

# Adoption of Advance Manufacturing Technologies (AMT) in Micro, Small and Medium Enterprises (MSMEs) of India

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## 1. Introduction

Micro, Small and Medium Enterprises (MSMEs) play a pivotal role in the development of national economy by contributing significantly in nation's Gross Domestic Product (GDP), employment generation and exports. The growth of these enterprises is particularly important for developing countries because they provide not only large employment at comparatively lower capital cost in comparison to large enterprises, but also help in industrialization of the rural and backward areas. They also contribute in reducing regional imbalances and assure more equitable distribution of national income and wealth.

To support the significant contribution of MSMEs, few recent examples are presented here. At the start of 2014, there were an estimated 5.2 million businesses in the United Kingdom (UK) which employed 25.2 million people and had a combined turnover of more than £3,500 billion. In UK, small enterprises accounted for 99.3% of all businesses, 47.8% of employment and 33.2% of turnover in private sector<sup>8</sup>. Further, across the European Union (EU), there were 21.2 million Small and Medium Enterprises (SMEs) in the non-financial business sector in 2013 and accounted for 99.8% of all enterprises, 66.8% of total employment and 57.9% of total value added generated<sup>9</sup>. In India, the size of the registered MSMEs was estimated to be about 46.756 million (about 31.8% MSMEs of manufacturing nature, whereas 68.2% MSMEs were engaged in the services) that employed approximately 106.152 million of persons and contribute nearly 7.28% of the country's GDP, 37.52% of the total manufacturing output and 34% of the exports<sup>10-12</sup>. As elucidated in these reports, it is thus well accepted that MSMEs are the backbone of a nation's sustainable economic development.

SMEs have played tremendous role in manufacturing sector all over the world<sup>6</sup> as these are manufacturing products for sale to customer, offering services and producing raw materials for big enterprises. To solve some of the existing manufacturing problems which existed in the form of low labour productivity, low machine utilization, high labour absenteeism, high rejection rate, high cost of production and high inventory, adoption for Advance

Manufacturing Technologies (AMT) is required<sup>4</sup>. AMT plays a major role in quality and flexibility improvements in SMEs<sup>7</sup>. Further, to increase competitiveness and productivity in SMEs, the use of AMT is one alternative<sup>3</sup>. The motivating forces for AMT proposals may also include obtaining financial benefits, counteracting skill deficiency and enhancing enterprise image<sup>5</sup>. However, marketing and manufacturing that included workforce skills and capabilities and workforce participation have larger effect on enterprise performance<sup>2</sup>. In addition to this, development in Information and Communication Tools (ICT) provides the opportunity for SMEs to expand their business into foreign market<sup>1</sup>.

India's GDP, although growing at a rate greater than 5% per annum during the last two decades, still lags other emerging economies such as China's GDP. As discussed above, one important way to improve India's competitiveness would be to drive innovation in MSMEs which currently have several barriers as identified and analyzed in this research. Keeping this in mind, a comprehensive study was conducted in this work to understand the role that MSMEs can play in India's growth potential. It is also important to point out here that previous studies on SMEs / MSMEs considered these enterprises as a whole and later classified these with variety of products. Hence, in order to broaden the understanding of the issues pertinent to specific industry sectors, the three sectors namely; glassware, shoe / footwear and lock manufacturing enterprises were considered in this study. These sectors were chosen as they affect daily life of all the consumers in India, and thus would have the utmost benefit to Indian economy if we would impart these sectors on a high growth path. Furthermore, the utility of AMT in growing these sectors has not been clearly understood so far. Thus, the research presented herein, performed a careful investigation of the willingness of these sectors to adopt new technologies. With this, the underlying challenges preventing their growth can be addressed. This is particularly important for a developing nation like India as it is necessary to develop innovative ways to accelerate and maintain growth while providing high quality products; and a range of AMT can provide such a pathway for MSMEs.

This research allowed us to identify key weaknesses in their current business strategies and inherent barriers for their growth. This would help us in providing guidance on future business strategies that MSMEs should focus on. The next contribution of research presented here is a clear understanding the role and current state of Human Resource (HR) related affairs on the success of MSMEs – this topic has not obtained sufficient attention in existing literature, especially in the Indian context. The final outcome of this research is detailed investigation of the adoption of Information Technology (IT) tools in MSMEs, again something that has been poorly addressed in literature in Indian context. Overall, we believe that the inferences drawn from this research will be valuable to future growth of these important sectors forming MSMEs, so that they can drive innovation leading to a future India that can successfully compete on a global scale and deliver high quality products at low cost while providing good employment to its large populace.

## 2. Methodology and Demographic Profile of Participating MSMEs

Methodology covers the detailed procedure for entire research. For the purpose of the survey to collect the responses, a structured questionnaire (questions on five point Likert scale) was framed and was sent to the enterprises involved in manufacturing of glassware and allied products (94 enterprises), shoe / footwear (96 enterprises) and locks (81 enterprises). A total of 84 responses (31% response rate) were collected. Personal visits were also conducted to improve the response rate. About 57% of the total respondents belong to manager's level, whereas remaining were either owner or partners.

Initial findings are discussed on the basis of descriptive statistics using mean, Standard Deviation (SD) and frequency distribution for which Statistical Package for Social Sciences (SPSS) Version 16.0 is employed to analyze the data collected through duly filled in questionnaire. For validity and reliability of collected responses, Cronbach's Alpha is computed. The framed hypotheses are validated and tested statistically by employing one-way ANOVA and t-test. Further, to establish relationship (or to know the impact) of few identified variables with performance parameters, factor analysis and correlation analysis (Pearson's correlation coefficient) is done.

Nature and characteristics of MSMEs surveyed is presented in the demographic profile. About 20% enterprises surveyed belong to micro (0-9 employees), 35% enterprises belong to small (10-49 employees) and 45% enterprises belong to medium (50-249 employees) enterprises. Hence, it reflects that all the enterprises surveyed are of MSMEs nature, not only in Indian respect, but

also in global respect. Further, there is nearly equal participation of all the three sectors in this survey.

## 3. Findings of the Research

From the conducted research, it was observed that more than a quarter of MSMEs (about 30%) were involved in export and were having annual sales turn-over of more than Rupees 500 lakhs (10 lakh = 1 million). More than half of the surveyed enterprises were having about 10% of sales growth and it was expected that the same would be maintained for the next three years. The state of availability of automated machines was very poor in MSMEs. Material handling in almost all the enterprises was done by manual means. A few enterprises employed sales promotion techniques. About one-third enterprises were involved in allocation of funds / budget preparation. Almost all the enterprises were referring competitors' product cost while fixing their products' cost. The largest numbers of orders were received by customers directly. Cancellation, modification in address, change in quantity / product etc. was generally acceptable. Unfortunately, none was offering after sales service. Almost none of the enterprises used to communicate with their customers and never collected any data related to customers' need, improvement in product etc.

It was observed that approximately 10% of enterprises encountered with the problem of disobeying payment agreements or terms for maximum of about one tenth of the orders. The top three order winning criteria included quality, product durability and product cost that not only help in retaining the customers but also help in improving sales. Almost all the enterprises outsourced the transportation whereas about 10% were using own shipment. Shipment in alliance with transporters was observed to be highly reliable and had its high trustworthiness as its delivery was safe. Payments were mostly received by cheques and by demand drafts. However, substantial amount of cash transaction and business on credit could not be ruled out. It was investigated that the procurement of raw material was either regular or done within a week time, just after accepting the order. During the procurement, poor attention was paid towards related issues that included record of suppliers, comparative charts, quality of items, transportation cost and safety and trustworthiness of procurement. The lead time of supply was quite high as about 40% respondents reported for lead time of more than 15 days. Almost all the enterprises (about 95%) maintained huge inventory of raw materials and brought out parts as holdings were for more than 15 days as high inventories were assumed to be the solution of fluctuating market. For generating production schedules, most of the enterprises considered the quantity of confirmed order. Further, most of the enterprises considered make to order, followed by make to stock, as prominent manufacturing strategy.

The most prominent pollutant generated were CO / CO<sub>2</sub> / NO<sub>x</sub> / SO<sub>2</sub>, followed by noise pollution, mixing of chemicals in water, mixing of residuals in water and discharge of hot water. None was adopting any prescribed method for solid waste disposal. Supply of power was poor and most of the enterprises were facing power crises and thus employed alternative power source or power backup, which was largely a generator. Non-availability of power generally made the product costlier and might also cause delay in meeting the due date of supply. However, many of the enterprises suggested that non-availability of power never affect the rate of production and in meeting quality standards because they knew it very well that electricity would not be available and therefore did not rely on regular electricity supply for production. Instead, they used to employ generator to meet-out the targeted production. About one-third enterprises never took any kind of loan from any of the banks and run the entire business from funds arranged on their own. Nearly half of the respondents reported that they did not experience any problem in getting the loan (from sanction to disbursement). However, respondents told that the major hindrance in getting loan was the "Security / Assets / Collateral Deposits". Further, the most adverse situation was created by fluctuation taking place in the cost of raw material, cost of fuels like Compressed Natural Gas (CNG) / Liquefied Petroleum Gas (LPG) / Diesel etc. and non availability of benefits of Tax and Special Economic Zone (SEZ).

About 40% enterprises were producing the products of excellent quality (fit for export), while about 90% enterprises were manufacturing the products of good quality (fit for Indian market) and 31% enterprises were producing the products of satisfactory quality (fit for rural market). These MSMEs were manufacturing more than one type of quality standards (as per order received). Surprisingly, very few enterprises reported for total rejection rate of less than 5% for which the major influencing factors included problem of supplied raw material, operator's problem and machine problem. So, there is a strong need to reduce the rejection rate, need for rework and rejection as scrap. Successful adoption of suitable AMT could offer significant improvement as the performance of MSMEs could be improved by improving product quality, employing automated machines for production and reducing cost of production. Product quality and reliability, increase in annual turn-over, reduction in product cost, increase in return on investment, meeting due dates of supply and production with zero defects were observed as the potential competitive priorities and business objectives among all the MSMEs. Most of the respondents were not aware of the latest developments taking place in the area of AMT. This research observed that only owner / partner or proprietor took the initiative for adoption of suitable AMT for most of the times as he / she was the supreme power of decision making and thus, it had least level of its opposition. Workers never got involved in idea

generation for adoption of AMT, thus, they might resist. It was observed that MSMEs have invested and adopted Numerically Controlled (NC) / Computerized Numerically Controlled (CNC) / Automated machines, followed by Office Automation (OA) and Computer Aided Design (CAD). In general, all sectors of MSMEs were still willing to adopt NC / CNC / Automated machines in near future. Improved quality, increased sales, lowering production cost, reduction in rejection / re-work / scrap, reduction in labour cost and reduction in labour were among the top five benefits that attracted adoption of AMT.

There was no process champion or technological expert. It was observed that the most common risks during AMT adoption were opposition by workforce, inadequate training of workers, production interruptions during AMT installations and failure in meeting financial objectives. The performance of enterprises was generally evaluated by increase in profit, sales and orders. The most of the enterprises neither evaluated employees' performance nor employed benchmarking in any area. Overall state of availability of welfare facilities and its effectiveness was poor in MSMEs. Miss-happening in terms of minor accidents was reported by almost all the enterprises. Availability of Doctor in MSMEs was rare. The most favourable five ergonomic aspects included approach to hand tools, availability of stair cases, availability of sun light, floor condition and ventilation. The most adverse five conditions included non-availability of smoking zone, non availability of canteen / tea and snacks, improper rest between shifts, existing sweating condition and back / body ache problems. Participation of employees for activities like for problem solving during machine failure / breakdown, cleaning of self work places, housekeeping and for preventive maintenance was somewhat poor. During planning of AMT investment, workforce should be involved from its initial idea generation to actual working phase, including post evaluations, as employees of various sectors of MSMEs were generally not willing to accept the adoption of newer technologies and used to oppose and motivate others to oppose. They forced to accept the introduction of new / latest technologies / AMT only because of fear of loss of job.

Employees' of various sectors of MSMEs were always bothered for reducing waste, improving the quality, effective utilization of resources, reducing the power requirement and reducing the pollution. MSMEs were generally operative for all week days with one or more shift working per day and were employing over-time with a provision of extra wages. State of leave was poor as more than one weekly off without deducting salary was given by very less number of enterprises. Enterprises generally offered gifts / bonus at the time of festivals. Effective loan facility was missing. Most of the workforce employed in MSMEs was unskilled and generally recruited with personal contact and / or with the reference of working employees. Most of the employees left the job because of more salary, better environment and due to personal

problems. When an employee leaves the job, only due Provident Fund (PF) was generally paid.

Except 15% of enterprises, all were equipped with computer and printer. Internet was available in three quarter of enterprises. However, overall observations reflected that MSMEs were having poor IT related infrastructure and hence would not be exploitable to the potential benefits of IT to compete in present era of global market. The maximum use of computer / IT / Electronic Commerce (EC) was reported for billing and collection followed by three more areas as payroll / HR, suppliers' information and in research and development. Documents used in MSMEs were generally manually prepared. About one-third enterprises were having their web-sites with poor updating frequency and only about 10% respondents reported that the user might place the order or they receive / get orders for supply of products through web-site. Regarding the problem faced by the enterprises when orders were received through Internet either via e-mail or web-site, about 15% respondents reported for problem faced in identity confirmation, address confirmation, payments, delivery of products and trustworthiness of customer, while about 13% respondents reported for problem faced in shipment. Respondents said that whenever they got order (either by phone, fax or by e-mail), they usually made a phone call for confirmation of identity. The most commonly used modes of payment receiving were cheques, demand draft and cash. About 60% respondents told that they used to accept cash on delivery.

#### 4. Web-based Order-supply System

A web based application system is proposed that can be prepared in a customized manner and can be hosted on web-server. Its development and successful adoption may enable the enterprises for (1) Marketing – Globally, (2) Order Receiving and Supply – Globally with shipment in alliance, (3) Communication with Customer, (4) Communication with Vendors – for the supply of raw material and sub-contracted parts, as and when required, and (5) Communication with Dealers – who are responsible for sales of products to customer, along with online transactions in real time.

#### 5. Discussion

Technology adoption is a catalyst not only for growth among India's MSMEs but for the growth of the Indian economy on the whole. Many stakeholders, including the Government of India, technology enterprises and MSME leaders recognize that roadblocks relating to infrastructure, technology and skilled labour must be eliminated to sustain the growth of MSMEs and ensure their continued contribution to India's industrial production,

economic growth and employment. Most of the MSMEs of India, at present, are not able to produce quality products, at par with global standards. Rejection is also appreciable that needs to be reduced. To grow, more orders are required and thus, more customers are required. To satisfy customer, high quality products are to be offered for sale to customer in an earliest possible time. These products must be reliable and cost effective. Lack of affordable and continuous power supply is hindering the functioning of MSMEs and thus, affecting quantity, quality and cost of produced products. Further, prevailing fluctuating markets are creating threats potentially in terms of cost of raw materials. Entire set of findings advocate for adoption of suitable AMT so as to explore its lucrative benefits, not limited to improved quality, less rejection, less inventory, less production cost and better performance of the products. Hence, adoption of suitable AMT, IT tools and improving workforce state (by training, motivation and offering favourable and ergonomic working conditions) is essentially needed for MSMEs of India so as to achieve their accelerated growth.

Further, Government of India is aware of most of the problems faced by the MSMEs and is taking appropriate measures. In order to boost the MSME sector, several schemes are operational that include Technology Centre Systems Programme, India Inclusive Innovation Fund, Credit Linked Capital Subsidy, Credit Guarantee Scheme, Prime Minister's Employment Generation Programme, Micro and Small Enterprises (MSE) Cluster Development Programme and Scheme for Extension of non tax benefits to MSMEs for three years. The Government has also notified the Public Procurement Policy that mandate that every central ministry / department / public sector-undertaking shall set a minimum annual procurement goal of 20% of total product purchases from MSEs from financial year 2012-13 onwards, in a period of three years<sup>11</sup>.

#### 6. Conclusions, Recommendations and Future Work

This research, on the basis of surveyed MSMEs of India, concluded that the largest numbers of orders are received by customers directly and the prominent order winning criteria (quality, product durability and product cost) not only help in retaining the customers but also help in improving sales. Significant amount of cash transaction and business on credit is in place. The lead time of supply is quite high and almost all the enterprises maintain huge inventory as holdings are for more than 15 days. Enterprises employed manufacturing strategy as make to order, potentially, followed by make to stock. The pollutants generation cannot be ignored as none is adopting any prescribed method for solid waste disposal. The supply of power is poor and enterprises

are facing power crises and thus use alternative power source or power backup, which is largely a generator. About one-third enterprises run the entire business from funds arranged on their own. Nearly half of the respondents told that “Security / Assets / Collateral Deposits” is the major hindrance / problem in getting the loan.

Almost all the enterprises reported for total rejection rate of more than 5% and quality of produced product is generally not suitable for export. So, there exists a strong need to reduce the rejection rate. Successful adoption of suitable AMT can offer potential improvement in this respect. MSMEs have invested and adopted NC / CNC / Automated machines followed by OA and CAD and in general, these are still willing to adopt NC / CNC / Automated machines. The top benefits of adoption of AMT include quality improvement, increase in sales and reduction in production cost, rejection, labour cost and in labour. While adopting AMT, opposition by workforce, inadequate training of workers, production interruptions and failure in meeting financial objectives are observed as the most common risks. The performance of enterprises is generally evaluated by increase in profit, increase in sales and increase in orders, while there is no evaluation of employees’ performance and they are not using benchmarking in any of the areas. Except 15% of enterprises, all are equipped with computer and printer and Internet is available in three quarter of enterprises. However, overall observations reflect that MSMEs are having poor IT related infrastructure and hence could not exploit the potential benefits of IT to compete in present global market. With this, greater emphasis on adoption of IT tools including suggested web-based order supply system in manufacturing sector is also needed.

On the basis of research conducted, not only to retain faith of customers, but also to satisfy the customer and to increase the customer base, it is recommended that all the entrepreneurs may be educated to adopt practices including allocation of funds / budget preparation, sales promotion techniques, communicating with customers, after sales service etc. More orders can be obtained by offering quality products with high level of durability at a lower cost in a shorter period. MSMEs should participate in seminars and trade fair so as to remain update from newer technologies and to open new opportunities. Suitable type of AMT should be adopted by MSMEs so as to improve product quality, reduce product costs, increase throughput, to reduce rejection and to increase flexibility, as needed to survive and grow. Skill deficiency of workforce is prone that results in more rejections with less wages / salaries. While planning for adoption of AMT, an enterprise may involve its entire workforce at various levels of adoption, even from the level of idea generation. All the employees should be considered as a team / family of enterprise and should be encouraged for training / re-training and for skill enhancement. Service of a technical consultant is needed even to

educate entire workforce as adoption of newer technology is not for their job loss, but it will help in increasing their earnings. Skill level of entire workforce will improve and thus, new opportunities will be generated as markets are global. All the enterprises should emphasize on various welfare facilities including first aid facility, hospitalization, Employee’s State Insurance Corporation (ESIC) scheme and training / re-training along with safety of employees. Working conditions must be designed ergonomically so that the life / health of workforce will not be in jeopardy. The state of leaves, leave rules, salary, wages, bonus, awards, PF, recruitment, trainings, payment of salary after leaving the job and retirement benefits may be as per governing rules and should be implemented with true and humanitarian spirit. Evaluation of employees as well as enterprises may be carried out that can be in terms of accepted production rate, reduction in rejection and increase in turn-over / sales.

Supply of power at normal rates for entire working hours should be made available to all the enterprises. The pollution generated by enterprises should be reduced and proper treatment / waste management should be employed to save ground, water, air and ultimately, the environment. In this regard, governing laws should be amended with its strict enforcement. Cash transaction / credit should be avoided. Financial assistance in terms of loan at cheaper interest rates is essentially needed for MSMEs. Loan procedures should be simplified with elimination of personal borrowings. The state related to cost of fuels like CNG / LPG / Diesel, cost of raw material and Government policies related to taxation should be addressed at policy makers’ level. Further, all the enterprise should be equipped with computer, printer and Internet. Each enterprise must have a web-site with real time database connectivity so that orders and transactions can be processed along with customers’ communication at any time from any geographic location, and should adopt EC / IT / ICT / software.

This study is based on responses of participated MSMEs of India and to broaden the aspect and coverage, the study must be planned in much larger way. Future studies and researches in this regard will help the manufacturers, policy framers and researchers to reach to a common consensus.

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