67% have not given priority for such implementation. Similarly, AGVs and RP systems were overall implemented with the 6.67% and 8.33% and where

as 93.33% and 91.67% did not implement these systems respectively. The detailed analysis is shown in Fig. 3.

4.2 In Direct AMTs

These kind of systems consist of various methodologies used for designing the products and assist the schedule of production in order to achieve the over all manufacturing targets.

An empirical study conducted in order to get the feedback of the different parameters of research, it was found that 23.3% of companies considered CAD as an important tool for their organization and have got benefit of this system where as 76.7% of the companies declined to implement this tool. The companies while using the MRPI were more optimists by implementing with the 71.67% whereas 28.33% did not implemented MRP-1 as shown in Fig. 4. The 61.67 % of companies have responded as Bar coding is important for their companies and implemented, where as 38.33% of companies did not implement the said system. The Tool MRP-II was also one of the favorable



implemented systems which were given the appropriate priority in their companies with the 68.33% to make their resources viable where as 31.67 % of companies declined to adopt this system without assigning any reason. Finally, 60% of companies considered SPC system was as an appropriate to implement in their organization.

4.3 Administrative AMTs

The set of computer assisted systems usually offers administration with support during manufacturing within the company, also helps an external support to integrate

other organization to exchange the information at the management level.

The companies were also requested to update the response regarding administrative AMT. the data provided by the manufacturing companies revealed that maximum no of the companies with the 78.33% used the ERP system in their companies where as 21.67% of companies somehow have not implemented. The manufacturing companies while using ABC and OA systems have shown significant indication by implementing with the 56.67% and 70% of companies respectively as shown in Fig. 5.

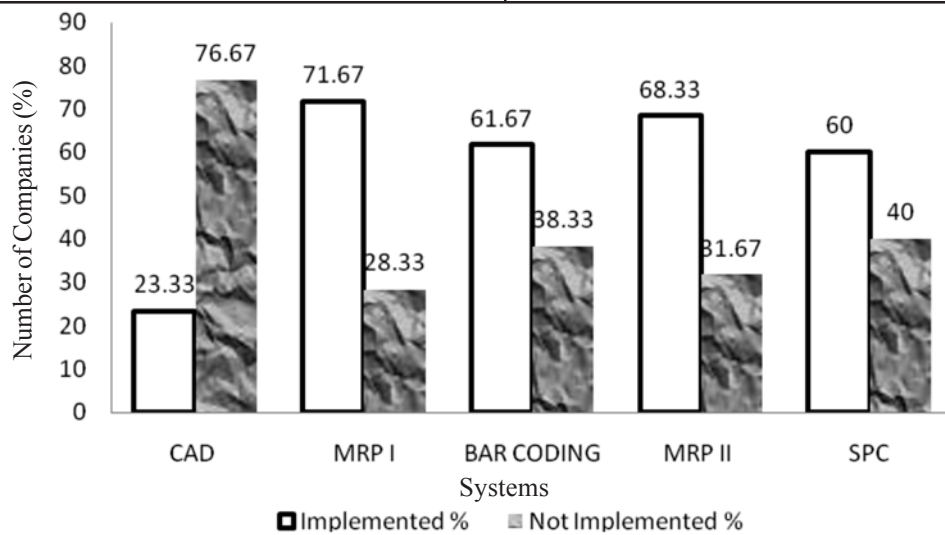


FIG. 4. IN-DIRECT AMTs IMPLEMENTATION IN MANUFACTURING ENTERPRISES

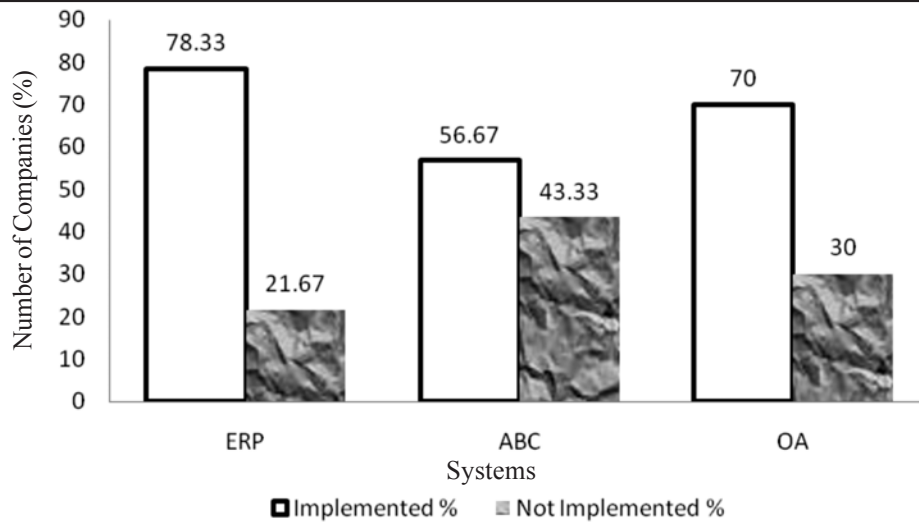


FIG. 5. ADMINISTRATIVE AMTs IMPLEMENTATION IN MANUFACTURING ENTERPRISES

5. CONCLUSIONS

In order to be competitive in business, the role of computer based technologies is unavoidable aspect for the sustainable growth. The overall picture drawn from the analysis indicates that AMTs are partially implemented in the manufacturing units of Sindh province.

It also appears from the analysis carried out from the information, that Direct AMT is ranked as the low priority of the company, where as some systems of In Direct AMT have been put on their appropriate priority in manufacturing enterprises. The Data revealed pertaining the Administrative AMT, it is obvious from their response, that this tool has more significance and has sought widely recognition in their companies. It is unambiguous that manufacturing companies have partially conceived and implemented these systems in their manufacturing organizations.

Although, the country's unstable conditions also did not pave the sustainable support in the technological path which may assist the manufacturing cycle viable. The overall prevailing environment has strongly disappointed the entrepreneurs that causes despair to go for software based investment in advanced manufacturing technologies as data shows. From the analysis carried out from the stakeholders consists of entrepreneurs, production engineers, managers, trainee engineers and supervisors from the surveyed companies revealed that the AMTs systems are partially understood and practiced that is also one of the cause towards slow progress of national exchequer.

The manufacturing companies should immediately go for adopting AMT based systems for rapid production. The indigenous manufacturing organizations should also develop the strong interaction with the various technical centres in order to get training for their employees with full use of AMT systems. It is the right time for government to go for long term industrial support policy in terms of

finance and industrial resources so as to reduce the poverty level in the country, it is further essential for the stakeholders to reshape their strategy to cope the existing situation and chalkout their strategic vision so as to meet their production targets for the global requirements by implementing advanced manufacturing systems.

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