An Investigation in to the AMT Implemented Systems in Manufacturing Enterprises of Pakistan

Ghulam.Yasin Shaikh, Zeeshan Khatri, Hussain Bux Marri, Dr R.A Sohag and M Aslam Uqaili
Department of Industrial Engineering and Management,
Mehran University of Engineering and Technology, Jamshoro – 76062- Sindh, Pakistan

ABSTRACT

In today's current, manufacturing, and business environment, the term Advanced Manufacturing Technology appears to be one of the global manufacturing icon in the business world. Its application in production has rendered tremendous and countless progress in the worldwide economies. Presently, because of the globalization and advent of information technolgy, new trends in business and communication systems in the manufacturing, have invented the numerous technology based packages (MIS) that have facilitated the indegenous and international customers to easily access products and services of their own choice at their doorstep and in very shortest possible time.In manufacturing world, AMT implementation is not a matter of only manufacturing between the companies, but it has become competitive slogan amongst developed and developing economies in order to sweep the business potential from the turbulent and dynamic environment. The information based manufacturing technologies have not only provided these facilities to the customers on one hand but also to the entrepreneurs to go for automated manufcturing to meet the emerging needs of complex and dynamic market. This hardware and software based system provides a platform to the companies to augment their research work and lataest methodologies for rapid, timely, easy, optimum use of resources and best use of employees efforts to get required as well as desired output with controlled mechanism of various advanced integrated manufacturing technologies.
An attempt has made in this paper to develop a conceptual model taking in to account various aspects of AMT such as AMT components, operational environment, Human resources management and strategic alliance. This research work further endeavors to present an empirical data analysis conducted in the manufacturing enterprises in province of Sindh, and the overall indigenous progress of manufacturing enterprises of Pakistan.

Keywords :- Integrated Manufacturing Tecnologies, Business environment, Globalization, technology based packages.,

1. Introduction

Pakistan is graced by the Almighty Allah with countless natural resources that can fulfill its long term domestic future needs. The agricultural based country consist diversity of natural resources for instance agriculture, oil, gas, coal, minerals and industrial out put. These are major pillars of its economic growth. It's more than 80% of manpower is engaged iwith agro based production for the sustainable escalation of national income.
Manufacturing Enterprises (MEs) has also provided strong base of employment opportunities to the stakeholders, methodologies to the Manufacturers and challenges for researchers to share, enhance and equip themselves with the global emerging changes in production areas (1). Successful enterprises usually possesses strong network to share their skills, information, competencies of internal resources not only tangible but also intangible (2). Presently industries either mature or developing industrial regions encountering considerable constraints for AMT implementation (3). Manufacturers are encountering various challenges in local and global competitors(4). to get the better and viable respond to the business opportunities, the implementation of Advanced Manufacturing Technologies (AMT) is unavoidable. The growing numbers of organizations stress the need to emphasis in human resources, infrastructure and AMT systems (5). To cope with emerging complex needs of the market, design and cultural aspects have played an important role in the success of organizations as experienced by AMT adopted organizations (6). "AMT shows wide range of outcomes, adopted by these technologies; ranging from

implementation failure to increased productivity and enhanced organizational flexibility" (7). Due to the high rates of energy and other liabilities has, crippled its business activity on one hand and the business net work on the other. In order to capture the market of business, MEs are seeking higher effectiveness and competitiveness across the entire business cycle such as Marketing, Product Design, and Manufacturing and Sales promotion. In developing countries like Pakistan MEs has always been overlooked for its values and significance by the stakeholders in terms of social, political and technical areas, which has consequently affected its output.

Since the advent of computer based systems, the variety of software's and business packages in production and other business areas have led to deal with increased demand of every manufacturing enterprise. In order to enhance the their performance at grass root level, the government and its Stakeholders are striving at their best for the sustainable development of manufacturing companies, however, this sector is increasingly supporting in the area of employment opportunities and human resources development of Pakistan. With the initiatives and multidimensional collaboration and support at regional level, there are 3.2 million successful business enterprises employing up to 99% constitute over 95% of all private in the industrial sector and 78% of the non-agriculture labor force. They contribute over 30% to he GDP, Rs.40 billion to export business and 25% of export of manufactured goods besides sharing 35% in manufacturing value added(8). Presently, the government of Pakistan while realizing the growing need of global market has approved the SME policy, emphasized to facilitate the logistic support and infra-structure to strengthen the SMEs. It has also committed to provide the liberal economic environment to forge the international partnership, enabling this sector to upgrade their competitiveness in the regional and in global market. This project idea will be materialized in every province of Pakistan; in this regard Ministry of Sindh has decided to setup 16 small industrial estates and three industrial parks in order to activate the business support for sustainable operation of SMEs (9).

1.1 AIM OF THE RESEARCH.

The main theme of the resaerch is to investigate the flexbility of manufacturing enterprises (SMEs to Large) of Sindh province, pakistan. Utilizing these technologies is also an other aspect of this work in order to meet the business requiremnets. In this regard conceptual model has been designed with four parameters such as, AMT components, Strategic Alliance,operational, environment and Human resources management.The efforts were made to collect the data and to analyse its applications.

2 Advanced Manufacturing Technologies.

In today's Manufacturing world, Advanced Manufacturing Technology (AMT), has been defined broadly as "an automated, computer based production system consist of people, machines, and tools for planning and control of the production process(9), including the procurement of raw materials, parts and components and shipment of finished products. It assists producers and designers to implement the advanced and modern method of production incorporating highly automated and sophisticated computer oriented soft wares and operational systems. Although these tools overall reduce the workmanship to meet the objectives of manufacturing companies (10&11). In manufacturing companies, one of the reasons attributed for low productivity is the organizational structure that remains mechanistic and not compatible with new technology in most of the AMT firms (12). The term Flexibility is a much-discussed issue (13)

Flexibility is the ability to change the direction rapidly (14). It is characterized as an ability of system to cope with unforeseen changes that can offer positive impact on production, while using these technologies(15).

Advanced Manufacturing systems, usually included as the set of computer-aided engineering, factory management and control systems, computer-integrated manufacturing processes, and information integration (16). It assists manufacturing of high quality products at low cost within the shortest delivery time and can easily fulfill the emerging needs of the ultimate consumers. The Advanced manufacturing systems are usually flexible in nature to apply, despite the wide interest, flexibility remains poorly understood in theory and poorly utilized in practice (17). There is variety of manufacturing systems including Assembly & robotics, Metal cutting and high speed machining, Design for manufacturing, rapid prototyping, tooling and reverse engineering, Abrasive processes, injection molding, CAD, CAM/CIM, Micro engineering, manufacturing systems, Process planning, casting and welding. It has been claimed that SMEs frequently lack expertise, time, money, and support to upgrade their current manufacturing operations, introduce new technologies and methods, implement better quality control, and improve workforce training (18). Large Scale Industries (LSIs) and SMEs collaborate in the development of a new product for the LSIs, e.g. small software or design houses collaborating respectively with large computer and automobile manufacturers (19). With the advancement in manufacturing technologies, it has brought revolutionary changes in the life of managers to alter their tasks in order meet the organizational objectives to compete the global trends (19).

After the globalization, the adoption of emerging technologies has promised more business market opportunity for SMEs (20)

2.1 HISTORY OF MANUFACTURING

The history of manufacturing is as old as the history of mankind on the globe, the ancient people developed and dsigned the products according to their immediate use in order to fulfill the needs and wants of their current requirements. Their product generlly reflects the norms, values and customs of their culture- and this practice is still continue as a source of their survival on this planet.

The industrial development started from the tradional kind of manual manufacturing and kept on crawling for further development with their cultural touches. the demand for the quality products raised to meet the needs and wants. This trend activtes industrialist to move for automated machine installation to cope with the emerging demand made by consumers . keeing all this in view, the enterpreneurs kept continuing efforts of fixing,expanding and updating their industry while including modern technologies as per demand of market and time. The expanded industry became the complete manufacturing industry along with all advanced manufacturing technologies to compete in this modern and innovative world. Designers have long used computers for their calculations. Initial developments were carried out in the 1960s within the aircraft and automotive industries in the area of 3D surface construction and NC programming, most of it independent of one another and often not publicly published until much later. Some of the mathematical description work on curves was developed in the early 1940s by Isaac Jacob Schoenberg. These developments were pioneered by the General Motors Research Laboratories in the early 1960s. One of the important time-saving advantages of computer modeling over traditional drafting methods is that the former can be quickly corrected or manipulated by changing a model's parameters. The second source of CAD was in the testing of designs by simulation. The use of computer modeling to test products was generated by high-tech industries like aerospace and semiconductors. The third source of CAD development resulted from efforts to facilitate the flow from the design process to the manufacturing

2.2 Historical perspective of Textile Manufacturing.

At the time of dis integration form the subcontinent, there were merely 07 textile units with 80,000 spindles and 30,000 looms,hardly meet the 08% of domestic demands of 76 millions of population. With the passage of time and continous efforts and support from the government, this sector became self sufficient to export the textile related products in the global market. The sector further progressed in shape of spinning and weaving sector during the period of 1950s and 1960s respectively (Report Ministry of Industry GOP,2008).

2.3 Focus on Textile Manufacturing.

Through out the history, textile industry has been considered as economic backbone and significant value added subsector in the economic growth of Pakistan. It is one of the pioneer and leading cotton producer sub sector in the international market. The industry has strong local network of receiving raw material from domestic market and provides largest employment opportunities to the industrial labour force, sector also contributes its due share in the form of foreign exchange to the national exchequer.
(www.textilesguide.com)

3 Research Methodlogy

In many literature review, questionnaire is reffered as an research tool that assists the stakehoders to extract the required and appropriate information from the industry. (21&22)

3.1 Questionnaire and data collection pocedure.

The quesionnaire was developed on seven point likert scale, and was sent to the various companies by courier service and few of these industries were personally visited by the researchers only when the companies failed to respond in this regard. The companies have provided the following information that consist of qualitative(through interview) and quantitative (by questionnaire) in nature.

3.2 Back ground of the companies

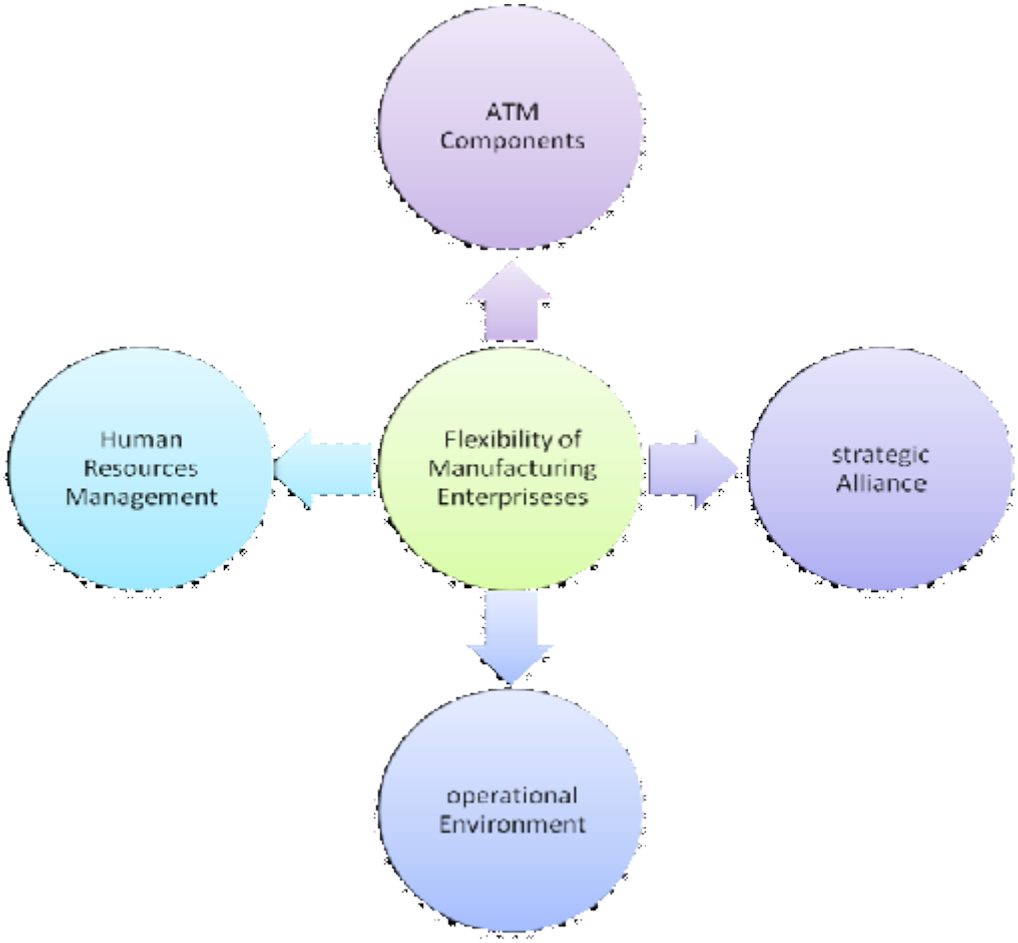
Serial No. of Companies	Classification of Companies	Age of Companies (years)	AMT (Implementation)	Number of employees
1	Garments industries	10-30	AMT COMPONENTS OPERATIONAL ENVIRONMENT STRATEGIC ALLIANCE HUMAN RESOURCES MANGEMENT	50 to 500+
2	Electrical industries,	10-30		50 = 100
3	Food processing industries	10-20		50 = 100
4	Auto Parts Manufacturing industries	10-40		50 = 300
5	Confectionary factories	5-15		20 = 200
6	Leather Products	20-40		50 = 100
7	Cement based products	05- 30		10-50 =
8	Chemical Industries	10-30		20 = 100
9	Plastic Industries	10 -30		20 = 50
10	Glass Industry	10-40		10 = 100

3.3 Model Role for Manufacturing Enterprises in Pakistan.

Manufacturing sector is generally regarded as a 2nd largest contributor to GDP (18%) after agriculture (26%) in term of value addition and, is an economic player for the sustainable economic growth of country which undergoes the various changes time to time designed by the stakeholders to meet the targeting purposes. SME has been defined by the stakeholders in the following manner. (Bureau of statistic, 2008,17)

4. Development of Conceptual Model.

The conceptual model or theoretical framework usually helps the researchers to carry out the work in the systematic and in logical manner so as to develop the appropriate relationship amongst the several identified factors to address their complex problems. Although during its developing process, lot of brainstorming will be required to manage the components that can reflects the outcome of research.



- **Conceptual Model.**

Figure 1: AMT conceptual model for the flexibilty of manufacturing enterprises

5 Emerical Data Analysis

In the literature review, the researchers have always tried their best to design, develop, and implement various conceptual models from the past research, service and experience, knowledge and current business methodlogies. keepng in a view, they further analyse nature of companies, economic stability, workmenship and other aspects in order to benifits the manufacturing enterprises.

5.1 Strategic Alliance

The term strategic alliance may be defined as a process, designed by the business partners on the ground of muatual understanding to create synergy and to provide opportunities for sustainable business growth.

5.2 Operational Environment.

It is an organized process of infrastructural facilities for the optimum use of resources that can be utilized for maximization of output to meet the organizational foals

5.3 Human Resouces Management.

It is an organized method of co ordinating human capabilities in the right direction so as to meet the pre determined objectives of an organization. The main objective of the organization is the best optimization of resources for maximization of companies output.

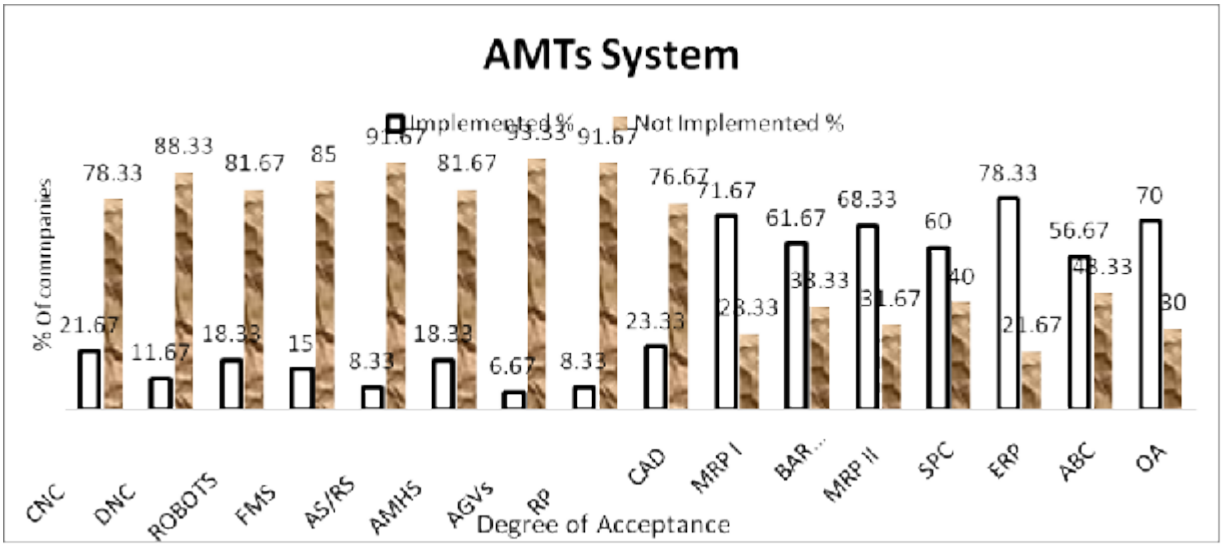


Figure2.

The manufacturing companies were requested to update regarding the implemented AMT systems so that it could be analyzed in terms of their technological strength. The questionnaire was dispatched regardless of their classification. The response indicates that 22% of the manufacturing companies have implemented the CNC on the contrary 78% did not use this facility. The companies which implemented DNC system was 12% where as 88% of companies did not give any prefernece to this tool. The companies which implemented these advanced tools like Robots system with 18%, FMS with 15%, AS/RS with 8,AMHS with 18% AGVs with 7% and Rapid production with 8% in their companies, where as the same system could not be materlized in their systems with 88%,85%, 93% and 92% respectively.

The data further indicates that one of the major desining CAD tool was implemented with 23%, MRPI,with 72% , Bar coding with 62% MRPII with 68% and SPC with 60% in their manufacturing companies. The companies,did not implemented the same systmes were 77%, 28%, 38%,32% and 40% respectively.
The manufacturing companies further revealed the information regarding, ERP system,activity based costing and office automation. It was observed that maximum companies were favourable for ERP system with prefernece of 78%,57% for ABC system and 70 % 0f the companies have implemented the office automation system in their companies.

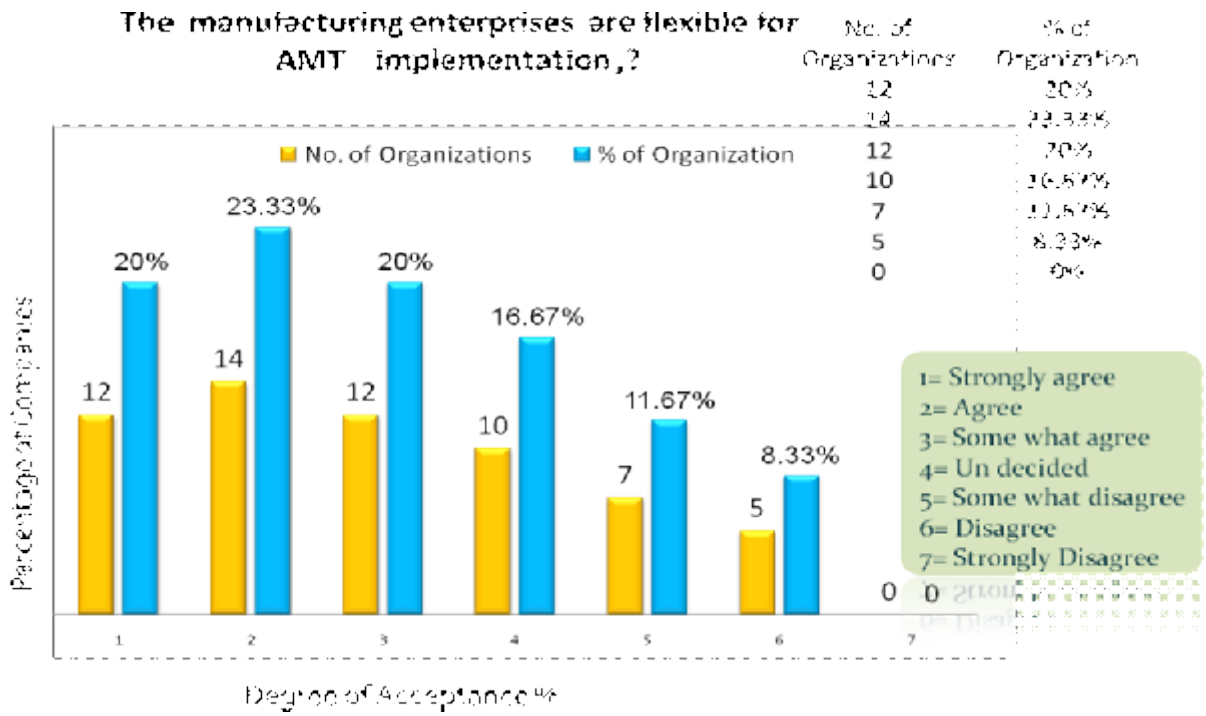


Figure 3

The manufacturing enterprises were requested to send their response regarding their flexibility for AMT implementation in their organizations. In this regard. Data of 60 companies companies were anlyzed that reflects their response as 20% companies have ranked this parameter as strongly agree for its implementation in their companies, where as 23% of companies have scaled its implementation to agree. The 20% of companies have shown their little inclination for its implementation and has ranked 3. The 17% of the organizations could not make any decision for this parameter and have scaled as 4. The remaining companies i-e 12% and 8% companies scaled this parameter 5and 6 respectively which indicates their un willingness for its implementation.

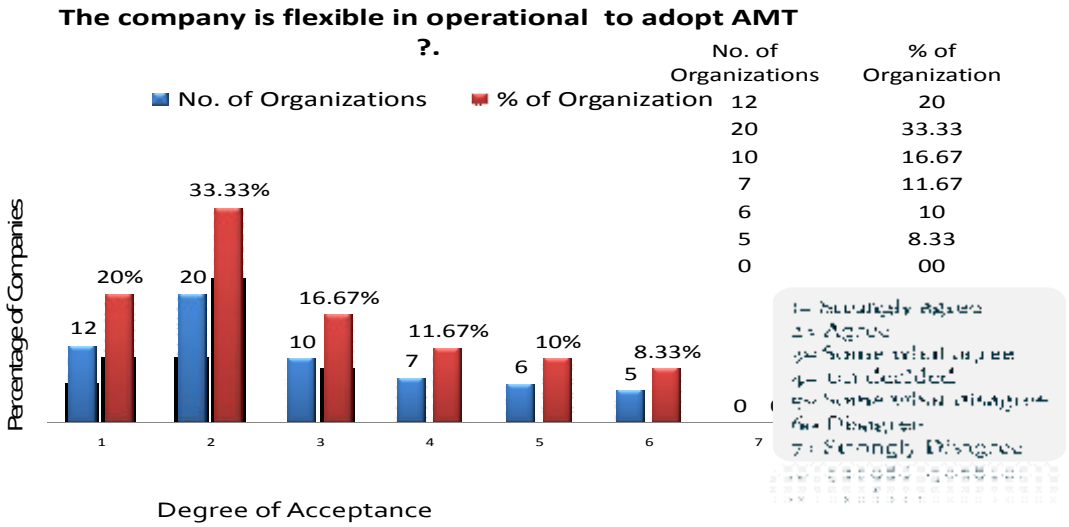


Figure 4

The companies were asked to give their response regarding their flexibility for operational purpose to adopt the AMT system. The questionnaire consist of so many questions was analyzed, the response shows that 20% & 33 of the companies were strongly agree and agree that their companies were flexible for operational pupose to adopt the AMT systems and have scaled this question 1&2 . where as 17% of the companies were indicated for its use in their manufacturing organizations. The companies i-e 12% were unable to make any comment on this parameter as scaled as 4. The 10 and 8% of manufacturing enterprises have ranked this parameter as 5 & 6 which shows unfavorable inclination towards the question, however no any company has declined the flexibilty of company for its operational capacity to adopt the particular system.

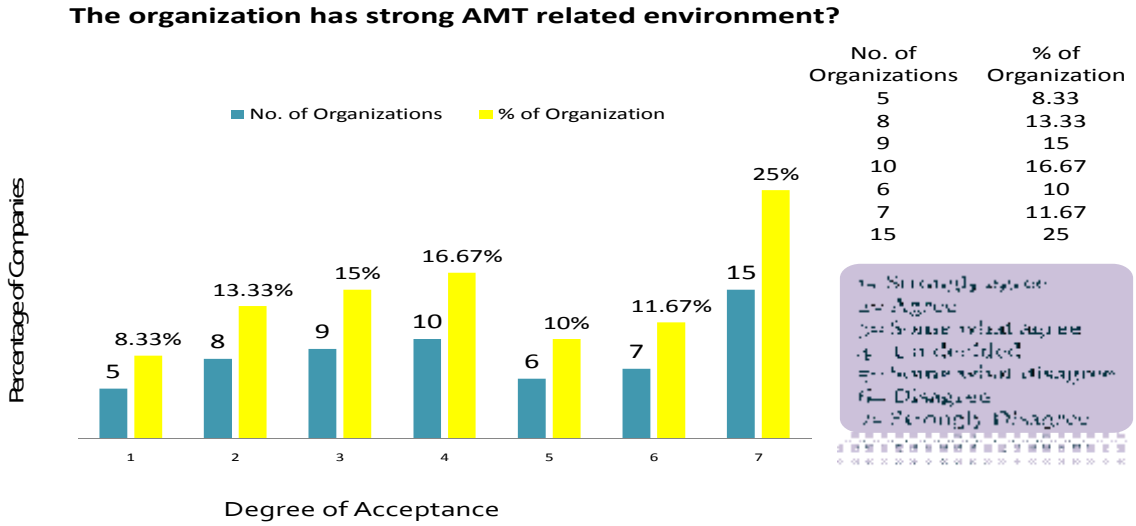


Figure 5

The manufacturing companies were asked to share their opinion for for AMT related environment.The manufacturing companies gave their response that shows 8% of companies were strongly agree regarding the favorable environment for AMT use and has scaled as 1, where as 13% of companies were agree for its use and scaled at 2. The 15% companies were scaled this parameter as 3 which shows and ranked as that these companies were some what agree. From the data it reveals that 17% companies were undecided for the strong AMT environment and scaled as 4. The data also shows that 10% and 11% companies have slightly dis agree with the question. The 25% of the companies were strongly disagree with this question that the companies and have scaled as 7.

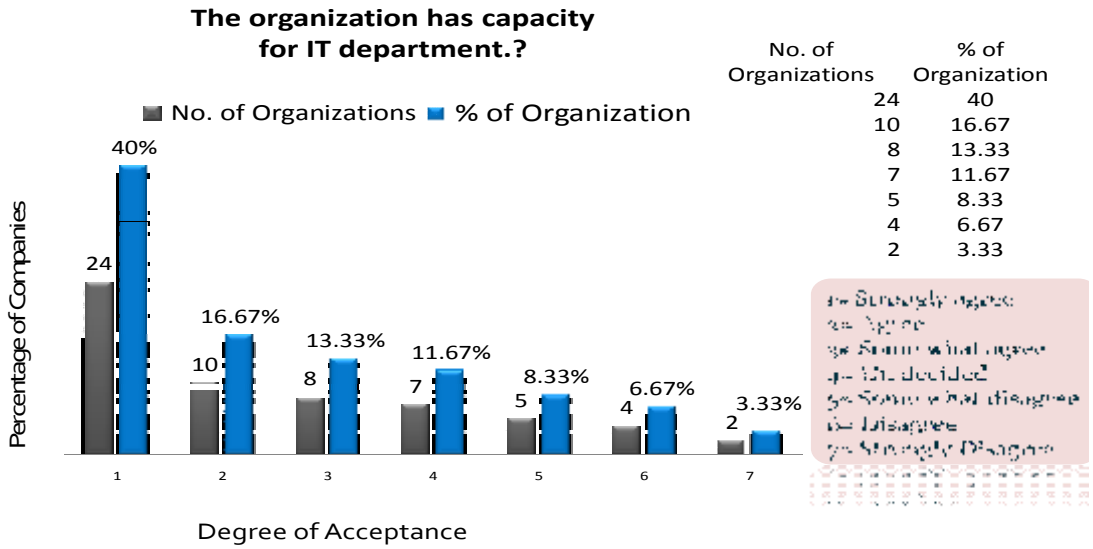
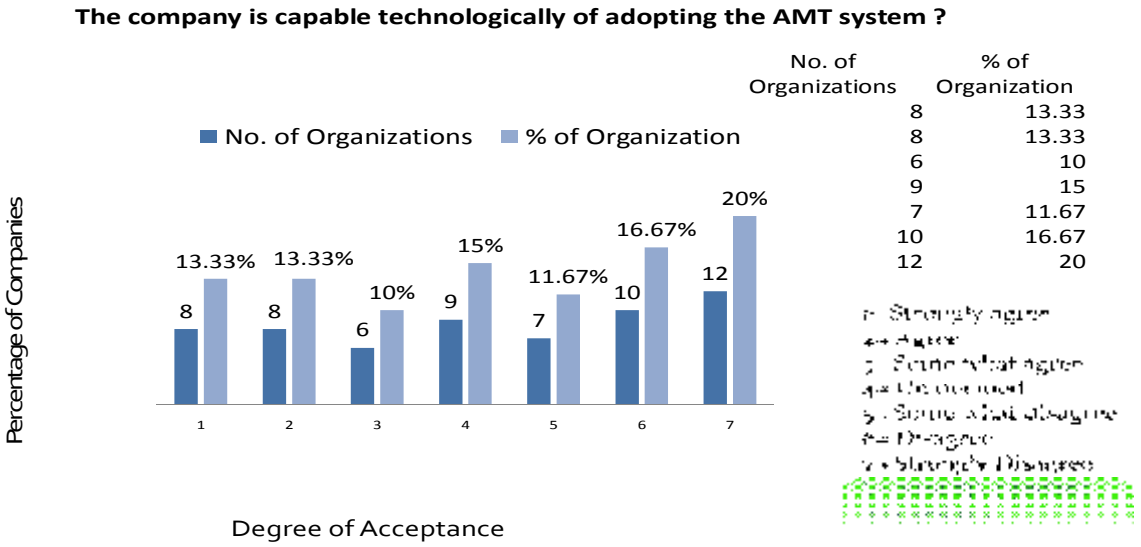


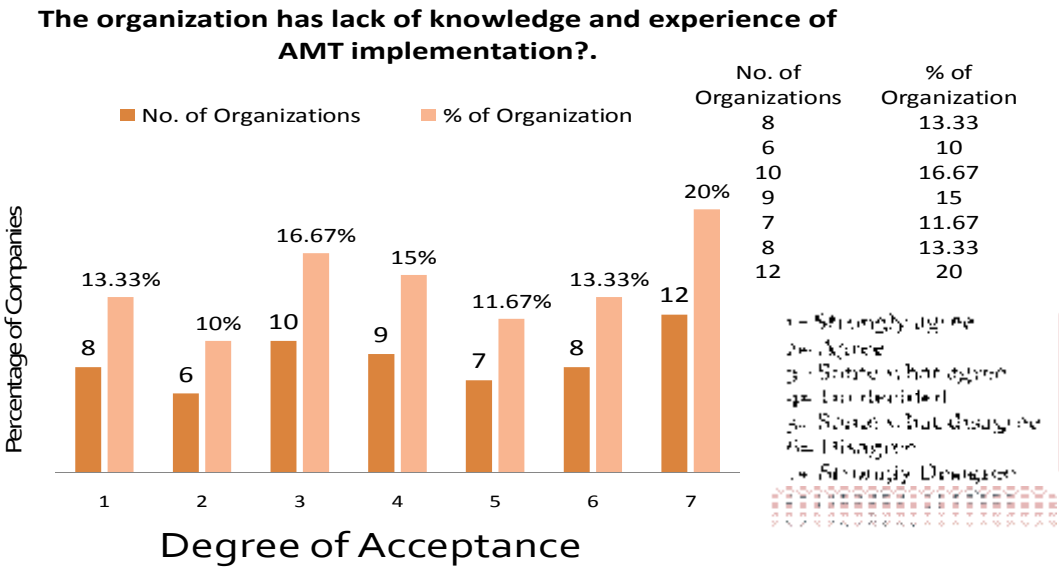
Figure 6.

Information technology is an integral component of any manufacturing organization in today's business environment, where the manufacturing is based on computer supported system. The companies were asked about the IT department in their organization. The 40% of the companies have acknowledged that they have IT deparment an have scaled this parameter as 1.and 17% of compnies also scaled this parameter as 2. The 13 % of manufacturing companies also give their positive inclination as ranked on 3. The 12% of companies did not respond to this parameter and scaled 4. Where as 8% and 7% companies have declined of existance and have scaled 5 & 6 respectively. Only 2% of companies has scaled this parameter on 7. Which indicates that companies having no cpapcity for IT department.



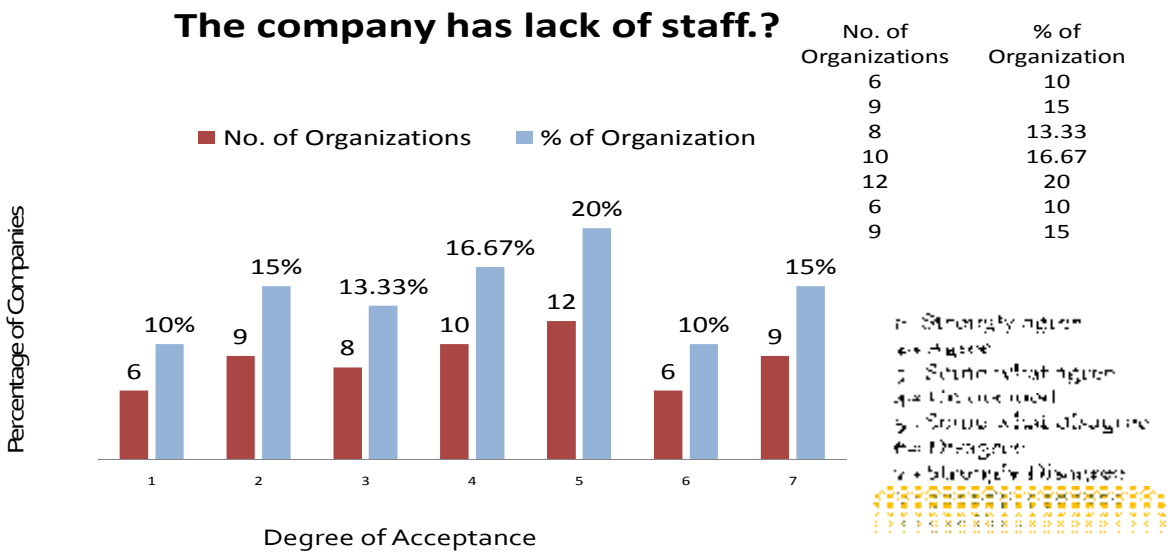
Figure, 7.

The manufacturing companies were asked to provide the information pertaining their capability for the AMT implementation. The response received from the companies reveals that 13% of the companies were strongly agreed for their companies capabilities where as 13% companies also were ranked this parameter as agree for the same system. The response also indicates that 10% of the companies were somehow agree and ranked it on 3rd for that system. The 15% of companies were undecided for implementation and has scaled 4. The remaining % of companies i-e 12%,17% and 20% scaled this parameter as ,5 ,6 and 7. Some what disagree,dis agree and strongly dis agree.



Figure,8.

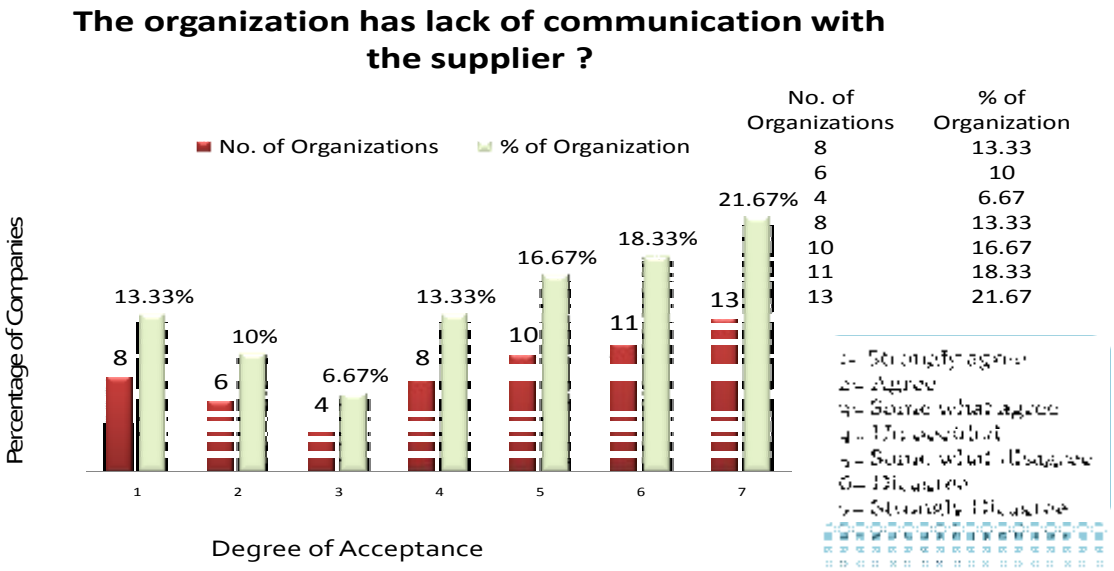
The knowledge and experience of the oraganization contribute a lot, for the existance in the dynamic business environment. The organizations were also requested to give their response in order to understand the mobility in the current business trends. The companies responded in this parameter as 13%,10% and 17% companies were of the opinion that there is a lack of knowledge and experience for the implementation of AMT systems. Where as 15% of the companies were undecided about this parameter. However, 11%,13% and 20 of the companies were some what dis agree, dis agree and strongly dis agree that there is any lack of knowledge and experience of AMT implementation.



No. of Organizations	% of Organization
6	10
9	15
8	13.33
10	16.67
12	20
6	10
9	15

Figure, 9.

Human Resources Management, concept is one of the integral segment of any sustainable organization. Keeping this in a view, the manufacturing companies responded that 10% of companies were strongly agree that their companies has lack of staff where as 15% companies were agree and 14% companies were some what agree and scaled this parameter 1,2 and3 respectively. The companies who decided for this parameter 17% and scaled as 4. As for as the remaining companies are concerned i-e 20%,10% and 15% companies were some what dis agree, dis agree and strongly disagree that there is any lack of staff in their companies and have scaled as 5,6 and 7.



No. of Organizations	% of Organization
8	13.33
6	10
4	6.67
8	13.33
10	16.67
11	18.33
13	21.67

Figure10.

Information technology has facilitated various manufacturing enterprises to explore,expand and communicate companies for the promotion of their business. In this regard data was collected from such companies. The data reveals that initialy, 13%,10% and 7% companies were strongly agree,agree and somewhat agree that there was lack of communication on the part of organization with the supplier for the AMT systemand were scaled as 1,2 and 3 respectively. The 13% of companies were of the opinion that they have made no any decision for such system. However , the other companies i-e 17%,18% and 22% companies gave this scale as 5,6 and 7 that means there was any lack communication with the suppliers for the facilitating of this system for their organizations.

conclusions and suggestios.

This paper has maily emphasised on the investigation of various components of Advanced Manufacturing Technologies invoved in the indeginous manufacturing enterprises of the province of Sindh,Pakistan.

It was observed from the data, that most of the companies have either partially implemented these systems in their organizations or reluctant to implement tools due to the varoius reasons best known to them, however it appears from the information gathered from the questionnaire and personal visits of these companies indicates, cost of the systems, lack of technical knowhow and lacking of economical viability of the companies may be the reasons.

It appears that manufacturing environment is not fully viable for AMT use, and companies are reluctant to adopt these systems due to some reasons.

It observed from the work that Entrepreneurs are reluctant to invest one of the reason in this regard may be the cost of systems.

It indicates from the visits and resaerch that manufacturing enterprises are generally flexible in their nature and operations, and there are so many propects that can attract the enterpreneurs to invest in the AMT based technologies. As for as capacity for the IT department or manpower strength is concerened, it is obvious from the study that there is lot of potential within the organization but there is need of commitment and appropriate utilization of available resources . It was further found that, the manufacturing enterprises must have the good relatioship not only within the enterprises but also with external forces that can help the organizations time to time. There should be strong integration with business players to develop the trust of organization

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