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Inventory Management Practices in Small and Medium Machine Tool Enterprises in India: What Differentiate between enterprises?

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ABSTRACT

The development of Small and Medium Enterprises (SMEs) can be considered as a vital instrument for employment generation, exports, poverty alleviation and ensure rapid industrialization of developed as well as developing countries. However, SMEs, particularly in developing countries like India, face constraints in key areas such as technology, finance, Inventory Management (IM), marketing and human resources. It is observed from literature that pursuing appropriate IM practice is one of the ways of acquiring competitiveness among others, by effectively managing and minimizing inventory investment. IM can therefore be one of the crucial determinants of competitiveness as well as operational performance of SMEs in inventory intensive manufacturing industries. The key issue is whether Indian SMEs pursue modern IM practices with an intention to enhance their competitiveness. If so, what are the IM practices pursued by these enterprises? In this paper the researcher has tried to identify the IM practices pursued by Indian machine tool SMEs and recommendations for improvements are identified. The Study brought out that performance of Indian SMEs in terms of IM practices have been found significantly below the international standard and the experience of the entrepreneur is one of the major factors which differentiate between enterprises.

Keywords: Machine tool, SMEs, Survey, Inventory Management Performance.

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1. Introduction

Small and Medium Enterprises (SMEs) occupy a place of strategic importance in developing as well as developed countries owing to its considerable contribution to national income, employment, exports, and entrepreneurship development (Saxena, 2012). SMEs contribute greatly to the economies of all countries, regardless of their level of development (Turyahebwa et al (2013). It is observed from literature that making use of formal Inventory Management (IM) practices is one of the ways to acquire competitiveness among others, by effectively managing and minimizing inventory investment (Sprague and Walker, 1996). However, while the critical role of IM for the survival of an enterprise is recognized in theory, it is not drive in practice in the context of Indian SMEs. When business strategies are formulated IM is generally not handled as a critical issue. Therefore, the objective of this paper is to study the current status of IM practices in Indian SMEs.

Inventories form a significant portion of the current assets of manufacturing enterprises (Kruger,2005). Inventory management (IM) is crucial to the enterprise because mismanagement of this important segment may threaten the enterprise's existence (Sprague and Wacker, 1996). The management of inventories has an important bearing on the financial strength and competitiveness of a manufacturing enterprise due to the reason that it directly affects the working capital, production and customer services (Vergin, 1998). Many practices are available for effectively managing inventories in a manufacturing enterprise (Azari Rad, 2004). There are traditional IM practices such as order quantity purchase, Always Better Control (ABC) practice and modern IM practices such as computerized inventory accounting Just-in time (JIT) and Vendor Managed Inventory (VMI).

An exploratory study is conducted to identify whether SMEs pursue modern IM practices with an intention to reduce production cost and improve IM performance. The study revealed that a majority of SMEs are pursuing IM based on the experience and intuition of the entrepreneur/s and adoption of modern IM practices are limited to a very small number of SMEs. The paper is organized in to five sections as follows. Details of the literature survey conducted are presented in section 2. The objective, scope and the research methodology is presented in section 3. The analysis of IM Practices Pursued and IM Performance in Indian SMEs are presented in section 4 and the summary and conclusions are presented in section 5 respectively.

2. Literature Survey

Many researchers have analyzed different IM practices and performance and these studies have amassed an enormous knowledge related to IM and operational

performance of enterprises. Maria and Jones (2003) argue that implementation of proper IM practice involves providing high quality products at relatively less cost. On the overhand Wallin et al (2006) are of the opinion that the lead-time is a good measure of inventory effectiveness. Koumanakos (2008) in his study aimed at testing the hypothesis that efficient IM leads to an improvement in a firm's financial performance. The results revealed that the higher the level of inventories preserved, departing from a lean manufacturing, by an enterprise the lower is its rate of returns. Amarjith et al (2010) argue that excess inventory is an operational liability, because it uses valuable storage space, increases inventory costs. Raw material ordering frequency is identified as an important factor contributing to inventory cost. Frequent ordering in small quantity is considered as an important strategy.

Jonsson and Mattsson (2008) studied the use of material planning methods to control material flow inventories of purchased items. The study explored the perceived planning performance of material planning methods used to control material flow in different types in manufacturing and distribution companies. Koh et al (2007) conducted a study to determine the underlying dimensions of Supply Chain Management (SCM) practices and to test a framework identifying the relationships among various SCM practices, operational performance and SCM related organizational performance. Teunter et al (2012) found that ABC analysis is commonly used as an IM practice in SMEs worldwide.

SMEs occupy a place of strategic importance in developing as well as developed countries like India owing to its considerable contribution to national income, employment, export, and entrepreneurship development. SME sector contributed about 39 per cent of the manufacturing output and 34 per cent of the export, apart from providing employment to almost 29 million people in Indian economy in 2004 – 2005. With respect to the SME sector of India, many studies have been conducted (Bala Subrahmanya, 2005). The author brought out that globalization, the process of continuing integration of the countries in the world, has increased the movement of goods, services, ideas, capital, and technology across national borders and this free movement of goods has enhanced the opportunity for SMEs of developing countries to cater to wider international markets. Rajesh (2008) brought out that automobile industry in India is facing a lot of problems in the current era of globalization. The study identified IM and knowledge management as as a source of competitiveness.

Sardana (2009) argued that performance evaluation is fundamental to any management control, which

primarily helps in understanding weak areas, identifies gaps to carry out improvement and ensures that business activities are properly aligned with business objectives. A SME has its own strengths and weaknesses, which need not be in common with those of a large organization. Therefore, business performance evaluations in an SME are different from those of large enterprise. The study brought out determinants that lead to success and developed a business performance measurement framework.

To pursue appropriate IM practices, the understanding of the factors influencing the same is necessary. This will enable SMEs to select an appropriate IM practice in their enterprise. Though the role of IM practices of a firm on IM performance is well explained in theory, an empirical evaluation of the same is not done so far in the context of SMEs, particularly in developing countries Rajeev (2010). In this context, this study is an attempt to identify the variables influencing IM practice pursued with respect to the machine tool SMEs in Bangalore.

3. Objectives, scope and Methodology

In this paper the researcher has tried to identify the IM practices pursued by Indian machine tool SMEs and variables which influence the development and growth of the machine tool SMEs in India. Therefore, the specific objectives of the present study are listed as follows:

- To study the IM practices pursued by machine tool SMEs in India.
- To ascertain the variables influencing IM performance of SMEs.
- To ascertain the relationship between experience of entrepreneur and firm performance in terms of the IM practices pursued.

This is basically an exploratory study based on primary data collected from 91 SMEs in the machine tool sector in the city of Bangalore, India. These SMEs are located in the various industrial estates of Bangalore city in Karnataka state in Southern India. The machine tool industry is the backbone of the industrial sector and is vital for the growth of capital goods industry. Small and medium enterprises form the core of the machine tool industry in India. Machine tools industry is largely linked to auto sector as more than 45% of the production from this sector goes to auto part industries, ancillary units and auto majors. The machine tool industry also plays a vital role in the development of strategic sectors such as railways, airlines and defense. Capitalizing on the abundance of skilled and cheap labour in India, more and more SMEs are foraying into machine tool industry. Around 68 percent of the Indian machine tool industry consists of SME players, most of whom are first generation entrepreneurs. In turn, the increasing number of SMEs in the machine tool sector

has boosted the total output of the sector, taking it to an overwhelming position.

Secondary information has also been collected from Ministry of Heavy Industries, SME associations, District Industrial Centers etc. Relevant literature related to this work has also been reviewed. The study used a semi-structured questionnaire. A pilot study was conducted in 20 machine tool SMEs initially and based on the pilot study experiences the initial questionnaire was modified. These 20 SMEs were included in the final sample of 91 SMEs. Primary data was collected using a structured questionnaire. The primary data related to inquiries on IM practices pursued in machine tool SMEs and their effect on operational performance. Both open-ended and closed-ended questions were used. The structured questionnaires validity was provided through adequate coverage of the topic under investigation as per the expert advice. According to Sekharan (2003) expert opinion is used to check the content and format of an instrument to judge validity of the content. The construct validity was ascertained by defining clearly the variables to be measured. According to Sekharan (2003) the test-retest method of assessing reliability of data involves administering the same instrument twice to the same group of subjects. Reliability of the instruments was provided through a test retest conducted in the same industry by using respondents who were not part of the study sample but work in the machine tool industries and in positions relevant to the research study. The quantitative data was analyzed using descriptive and inferential statistics. Descriptive statistics involved working out the mean, percentages and frequencies which were used to assess the correlation of the variables. The inferential statistics involved the use of hypothesis testing and regression analysis to assess the relationship of variables in the study; and the results thereof interpreted.

4. Analysis of IM Practices Pursued and IM Performance in Indian SMEs

Since the machine tool SMEs are inventory-intensive in nature with a significant portion of their production cost involving material and inventory related cost, it is likely that the entrepreneurs recognize its due importance. Therefore, at the outset, we are keen to know how many of the 91 surveyed SMEs have considered IM a very important concept in their enterprise. The IM practices pursued by SMEs surveyed in this study are presented in Table 1. The survey revealed that 57 out of 91 SMEs pursue IM practice based on heuristics. Another 20 SMEs pursue IM practices based on ABC heuristically. Even though ABC is pursued heuristically it is considered as a separate practice because ABC is a definite rule in inventory management. Modern IM practices such as computerized inventory accounting and VMI are pursued by only 14 SMEs. Analysis of their

IM performance brought out that 39 out of 91 SMEs have an ITR value above 5 and the remaining SMEs have ITR values up to 5. The IM performance of SMEs evaluated using ITR values as it is considered as the most important and effective measure to evaluate the IM performance of enterprises (Vergin,1998; Rabinovitch et al, 2003).

SI No	IM Practices Pursued	Number of SMEs
1	Heuristics	57
2	ABC Practice	20
3	Computerized Inventory Accounting	4
4	VMI	10
Total		91

Table 1: IM practices pursued by SMEs

The study revealed that including those SMEs which pursue ABC heuristically, a majority of the surveyed SMEs (77 out of 91) pursue IM heuristically. Therefore, it is essential to probe this issue further. The breakdown of SMEs in terms of the heuristics pursued is presented in Table 2. It is observed that 22 out of 91 SMEs pursue IM practice based on routine heuristic. Another 25 SMEs pursue IM practices based on heuristics based on the situation such as high demand, quantity discount, anticipation of price hike etc. This is referred to as situation based heuristics in this study. About 10 SMEs follow order based heuristics. About 20 SMEs pursue ABC heuristically. The study brought out that even in inventory intensive manufacturing SMEs like machine tools IM practices are pursued on a heuristic basis. The poor IM performance as indicated by the ITR values further revealed that there is ample scope for SMEs to improve their IM performance by pursuing modern IM practices such as computerized inventory accounting and VMI.

SI No	Heuristics Pursued by SMEs	Number of SMEs
1	Routine Heuristics	22
2	Situation based heuristics	25
3	Order quantity based heuristics	10
4	ABC based heuristics	20
Total		77

Table 2: Heuristics pursued by SMEs

The above features of SMEs motivated the researcher to ascertain major problem areas related to IM and its associated issues in Indian machine tool SMEs. A major problem area is the scarcity of resources including raw materials. SMEs work with insufficient working capital and resource scarcity and faced with inadequate access to raw materials, favorable credits etc. Their purchase volume is so small that they never get benefits such as quantity discounts. Excess inventory and at the same time shortage for many items is a major problem observed in SMEs. It is interesting to note that only 19% (17 out of 91 SMEs) of the studied SMEs had a purchase department in their enterprise. Absence of modern production and IM practices is the other major problem area for the development of SMEs in India is the attitude towards implementing new production technologies.

Many SMEs found it very difficult to implement modern production technologies in their enterprise. One reason could be it requires a total redesign of their plant which requires some initial investment.

Proper IM is one of the ways of acquiring competitiveness, among others. However, a majority of SMEs pursue raw material based on heuristics. Though SMEs are familiar with traditional inventory management practices such as order quantity purchase, ABC and modern practices such as computerized inventory accounting, Just-in-time (JIT) production and VMI, they found it very difficult to implement these practices in their enterprises. Inadequate infrastructure development such as electricity, roads, transportation facilities hinder the growth of SMEs. Because of improper plant layout and road condition carrying cost of inventory is high. Availability of sufficient funds hinders the growth of machine tool SMEs in India. SMEs normally have limited free cash and adequate resources to fund new operational systems and therefore, depend on financial institutions for their fund generation. SMEs have limited clout with financial institution. Because of limited access to financial institutions SMEs rely on financing services from inefficient informal sources. The activities of SMEs centers around one or more entrepreneurs.

Knowledge and commitment of entrepreneurs is vital for the survival of SMEs. An entrepreneur with a positive attitude aiming at improvement of overall performance will think of adopting modern production technologies, keeping constant communications with employees, customers and suppliers, pursuing research and development etc. Inadequate support from government is a major problem faced by SMEs. Government while framing its industrial policy should consider SMEs exclusively. SME policy should be fine-tuned considering the constraints and special requirements of SMEs. Such assistances would prompt SMEs to harness their inherent potential to undertake innovation and overcome many barriers they normally face. SMEs work under several constraints. They have limited free cash to invest in activities such as research and development. It is observed that investment in research and development is not sufficient. SMEs have been exposed to intense competition since early 1990s because of globalization. Globalization has put more pressure on Indian SMEs because a product from Indian SMEs has to compete with comparatively cheaper goods from countries like China, Taiwan, Korea etc. On the other hand this has open up new avenues for exploiting global opportunities through exposure to international markets. The level of interaction with suppliers and customers is very minimal. All surveyed SMEs are equipped with telephone and computer network. However, this is used mainly for data processing and

word processing only. A majority of SMEs found it very difficult to retain skilled and trained employees in their enterprises. Due to limited carrier growth and comparatively low salaries most of the employees leave SMEs after gaining sufficient experience. People consider SMEs as a platform to learn and gain practical knowledge.

After reviewing the available literature a total of 10 constructs were selected which are supposed to be the main variables influencing the IM performance of SMEs. These 10 constructs and their nature in the surveyed SMEs are presented in Table 6 and 7. Each construct was measured on a five point Likert scale where a score of 1 represents very poor performance, 2 represents for poor performance, 3 moderate, 4 high, and 5 very high performance for the variable identified. Based on the IM performance based on the IM practices pursued by SMEs and ITR values firms are grouped in to two distinct categories and the following hypothesis are tested. All these observations are generated in general for all sectors more particularly in the context of large enterprises. Therefore, it is essential to examine whether the same is applicable to SMEs also. With this in mind the following hypotheses are tested to test applicability of these observations to SMEs.

Hypotheses H1-1 to H1-10: SMEs pursuing formal IM practices execute each of the above variables of IM performance more effectively compared to SMEs pursuing IM practices based on simple thumb rules.

Hypotheses H2-1 to H2-10: Better performing SMEs on the basis of IM performance execute each of the above variables more effectively compared to poorly performing SMEs.

All the hypotheses (H1-1 to H1-10) were tested using one tailed t-test. Results of these t-tests are presented in Table 5. For each construct, the table shows mean score, standard deviation and the tvalue of the particular construct selected. The results obtained provided many important research implications. Table 3 clearly brought out that there is a statistically significant difference between SMEs pursuing formal IM practices and those pursuing IM practices based on simple heuristics based on the intuition and experience of the entrepreneurs. The study revealed that the difference between the two groups is due to the fact that SMEs pursuing formal IM practices execute many activities related to IM such as frequency of raw material purchases, frequency of stock verification, relationship with suppliers and customers, housekeeping, lead time reduction, better employees training etc, more meaningfully.

Hypotheses (H2-1 to H2-10) were tested using one tailed t-test. Results of these t-tests are presented in Table 4. The results indicate that there is a statistically significant relationship between better performing SMEs and poorly performing SMEs based on their IM

performance. For this purpose SMEs were classified in to two groups based on their ITR values. ITR in the range of 5 and above is considered as better performing SMEs and those up to 5 are considered as poorly performing SMEs for the present study. The analysis brought out a similar result that the difference between the two groups is due to the fact that better performing SMEs execute major activities related to IM such as frequency of raw material purchases, frequency of stock verification, relationship with suppliers and customers, housekeeping, lead time reduction etc, in a more effective manner.

Hypothesis	Construct	SMEs (Formal IM practices) N=44		SMEs (No formal IM practices) N=47		T-value
		Mean	s.d	Mean	s.d	
H1-1	Entrepreneurial attitude	3.86	1.32	3.58	1.89	2.51*
H1-2	Employees training	4.35	1.13	4.09	1.42	2.95***
H1-3	Raw material ordering frequency	3.65	1.93	3.14	2.17	3.12***
H1-4	Stock verification frequency	3.93	1.36	3.23	1.81	2.89***
H1-5	Interactions with Suppliers	4.21	1.32	3.87	1.76	2.46*
H1-6	Interactions with Customers	4.79	0.91	3.43	1.67	4.13***
H1-7	Lead-time	4.04	1.31	2.63	1.47	1.98*
H1-8	Production technology	3.59	1.78	3.23	2.06	2.58*
H1-9	Supplier empowerment	4.35	1.31	4.19	1.72	3.14***
H1-10	Just-in-time purchasing	3.47	1.93	3.16	2.12	1.91*

Note: * equal to for p<.05, ** equal to p<.01, and *** equal to p<.005 respectively

Table 3: SMEs pursuing formal IM practices Vs Non- IM practice SMEs

Hypothesis	Construct	SMEs (Formal IM practices) N= 44		SMEs (No formal IM practices) N=47		T-value
		Mean	s.d	Mean	s.d	
H2-1	Entrepreneurial attitude	3.76	1.38	3.24	1.89	2.95***
H2-2	Employees training	4.24	1.32	4.18	2.17	4.21***
H2-3	Raw material ordering frequency	4.18	1.51	3.98	1.96	2.98***
H2-4	Stock verification frequency	4.32	0.93	2.89	1.39	2.21*
H2-5	Interactions with Suppliers	4.51	1.29	3.94	1.46	1.74*
H2-6	Interactions with Customers	4.28	1.94	3.98	2,13	3.14***
H2-7	Lead-time	3.99	1.35	3.23	1.45	4.06***
H2-8	Production technology	4.02	2.09	2.98	1.92	1.91*
H2-9	Supplier empowerment	4.65	1.28	3.45	1.48	4.13***
H2-10	Just-in-time purchasing	3.97	1.19	3.01	1.06	2.49*

Note: * equal to for p<.05, ** equal to p<.01, and *** equal to p<.005 respectively

Table 4: Better performing SMEs Vs Poorly performing SMEs

Based on the above result an attempt was made to classify enterprises based on the experience of the entrepreneurs. It was observed that enterprises run by experienced entrepreneurs consciously worked on the observed variables explored by the above analysis in a better manner compared to those run by entrepreneurs

without much experience. To analyze this rank correlation between experience of entrepreneurs and IM performance was determined and the result brought out that significant positive correlation was observed between experience of the entrepreneur and IM performance (Table 5). The above result was further substantiated by conducting a multiple regression analysis (Table 6).

			Rank ITR	Rank Experience
Spearman's rho	Rank ITR	Correlation Coefficient	1.000	0.229*
		Sig. (2-tailed)	.	.029
		N	91	91
	Rank Experience	Correlation Coefficient	0.229*	1.000
		Sig. (2-tailed)	.029	.
		N	91	91

Correlation is significant at the .05 level (2-tailed).

Table 5: Rank correlation between experience of entrepreneurs and IM performance

Machine tool SMEs →	Beta Coefficients	't' values	Significance level
D _{ex1}	0.583	5.283	0.000
D _{ex2}	0.165	1.555	0.124
D _{ex3}	0.070	0.626	0.533
Constant	2.590	3.714	0.000
Adjusted R ²	0.256		
F		11.346	0.000
N		91	

Table 6: Dummy variable regression for experience of the entrepreneur (Dependent Variable: ITR).

Multiple regression analysis was conducted with ITR as the dependent variable and experience of the entrepreneur as the explanatory variable. The ITR is the most commonly used technique to study the IM performance of enterprises (Vastag and Whybark, 2005). To represent experience of the entrepreneur three dummy variables were selected to represent the four groups (such as entrepreneurs having more than 30 years of experience, in between 20 to 30 years of experience, 10 to 20 years of experience and below 10 years experience) of entrepreneurs as follows:

D_{ex1} : take value 1 for those group of entrepreneurs who have more than 30 years of experience and 0 for the rest.

D_{ex2} : take value 1 for those group of entrepreneurs who have experience between 20 to 30 years of experience and 0 for the remaining ones.

D_{ex3} : take value 1 for those group of entrepreneurs who have experience between 10 to 30 years of experience and 0 for the rest.

The result brought out that those SME entrepreneurs having more than 30 years of experience were able to achieve better IM performance compared to others. Similarly entrepreneurs having experience in between 20 to 30 years of experience also were able to achieve

better IM performance compared to those having experience between 10 to 20 years and experience below 10 years of experience. To check the adequacy of grouping based on the cumulative score of variables influencing IM performance a discriminant analysis was conducted and the results are shown in Table 7 and Table 8 respectively

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	2.254	100.0	100.0	0.832

a First 1 canonical discriminant functions were used in the analysis. Eigen value indicates that the discriminant function is highly efficient in separating the two groups based on their cumulative score of 10 variables supposed to influence the IM performance.

Table 7: Eigenvalues

Variable	Wilks' Lambda	Chi-square	df	Sig
Cumulative Score	0.307	104.417	1	.000

The value of Wilks' Lambda indicates high discrimination between groups having cumulative score of variables above 30 and groups having the same score below 30.

Table 8: Tests of Equality of Group Means

5. Summary and Conclusions

The study probing the IM practices pursued by Indian machine tool SMEs revealed that a majority of SMEs pursue informal practices for material procurement. A list of 10 variables were identified which influence the IM performance of SMEs. The relevance of 10 variables for IM performance was measured in 91 SMEs. They were analyzed along two categories based on IM practice pursued (formal IM practices Vs SMEs pursuing IM practices based on simple heuristics) and IM performance (better performing SMEs Vs poorly performing SMEs). The results brought out those SMEs that are pursuing formal IM practices make a conscious effort to better implement the IM performance identified in this study. This enabled them to improve their performance by manufacturing better quality goods at a comparatively lower cost. The same was further substantiated by grouping the enterprises based on their IM performance and a similar result was obtained. Further the role of entrepreneur's experience in enhancing the firm performance was analyzed and explored a positive relationship between them is observed.

In order to overcome the above observed problems in the machine tool SME sector of India the following suggestions are recommended. Government must take necessary steps to support SMEs for their raw material purchase. ii. Infrastructure development is a key factor for the growth of SMEs. Government must ensure uninterrupted supply of power, raw materials and must frame appropriate policy for the infrastructure development. SME organizations must conduct seminars, training program, trade fares etc and

encourage SMEs to come forward and carry out group activities such as raw material purchase, output marketing etc. under a purchase consortia. SME must realize the importance of modern IM practices with an intention to enhance their competitiveness. v. In the era of globalization manufacturing of high quality products at a relatively lower cost is a pre-requisite for the survival and growth of SMEs. Government and the SME association must promote the implementation of modern production concepts such as Just-in Time (JIT) production and VMI which will enable them to reduce production cost substantially without affecting the product quality. SMEs play a vital role for the economic growth, employment generation, poverty alleviation and rapid industrialization of developed as well as developing countries. Government of India has highlighted the importance of this sector while framing industrial policy in recent years. Although government of India has taken many steps to help and support the growth of SMEs but these steps alone are not sufficient. Government must give more focus on some key areas identified in this study such as arrangement of finance, infrastructural facilities, support for raw material purchase, to name the most important ones. It is evident that if the above mentioned suggestions are implemented then the growth of SME sector in India will be accelerated.

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