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Reluctant Workforce May Derail the Adoption of Advance Manufacturing Technology in Micro, Small and Medium Enterprises of India

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Abstract

Micro, Small and Medium Enterprises (MSMEs) contribute enormously to socio-economic development of a country. A key necessity for maintaining sustainable growth of MSMEs is the adoption of suitable Advance Manufacturing Technologies (AMT) that requires utmost care in human related issues. The investigations on the basis of surveyed 84 MSMEs of India, suggest that the workforce, although engaged in producing quality products, is not keen to reduce the rate of rejection. While implementing suitable AMT in the industrial processes, workforce generally did not accept the technological changes; and a process champion was rarely employed. This reluctance of the workforce towards the adoption of AMT in Indian MSMEs is a major challenge to their ability to sustain in this globally competitive environment. Thus, for improved human resources, an humanitarian and honest attention is essentially required.

Keywords: Adoption of Newer Technologies, Advance Manufacturing Technology, Employees' Culture, Ergonomic Working Conditions, Human Factors, Small and Medium Enterprises

1. Introduction

The sector comprising Micro, Small and Medium Enterprises (MSMEs) can be considered as nurseries for entrepreneurship, often driven by individual creativity and innovation, and contributing enormously to the socio-economic development of a country. MSMEs provide employment to a large populace at a comparatively lower capital cost than the larger enterprises and helps in the industrialization of rural and backward areas, leading to a reduction in regional imbalances by assuring more equitable distribution of national income and wealth geographically. They increasingly play a pivotal role in the country's economic progress and recovery, mainly due to their higher rates of employment growth than other industrial sectors, as reported in recent articles[1,2]. The studies conducted by many researchers like Buckley[3]; Burhanuddin et al.[4]; Dalu and Deshmukh[5]; Farsijani and Carruthers[6]; Gunasekaran et al.[7]; Harvie[8]; Koc and Bozdag[9]; Romijn[10]; Schmitt and Lane[11]; Shi and Li[12]; Subrahmanya et al.[13] have also supported for significant contribution of small sectors in nation's Gross Domestic Production (GDP), industrial production, export and employment. Such significant contribution has lead to an unprecedented growth in MSMEs worldwide and to increase their performance, competitiveness and productivity, the use of suitable Advance Manufacturing Technologies (AMT) is one alternative for Small and Medium Enterprises (SMEs), as suggested by Rahman and Bennett[14], Gill et al.[15], and Singh et al.[16].

The literature cited above shows that the contribution of MSMEs towards sustainable development of any nation's economy is now well accepted. It implies that for a sustained growth of economy of India, the development and improvement in the performance of MSMEs that urges for adoption of suitable AMT, is required. However, the successful adoption of newer technologies and improvement in productivity requires carefully addressing and taking care of human related issues. Motivated by this, a thorough study was undertaken in manufacturing MSMEs to analyze the state of human related factors and their participation in the adoption of AMT. The study undertaken in this work covered three sectors of MSMEs, namely glassware, shoe/footwear and lock manufacturing, in North India. These sectors were chosen as they belong to the consumer sectors and thus affect every person in their routine life. Further, only three sectors were selected as these can be handled easily - it will make three

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sub-groups (a sub-group comprising two sectors at a time) as used in many cases of statistical analysis, like using t-test (adopted for statistical validation of hypothesis). Aspects covered in this study include demographic profile with important issues related to the performance of the enterprises, welfare facilities, safety, employees' participation in various activities, acceptance of newer technologies by employees, availability of process champion, employees' culture, and ergonomic working conditions. The primary objective of the research study was to investigate key human challenges facing adoption of AMT in MSME workforce in India and reveal any underlying psychological issues such as reluctance to change. A secondary objective was to understand whether the reasons for these challenges are cultural or technical in nature. The role of ergonomic working conditions was also investigated. Through this investigation, viability of possible solutions, e.g. process champion, was also analyzed.

2. Review of Literature

2.1 Contribution of Small Sectors in Nations' Economy

Existing body of literature suggests that SMEs contribute significantly in nation's GDP, total manufacturing production, exports and employment. To support this, few examples of some of the important countries are quoted herewith. China had more than 4.3 million registered SMEs in 2009 that comprises 99% of the nation's registered businesses. SMEs contribute about 60% to the nation's GDP, half of its tax payments, about 70% of its exports and create about 80% of new jobs[17]. Further, SMEs employ nearly 80% of the country's population[18]. In the latest available data for South Korea, there were approximately 3 million SMEs which accounted for 99.9% of all enterprises, employed 87.5% of the total workforce and contributed to 31.9% of total export[19]. As per the information given by SME Corporation of Malaysia in SME Census 2011, (reference year 2010), manufacturing SMEs constitute about 95.4% of total enterprises and employ approximately 0.7 million persons[20].

SMEs form the backbone of the EU economy, which is accounting for 99.8% of non-financial enterprises in 2012, which equates to 20.7 million businesses (92.2% micro enterprises, 6.5% small enterprises 1.1% medium enterprises and 0.2% large enterprises). In employment terms, SMEs provided an estimated 67.4% of jobs in non-financial business economy in 2012 [21]. At the start of 2012, SMEs accounted for 99.9% of all private sector businesses in the UK, 59.1% of private sector employment and 48.8% of private sector turnover. SMEs employed 14.1 million people and had a combined turnover of £1,500 billion[22]. In India too, MSMEs contribute 8% of the country's GDP[23]. As per the Annual Report (2011–2012) of Ministry of MSMEs, issued by Government of India, MSMEs account for about 45% of manufacturing output and 40% of the total exports of the country[24].

2.2 Human Factors in Technology Adoption

The customer of 21st century demands products and services that are fast, right, cheap and easy. To respond quickly and effectively to the rapidly changing needs of the customer and to maintain a high level of competitiveness in the global arena, manufacturers are adopting AMT[25]. Broadly, AMT refers computer aided technologies used by manufacturing organizations. In the past decade, manufacturers have invested significantly in the implementation of AMT in an attempt to reduce costs and gain a competitive advantage in their organization[26]. Taha and Tahiri[27] cited that AMT plays a major role in quality and flexibility improvements in SMEs. Motivated from lucrative benefits offered by adoption of AMT, as suggested by Hoffmann and Orr[28] and Hynek and Janecek[29], it has been introduced in Indian manufacturing enterprises to have a competitive edge in the global market. Despite the claims that attractive benefits can accrue through the use of AMT in manufacturing enterprises, only modest benefits are reported. Productivity of AMT enterprises is found to be low even after several years of implementation of AMT. 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 enterprises[30,31].

A research finding of Bessant[32] reflects that the effective implementation of AMT depended upon factors like employment security, a clear business rationale for using AMT and the effective communication and discussion for this at all levels, priority given to planning of human resources issues in comparison with technical and physical issues, management efforts to effect culture change and to support and guide the development process. Worker empowerment is considered to be critical supporting element in supporting AMT investments[33]. Muscatello and Greene[34] stressed that the key to success in adoption of AMT included team approach, support of top management, responsibility, decision making authority, phased implementation approach, dedication, project ownership of team members and their commitment. The factors that affect the morale of employee and indirectly productivity are safety, ergonomic working conditions, hygiene working environment, less fatigue, human-friendly systems, health hazards, superior light and ventilation and clean air, water and canteen facilities[35]. Further they emphasized the need of addressing human issues including employee cooperation, employee relations, employee morale/motivation, manpower planning, availability of technological champion, worker involvement in planning, capability of workers in skills, knowledge and attitude, recognition of work groups, training and education to reduce resistance and modification of pay system[36].

The way of organization and management of production has huge impact on success or failure of entire enterprise[37]. Challis et al.[38] observed that manufacturing managers are becoming increasingly committed to the need of organizational and human resources investments in order to maximize the value of employee contribution to the operational and business performance of their enterprise. Marketing and manufacturing that included workforce skills, capabilities and participation have larger effect on company performance than logistics[39]. However, an industry-based generic training process can enhance the skills of workers at all levels, allow them to dynamically cope with changing technology, give them options for personal and professional growth, cut costs, increase productivity and quality of products manufactured[40]. Sohal et al.[41] also supported for the need of worker involvement at all stages alongwith their training. Many researchers stated the importance of process champion for adoption of AMT. A professor or an interested group can promote AMT through conducting workshop and seminars, research projects and teaching[42]. Harney and Dundon[43] presented a framework to evaluate Human Resource Management (HRM) in SMEs. Development of HRM capabilities allows SMEs to improve their productivity and also amplify the effect of Research and Development and AMT capabilities on productivity[44]. The central arguments in HRM literature is that effective and evolving HR practices lead to better and/or changed employee behaviour which helps enhance organizational performance[45].

Mismatches between human performance and task requirement relate to incompatibilities, inappropriateness, unsuitabilities or inconsistencies which, if not addressed, would lead to errors[46]. Excessive reliance on automation technology may be undesirable if the overall goal is to enhance productivity of manufacturing enterprises. A human-centered approach to modern manufacturing may be more effective based on actual productivity gains, economics, technical feasibility and equipment capability and reliability, and problems created by automated manufacturing technologies[47].

Many enterprises fail to invest properly in workers and their training for usage of new manufacturing technologies, which can lead to an alienated workforce[48]. Beaumont et al.[49] investigated that the failures are often attributable to enterprises not making changes that support AMT, e.g. not developing skills, not exploiting the machines to make customized or higher quality products and not searching for markets for new products the machine could make. The barriers that affect the manufacturing system significantly include scarcity of skilled/expert workforce, training to management and its employees, lack of related infrastructure, resistance from employees to the changing conditions and disparity in pay scales of employees[50].

3. Generation of Hypotheses

In the light of discussed literature, it can be remarked that for sustainable development of MSMEs, adoption of suitable AMT is utmost required, even to compete in global market places. This necessitates for better care of entire set of human related affairs. SMEs are labour intensive production enterprises[51] that run through workforce and hence workforce plays a significant role in the functioning, growth and needed technology adoption of an enterprise. The actual benefits of the AMT incorporation can be obtained by making the organizational structure and current design compatible with introduced changes in the manufacturing system[52]. Thus, if human factors are taken into consideration properly, it opens up for improved productivity and a higher efficiency. This can be achieved by redesign of jobs, job enlargement, job enrichment, team based work and assigning the planning decisions from management to individuals or group of workers to offer better production with higher flexibility[53].

The mood / approach of the employees is very important while adopting and implementing AMT. It can be analyzed by measuring employee acceptance towards AMT implementations that includes acceptance with 100% motivation, acceptance as a burden, acceptance due to fear of loss of job, rejection, opposition and opposition with motivating others to oppose. In this regard, the framed alternate hypothesis can be stated as :

H_{A1} : Employees of various sectors of MSMEs of India are generally not willing to accept the adoption of newer technologies and oppose and motivate others to oppose.

It is encouraging that improvement in productivity may help in reducing the product cost as more manufacturing output can be achieved by effective utilization of available resources. Employee organizational commitment is highly valuable as commitment is vital to the productivity, quality and good performance of an organization[54]. Quality products are often produced by proper care of man-power where manual operations are involved. Muda and Hendry[55] stated that the World Class Manufacturing (WCM) enterprises will have to achieve higher levels of flexibility and worker along with to have attained higher standards in several areas including motivation, enthusiasm, housekeeping, quality assurance, preventive maintenance and machine repair. Once the employees' mood / approach towards technology adoption is known, the need exists to know the employees' culture through various aspects that include botheration of employees for reducing waste, quality improvement, reducing rejection rate, effective utilization of resources, reducing power/energy requirements and reducing pollution. To understand employees' cultural aspect, one null hypothesis and an alternate hypothesis is generated as:

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H_{N1}: The employees of various sectors of MSMEs of India are not bothered for reducing the rejection.

H_{A2}: The employees of various sectors of MSMEs of India are utmost bothered for improving the product quality.

4. Methodology Adopted

To collect the responses of the survey, a structured questionnaire was framed. The questions pertaining to the questionnaire were on a five-point Likert scale. Enterprises were carefully selected from www.indiamart.com, directories of various industrial areas and their physical presence. In total, 271 questionnaires were mailed to different MSMEs throughout the country. These included the manufacturers of glassware (94 units), shoes/footwear (96 units) and locks (81 units). This survey was conducted during the period of May'2009 to February'2010. Out of 271 questionnaires mailed to the Proprietors/Managers, 2 questionnaires returned undelivered, 1 unit was reported to be closed and 1 was reported to be shifted. A total of 84 valid responses were collected. This gives an effective response rate of 31.23%.

To improve the response rate of MSMEs in this study, personal visits were also conducted as personnel from MSMEs are generally less motivated for participation in such activities. This sample size is low as compared to the actual numbers of existed MSMEs in the country, however quite high for such studies. Overall, this study was helpful in digging the actual practices and state of affairs related to the studied aspects.

Statistical Package for Social Sciences (SPSS) V16.0 is used for entire set of computations/analysis. Initial analysis is done by using descriptive statistics that includes mean, Standard Deviation (SD) and frequency distribution. Validity of data is evaluated by reliability and reliability is tested by computing value of Cronbach's Alpha. Further, hypotheses are tested based on mean of all the sectors, mean of the individual sectors, one-way ANOVA values with their significance for all the three sectors and *t*-statistics for all the three sectors in the groups. Hypothesis computations are represented in a tabular form for validation and discussion. Further, to establish relationship of few identified variables related to ergonomic working conditions with the performance parameters, factor analysis and correlation analysis has been done. Factor analysis is done by employing principal component analysis with Varimax rotation method to find potential components in the area of concern that reduces number of variables to be used further. Then, the correlation of new variables (employing Bivariate Correlation procedure) with indicators (four performance variables named as sales turnover, market share, sales growth and export) is computed that measures how variables or rank orders are related. These computations are presented in respective tables and discussed in respective sections.

5. Demographic Profile of Participating Enterprises

The nature and characteristics of surveyed enterprises is included in the demographic profile (Table 1) that comprised segment wise participation and number of employees. This also consists of performance parameters like annual sales turn-over, involvement in export, market share, past sales growth over last three years and projected sales growth for coming year. The definition of MSMEs varies from country to country and region to region. In India, the definition of these enterprises is based on investment limit. For global reference, refer Table 2.

Referring to the definition of MSMEs adopted by many countries (Table 2) and surveyed data (Table 1), about 20% surveyed enterprises belong to micro (0-9 employees), 35% enterprises belong to small (10–49 employees) and 45% enterprises belong to medium enterprises (50-249 employees). It reflects that all the surveyed enterprises belong to MSMEs sector. It is important to note that the three sub-sectors are nearly equally distributed in this survey (Table 1). Nearly 70% of enterprises reported an annual sale turn-over less than 50 million INR (Indian National Rupee). About 31% enterprises reported that they are engaged in export of their produced products. Thus, it can be inferred that those enterprises which are involved in export, are having annual sales turn-over of more than 50 millions of INR as both the cases are having nearly equal percentage. Most of the participating enterprises (about 85%) had a market share of less than a single percent.

6. Findings of this Survey

6.1 Welfare Facilities

Respondents were asked about the availability of welfare facilities and its effectiveness as shown in Table 3. The value of Cronbach's Alpha for reliability of data is 0.741 (N = 11).

The most cited available facility was the facility of first aid (mean = 2.95, SD = 0.62). It included localized availability of dressing and availability of most commonly used medicines. Regarding the availability of Hospital (mean = 2.23, SD = 0.94), employees were generally registered with Employees' State Insurance Corporation (ESIC) scheme. In case of emergency occurred during working (within the enterprise during working hours), the management used to offer medical assistance through nearly hospital depending upon its seriousness. Respondents said that safety of manpower was their prime responsibility. No other facility was cited to be offered effectively as all other facilities were having mean value of less than 2. The value of satisfaction is 3 (as taken in survey on Likert scale of 5). Figure 1 indicates the presence of welfare facilities.

Table 1. Demographic profile of participating enterprises

Demographic profile Parameters for of participating enterprises (with the number and % of the respondents)						**Total Respondents, Percent**
Participation by segment	Glassware Manufacturing Enterprises (31, 36.9%)	Shoe / Footwear Manufacturing Enterprises (30, 35.7%)	Lock Manufacturing Enterprises (23, 27.4%)	-		84, 100%
Number of Employees	Less than 10 (17, 20.0%)	Between 10-49 (29, 34.5%)	Between 50-199 (30, 36.0%)	Between 200-249 (8, 9.5%)	250 and Above (0, Nil)	84, 100%
Annual Sales Turn-over	Upto 50L (15, 17.9%)	Between 51-100L (12, 14.2%)	Between 101-200L (19, 22.6%)	Between 201-500L (13, 15.5%)	More than 500L (25, 29.8%)	84, 100%
Enterprises Doing Export	Doing Export (26, 31%)	Not doing Export (58, 69%)		-		84, 100%
Market Share	Upto 1% (71, 84.5%)	Between 1-5% (12,14.3%)	Between 6-10% (0, Nil)	Between 11-15% (1, 1.2%)	More than 15% (0, Nil)	84, 100%
Sales Growth (Over past 3 years)(Increase)	No Increase (1, 1.2%)	Upto 10% (54, 64.3%)	Between 11-20% (28, 33.3%)	Between 21 to 50% (1, 1.2%)	More than 50% (0, Nil)	84, 100%

Source : Computed outcome of responses collected through conducted survey
'L' means Lakhs of Rupees (INR), 10 Lakhs = 1 million, 1 US Dollar = ₹ (INR) 61.603500

Table 2. Defining MSMEs (Manufacturing / Production Enterprises)[19,56,57,58,59]

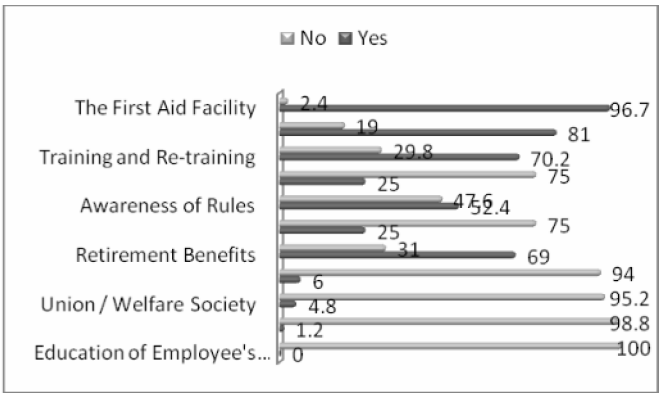
Country	**Micro Enterprises**	**Small Enterprises**	**Medium Enterprises**
European Economy (€)	With less than 10 persons employed AND Turn-over or Balance Sheet Total of ≤ € 2 million	With 10 to 49 persons employed AND Turn-over or Balance Sheet Total of ≤ € 10 million	With 50 to 249 persons employed AND Turn-over or Balance Sheet Total of ≤ € 50 million
India (₹)	Investment ceiling for Plant, Machinery or Equipments upto INR 2.5 million	Investment ceiling for Plant, Machinery or Equipments above INR 2.5 million and upto INR 50 million	Investment ceiling for Plant, Machinery or Equipments above INR 50 million and upto INR 100 million
Japan (Yen)	Capital less than 300 Million yen (US$ 2.70 million) with number of employee less than 300		
Malaysia (RM)	Sales turnover of less than RM250,000 OR full time employees less than 5	Sales turnover between RM250,000 and less than RM10 million OR full time employees between 5 and 50	Sales turnover between RM10 million and RM25 million OR full time employees between 51 and 150
South Korea (Won)	Less than 10 employees	Less than 50 employees	Less than 300 employees and Capital (and sales) of 8 billion won or less
UK (£)	Turnover of not more than £6.5 million, a balance sheet total of not more than £3.26 million and not more than 50 employees. While, according to Department of Trade and Industry (UK), micro enterprises has employees less than 10		turnover of not more than £25.9 million, a balance sheet total of not more than £12.9 million and not more than 250 employees
US ($)	Employees less than 10, annual turnover of less than $3 million and balance sheet total of less than $3 million	Employees from 10 to 49, annual turnover of less than $13 million and balance sheet total of less than $13 million	Employees from 50 to 249, annual turnover of less than $67 million and balance sheet total of less than $67 million

1 € = $1.354023;1 US $ = ₹ (INR) 61.603500; 1 Yen = $0.009590 ; 1 RM = $0.303398; 1 Won = $ 0.000942; 1 £ = $1.641500

Table 3. Welfare facilities

Welfare Facilities	Mean	SD
The First Aid Facility	2.95	0.62
Hospital Facility	2.23	0.94
Facilities for Training and Re-training	1.77	1.08
Transportation facility provided by Org.	1.56	1.06
Awareness of Org. Rules and Regulations	1.43	0.65
Availability of Canteen/Lunch and Snacks	1.39	0.75
Retirement Benefits	1.33	0.55
Accommodation Facility	1.08	0.45
Union/Welfare Society for the Employees	1.05	0.26
Recreation Facility	1.04	0.33
Facility for Education of Employee's Children	1.0	0

Source : Computed outcome of collected responses concerned through survey, employing SPSS



Source : Computed outcome of collected responses concerned through survey, employing SPSS

Figure 1. Presence of welfare facilities.

Enterprises were not offering any facility of education of employees' children that lead to deskilling, uneducated mass and frustrated life. Due to non-availability of schools (owing to non-payment of fee or any other), employees are eager to use their children for workforce. It may lead to child labour. Lack of recreation facility and welfare society again leaded to unhealthy working conditions as work and only work would reduce the productivity. Due to lack of accommodation facility, workforce could not do work for late night conditions as they have to go to home after completing the work. Road safety is crucial for late going employees. Facility of canteen and transport was again poor that may leaded to reduction in productivity indirectly. Retirement benefits were poor as most of the employees said that there was no such long life in an enterprise. They left the job or forced to leave the job much earlier to the retirement. While planning to invest in AMT, an honest attention should be paid to these activities.

6.2 Employees' Participation

Respondents were asked to rate the participation of employees in various activities. In this regard, values of mean and SD is presented in Table 4. The value of Cronbach's Alpha is 0.798 (N = 10) for collected concerned data.

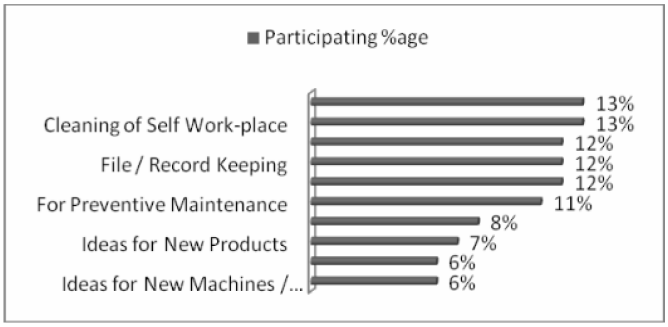
From Table 4, it is clear that employees were participating in filing / record keeping and communicating the working problems. Participation of employees for activities like problem solving during machine failure / breakdown, cleaning of self work places, housekeeping and for preventive maintenance was somewhat poorer. Further, outcome reflected that participation of employees in expansion of plant, ideas for new / latest technologies / machines, ideas for new products and ideas for solving of working problems was either not satisfied or less satisfied. Figure 2 indicates the frequency distribution of employees' participation in various activities.

It can be said that the reason for getting least active involvement is due to their inherent nature of least belongingness. They never feel that this enterprise is ours and all the works

Table 4. Employees' participation in activities

Employees' Participation Activities	Mean	SD
File/Record Keeping	3.68	1.18
Communicating the problems related to work	3.32	1.3
For solving Break-down & m/c failure State	2.74	1.05
Cleaning of self work place	2.41	0.79
Housekeeping	2.23	0.81
For preventive maintenance	2.08	0.84
Idea generation for working problem solving	1.75	1.11
Ideas for new products	1.18	0.56
Ideas for new machines/technologies	1.11	0.41
For Expansion of Plant	1.11	0.41

Source : Computed outcome of collected responses concerned through survey, employing SPSS



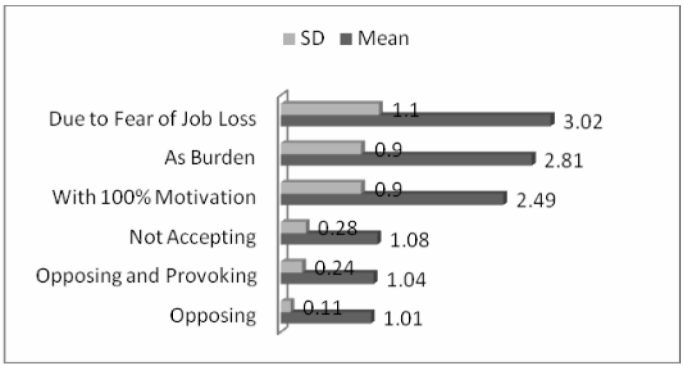
Source : Computed outcome of collected responses concerned through survey, employing SPSS

Figure 2. Employees' participation in activities.

pertaining to this enterprise are ours and we have to comply with them with full dedication and effectiveness. They never feel that 'to work for upliftment of the enterprise is our prime responsibility'.

6.3 Acceptance of Technology by Workforce

Respondents were asked to rate the acceptance of newer technologies or AMT by employees through accepting with 100% motivation, acceptance as burden, accepting due to fear of loss of job, not accepting, opposing, and opposing and provoking. Conducting reliability analysis, value of Cronbach's Alpha appears 0.610 (N = 6). Refer Figure 3 for values of mean and SD for these considered aspects.



Source : Computed outcome of collected responses concerned through survey, employing SPSS

Figure 3. Acceptance of AMT by workforce.

From Figure 3, it can be interpreted that employees were accepting introduction of newer / latest technologies / AMT only either because of fear of loss of job or as burden. In both cases, there was no self motivation and acceptance approach towards learning and introduction of AMT. While planning for AMT investment, almost entire workforce should be involved from its initial idea generation to actual working phase, including post evaluations. With their active involvement at various stages, the fear will reduce and offering training and motivation, confidence will arise. Let, discuss the generated alternate hypothesis (H_{A1}) for its statistical validation. To validate this alternate hypothesis statistically, findings are presented in Table 5.

Results presented in Table 5 show that there is significant difference of mean ($p < 0.05$, at 95% confidence level) for acceptance of AMT by employees' of all the three sectors due to fear of job loss (based on the F-value obtained by employing one-way ANOVA). Hence, it cannot be considered as potential aspect. Further, referring values of *t*-test (between the two sectors, in groups), the significant difference of mean ($p < 0.05$, at 95% confidence level) is observed for accepting AMT 'as burden' (between manufacturer of shoe/footwear and lock), with 'full motivation' (between manufacturers of glassware and shoe/footwear), and 'opposing' (between manufacturers of glassware and shoe/footwear). Thus, these cannot be considered as potential behaviour offered by employees of all sectors of MSMEs of India.

Hence, it cannot be rejected that employees of various sectors of MSMEs of India are generally not willing to accept the adoption of newer technologies and oppose and motivate others to oppose.

Table 5. Computed hypothesis values for acceptance of AMT

Acceptance of AMTs	Overall		Glassware Manufacturing Enterprises (1)		Shoe/footwear Manufacturing Enterprises (3)		Lock Manufacturing Enterprises (5)		F-value (Sig.)	t-value (Sig.)		
	Mean	SD	Mean	SD	Mean	SD	Mean	SD		1-3	3-5	5-1
Fear of Job Loss	3.02	1.10	3.13	0.96	3.40	1.04	2.39	1.18	6.482 (0.002)	-1.061 (0.293)	3.393 (0.001)	-2.607 (0.012)
As Burden	2.81	0.90	2.84	0.74	3.03	0.93	2.49	0.99	2.610 (0.080)	-0.910 (0.367)	2.093 (0.041)	-1.534 (0.131)
Full Motivation	2.49	0.90	2.61	0.76	2.20	0.76	2.70	1.15	2.547 (0.085)	2.119 (0.038)	-1.890 (0.064)	0.319 (0.751)
Not Accepting	1.08	0.28	1.03	0.18	1.17	0.38	1.04	0.21	2.166 (0.121)	-1.779 (0.080)	1.402 (0.167)	0.212 (0.833)
Opposing and Motivating	1.04	0.24	1.07	0.36	1.00	0.00	1.04	0.21	0.548 (0.580)	0.983 (0.329)	-1.146 (0.257)	-0.251 (0.803)
Opposing	1.01	0.11	1.00	0.00	1.00	0.00	1.04	0.21	1.337 (0.268)	0	-1.146 (0.257)	1.165 (0.249)

Source : Computed outcome of collected responses concerned through survey, employing SPSS

Thus, the alternate hypothesis is statistically validated. Most of the employees remain unaware regarding the adoption of AMT whose decision is made solely by management without consulting their employees and taking them in confidence. Employees feel themselves to be unfit to newer technologies and seek no guidance, motivation and training. It generates feeling of laying-off and to save their jobs, they start opposition. Older workers feel that they cannot learn even when training will be offered, cannot be as promising and useful to enterprise as younger ones and promote unions to oppose and motivate other to oppose.

6.4 Process Champion

Respondents were asked to state the availability of process champion, who is having expert knowledge about the adoption of suitable AMT. Out of total respondents, 91.7% respondents ruled out the availability of process champion or technological expert. He was neither the employee of the enterprise nor hired one. Lack of availability of process champion or technical expert hamper the process of adoption of AMT. There is no one who can motivate the workforce, emphasizing its benefits to enterprises and themselves. If AMT are adopted, the problem understanding and solving is missing.

Huang and Sakurai[60] observed that, in Japan, the automation systems are designed and selected by the enterprise's own technical staff. For successful adoption, an enterprise needs the support of employees with adequate training, to operate as well as design and select automated equipment. However, in USA and in a number of other countries, hiring of technical consultants to design, select and evaluate automated systems has been a common practice. Chen and Small[61] stressed that the presence of technology champion is essential to project success. Human beings are very complex in their psychological make-up and hence, managers cannot influence employees' inner states directly. They can create environments that encourage quality performance[62]. Reid et al.[63] quoted that HRM managers were not involved in strategic decision making either the development or implementation stage. The work of a committed and highly qualified champion can be easily frustrated by an unsupportive organizational structure.

6.5 Employees' Culture

Further, employees' culture was tried to understand by analyzing their participation for reducing rejection rate, quality improvement, reducing pollution, reducing waste, effective utilization of resources and reducing power/energy requirements. The value of Cronbach's Alpha is 0.917 (N = 06). Refer Table 6 for the values of mean and SD in this regard.

The outcomes shown in Table 6 reflect that employees were bothered for reduction in rejection rate (mean = 3.67, SD = 0.90) and for quality production (mean = 3.63, SD = 0.95). It can be stated here that there are two type of labour wages, first - labour on fixed salary, and secondly, salary on piece count (only by producing acceptable products). Thus, to maximize their earnings, more acceptable quantity is to be produced. Production of defective items along with rejection may cause deduction in salary. With adoption of AMT, benefits like reduction in waste/scrap, reduction in rejections, improvement in quality, effective utilization of resources and reduction in pollution is achieved. Moreover, human error can be reduced that will lead to these benefits.

Table 6. Employees' culture

Employees' Culture	Mean	SD
Reducing Waste	3.21	0.91
Quality Improvement	3.63	0.95
Reducing Rejection	3.67	0.90
Effective Utilization of Resources	2.89	0.89
Reducing Power Requirements	2.86	0.91
Reducing Pollution	3.31	0.93

Source : Computed outcome of collected responses concerned through survey, employing SPSS

Huang and Sakurai[60] discussed the importance of worker's participation in the implementation process of automation projects. Rao and Deshmukh[64] emphasized that in most cases top management takes the initiative without consulting their employees. Further, respondents were asked about the participation of employees for various brain storming activities that included idea generation (mean = 1.27, SD = 0.61), problem solving (mean = 1.51, SD = 0.84), new products (mean = 1.20, SD = 0.53) and learning about new / latest technologies (mean = 1.27, SD = 0.65). As all mean values are less than 2 (on a Likert scale of 5), that indicated for less satisfactory range. Thus, there was no active participation of employees in brain-storming for various activities. Top management generally did not involve their workers for idea generation. The decision of investing in AMT was rarely discussed with them and they never be tried to motivate / encouraged for these newer / latest technologies. Let, examine the framed null and alternate hypothesis (H_{N1} and H_{A2}) for their statistical validation.

Referring the Table 7, the significant difference of mean ($p < 0.05$, at 95% confidence level) among all the three sectors (based on F-value obtained by applying one-way ANOVA) is observed for reducing rejection. Thus, it cannot be considered as the potential employees' culture and can be inferred as the employees of various sectors of MSMEs of India are not bothered for reducing the rejection. Hence, it cannot be rejected that the employees of various sectors of MSMEs of India are not bothered for reducing the rejection. Thus, the null hypothesis is statistically validated.

Referring the observations of Table 7 and arranging the parameters of employees' culture in descending order of mean,

Table 7. Computed hypothesis values for employees' culture

Employees' Culture	Overall		Glassware Manufacturing Enterprises (1)		Shoe/footwear Manufacturing Enterprises (3)		Lock Manufacturing Enterprises (5)		F-value (Sig.)	t-value (Sig.)		
	Mean	SD	Mean	SD	Mean	SD	Mean	SD		1-3	3-5	5-1
Reducing Waste	3.21	0.91	3.42	0.92	3.20	0.61	2.96	1.15	1.760 (0.179)	1.091 (0.280)	0.995 (0.324)	-1.643 (0.106)
Quality Improvement	3.63	0.95	3.74	1.03	3.63	0.72	3.48	1.12	0.498 (0.609)	0.476 (0.636)	0.611 (0.544)	-0.894 (0.375)
Reducing Rejection	3.67	0.90	3.94	0.85	3.70	0.75	3.26	1.01	4.050 (0.021)	1.143 (0.258)	1.818 (0.075)	-2.656 (0.010)
Effective Utilization of Resources	2.89	0.89	3.03	0.88	2.90	0.76	2.70	1.06	0.940 (0.395)	0.630 (0.531)	0.817 (0.418)	-1.275 (0.208)
Reducing Power Requirement	2.86	0.91	3.00	0.78	2.90	0.89	2.61	1.08	1.290 (0.281)	0.470 (0.640)	1.081 (0.285)	-1.555 (0.126)
Reducing Pollution	3.31	0.93	3.36	0.95	3.43	0.73	3.09	1.13	0.958 (0.388)	-0.361 (0.719)	1.358 (0.180)	0.947 (0.348)

Source : Computed outcome of collected responses concerned through survey, employing SPSS

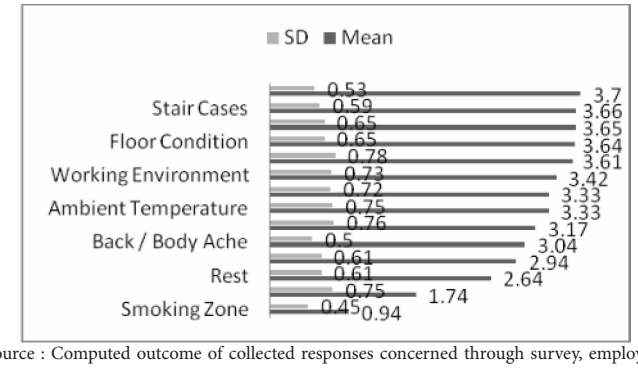
it can be concluded here that employees of MSMEs of India are bothered for quality improvement, reducing pollution, reducing waste, effective utilization of available resources and reducing the power requirements.

Further, on the basis on the mean, as presented in Table 7, all sectors seem to be agreed that their employees' were always bothered for improving the product quality. It was observed that most of the MSMEs employ working persons on contractual basis and salary and wages are often dependent on successful output. Every employee wants to earn the maximum, so, he always remained eager to produce such products which could not be rejected otherwise he would loss his salary even-after expending his time in production. Moreover, the dedicated employees thought that the earning of the enterprise can be maintained and be improved by offering quality products to customer. Hence, it cannot be rejected that the employees of various sectors of MSMEs of India are utmost bothered for improving the product quality. Thus, the alternate hypothesis is statistically validated.

In this way, it can be remarked that the adoption of suitable AMT tools is essential for MSMEs of India as benefits of its adoption include not only the improvement in quality but also reduction in rate of rejection, which is the dire need of MSMEs at this stage. Further, it helps in reducing the waste and power requirements.

6.6 Ergonomic Working Conditions

In this section, conduct of time motion study, availability of doctor and state of ergonomic working conditions were tried to be analyzed. Surprisingly, none of the respondents reported that they were employing time-motion study. When asked for the availability of doctor with its regularity, only 9.5% reported that there was availability of doctor. When asked for arrangement of doctor in emergency (either in-house or at hospital), 85.7% respondents reported that they arranged doctor as a matter of concern. Further, respondents were asked about various ergonomic working conditions. The value of Cronbach's Alpha is 0.848 (N = 14). Regarding these ergonomic working conditions, Figure 4 indicates the value of mean and SD in descending order of mean.



Source : Computed outcome of collected responses concerned through survey, employing SPSS

Figure 4. Ergonomic aspects.

From Figure 4, it can be inferred that the top five adverse conditions included non-availability of smoking zone, non availability of canteen / tea and snacks, improper rest between the

shifts, existing sweating condition and back / body ache problems. It was observed workers were doing their work on sitting at ground in most of the enterprises and no tables were in use for working in standing position. The acceptable top five ergonomic aspects were approach to hand tools, availability of stair cases, availability of sun light, floor condition, and ventilation. It can be argued that with motivated workforce, quality production can be improved with less rejection. Offering ergonomic conditions and some other necessary facilities will utmost satisfy the workforce and will definitely help in working without fatigue and in improving productive time.

6.7 Impact of Ergonomic Working Conditions on Performance

Impact of ergonomic working condition on the performance was analyzed by employing factor analysis to reduce the number of variables to be used further and correlation analysis further. Factor analysis concluded the following outcome (Table 8).

Factor analysis of working conditions reduced fourteen parameters into four components (Table 8) that included Ergonomic Conditions (WC F1), Idle Time Reducing Condition (WC F2), Strain Condition (WC F3), and Refreshing Condition (WC F4). Ergonomic Conditions included working environment for employees, ventilation at working place, comfort condition of the workers, ambient temperature at working place, effectiveness of cooling arrangements made for workers, sweating condition among the workers at production place, availability of sun light / electric light at workplace and floor condition for movement of worker. Idle time reducing conditions included approach and availability of hand tools used in production and stair conditions and its availability for workers movement. Strain conditions included back ache/body ache problem of workers and availability of smoking zone. Refreshing conditions included availability of rest in between the shifts and availability of tea / coffee / snacks etc.

Correlation among identified variables and performance variables is shown in Table 9. It is observed that ergonomic conditions are strongly and positively correlated ($p < 0.01$, at 99% confidence level) with sales growth and positively correlated with export as performance parameter ($p < 0.05$, at 95% confidence level), while negatively correlated with market share. It shows that improving ergonomic conditions, performance can further be improved. Idle time reducing conditions are positively correlated with annual sales turn-over and export ($p < 0.05$, at 95% confidence level) as it will help in improving manufacturing

Table 8. Factor analysis of working conditions

Working Conditions	Component -1	Component -2	Component -3	Component -4
Working Environment for Employees	.714	.274	.089	.085
Ventilation at Working Place	.737	.083	.352	.289
Comfort Condition of the Workers	.893	.106	-.052	.129
Ambient Temperature at Working Place	.862	.084	-.015	.072
Effectiveness of Cooling Arrangements made for workers	.832	.008	-.082	.147
Sweating Condition among the workers at Production Place	.618	.154	-.062	-.451
Back Ache/Body Ache problem of Workers	.027	.092	.741	-.254
Availability of Sun Light / Electric Light at Workplace	.665	.189	.267	.236
Floor Condition for Movement of Worker	.607	.602	.071	-.087
Approach and Availability of Hand Tools used in Production	.070	.877	.024	.052
Stair Conditions and Its Availability for Workers movement	.183	.845	-.010	.193
Availability of Rest in between the shifts	.281	.041	-.033	.786
Availability of Tea / Coffee / Snacks etc	.103	.250	-.249	.597
Availability of Smoking Zone	-.072	.057	-.891	-.024

Rotation converged in 5 iterations,
Highlighted values are the maximum absolute values and are to be grouped to form the new variables.
Source : Computed outcome of collected responses concerned through survey, employing SPSS

Table 9. Correlation matrix for working conditions and performance variables

	Sales Turn-over	Market Share	Sales Growth	Export	WC F1	WC F2	WC F3	WC F4
Sales Turn-over	1							
Market Share	0.109 (0.324)	1						
Sales Growth	0.338** (0.002)	-.057 (0.604)	1					
Export	0.607** (0.000)	-.035 (0.749)	0.297** (0.006)	1				
WC F1	0.179 (0.104)	-0.251* (0.021)	0.324** (0.003)	0.267* (0.014)	1			
WC F2	0.220* (0.045)	-0.140 (0.205)	0.007 (0.952)	0.342* (0.001)	0.310** (0.004)	1		
WC F3	0.025 (0.821)	-0.086 (0.437)	-0.014 (0.896)	0.191 (0.081)	-0.021 (0.849)	0.042 (0.704)	1	
WC F4	0.384** (0.000)	0.347** (0.001)	0.040 (0.721)	0.209 (0.057)	0.286* (0.008)	0.254* (0.020)	-0.027 (0.808)	1

**. Correlation is significant at 0.01 level (2-tailed); *. Correlation is significant at 0.05 level (2-tailed).
Source : Computed outcome of collected responses concerned through survey, employing SPSS

output. Strain conditions did not find any significant correlation with performance improvement as in MSMEs; employee has to work even in such painful conditions, failing which he may lose his salary. Mostly employees are on contractual basis and salary is proportional to produced quality products. Refreshing condition found strong positive correlation ($p < 0.01$, at 99% confidence level) with annual sales turn-over and market share as rest between the working shifts refreshes the employees so that they can work harder again for more duration and offering tea / snacks etc. generates personal affection that helps in improving production with less rejections. All these will improve quality production with less rejection, better utilization of resources and productivity.

7. Discussion

Many researchers who advocates for successful adoption of AMT, necessitate the addressing of human factors. Failures are observed when affairs related to human factors are not properly planned and taken care for action. In this research, state of affairs related to human factors in MSMEs of India is investigated. Findings reflect that welfare facility must be improved as present state of offering welfare facility is not satisfactory. Management must motivate their employees for their active participation in various activities and needs of the enterprise. The feeling should emphasis for an entire family within the enterprise. The philosophical change, motivation, training and re-training is required. Adoption of newer technologies is not fruitful until and unless workforce is not accepting them with full motivation. High capital investment could not reap the benefits without the encouragement and involvement of manpower. State of availability of process champion or technical expert is negligible. Thus, motivation and knowledge support is missing during planning and adoption of AMT. Enterprises are mostly employing unskilled labour whose wages are less and training level is also less. This hampers quality production and adversely affects the ultimate goal of the enterprise. Employees of MSMEs of India are bothered for quality improvement, reducing pollution, reducing waste, effective utilization of available resources and reducing the power requirements. Working environment should ergonomically be designed. It will definitely help in employees working without much stress and fatigue and will help in improving productivity. Thus, proper care and investment in human resources is an essential requirement for successful adoption of AMT.

8. Conclusions

Although the importance of MSMEs in the growth of advancing nations is undisputed, this sector suffers from the lack of technology adoption. In order to understand the affairs related to human factors during AMT adoption, a comprehensive study was conducted through questionnaire. Our major focus here was to understand cultural, welfare, ergonomic and psychological factors affecting AMT adoption in MSMEs of India. The

outcomes of this study indicate that except first aid facility and hospitalization in ESIC schemes, none of the welfare facilities are available in satisfactory condition. This typically may result into minor accidents and rifts. The participation of employees for activities such as rectification of machine failure, breakdowns, cleaning of self work-places, housekeeping, preventive maintenance, expansion of plants, ideas for the latest technologies, products and machines, was found to be quite unsatisfactory. It seems that the employees are not bothered for reduction in the product rejection rate, mainly due to psychological and cultural factors. However, it was quite surprising that the employees are keen for delivering highest quality product. Furthermore, employees of various sectors of MSMEs of India are generally not willing to accept the adoption of newer technologies and motivate others to oppose. Finally, it was found that the availability of a process champion or technical expert is almost rare in these enterprises. This is revealed as a core factor contributing to the reluctance for new technology adoption. All the respondents reported that they did not employ time-motion study. Doctor's availability for regular check-ups was also considered negligible. Working environments were found to be lacking in good ergonomic design. It was reported that the top five adverse conditions include non-availability of smoking zone, non-availability of canteen for tea and snacks, improper rest between the shifts, existing sweating condition and problems related to back and body ache. The acceptable top five ergonomic aspects included approach to hand tools, availability of stair cases, availability of sun light, floor condition and ventilation. Overall, this study suggests that utmost care of human related affairs, in a multi-facet manner, is an essential act for any enterprise to ensure improved performance and successful adoption of AMT that also includes improved skills, training, re-training, salary and wages, and working environment as a whole for entire set of workforce.

8.1 Research Implications

On the basis of this research, it can be suggested that to ensure effective and successful adoption of suitable AMT, entire workforce must be encouraged and motivated for their active and efficient involvement in all the areas of an enterprise. It can be achieved through hiring process champions, improving workplace safety and ergonomic conditions, and imparting knowledge of novel technologies to the workforce.

Future studies are essentially required to analyze the human related affairs so as to ensure smooth acceptance of adoption of newer technologies without hesitation, more participation in almost all the activities of an enterprise and thus, improved performance of MSMEs. This study cannot be taken as reference in policy making or in generalizing the case as it is based on responses of participated 84 MSMEs of India only as there are large numbers of functioning manufacturing MSMEs. Further, 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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