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EXPLORING LINKAGES BETWEEN MANUFACTURING FUNCTIONS, OPERATIONS PRIORITIES AND PLANT PERFORMANCE IN MANUFACTURING SMES IN MUMBAI

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Abstract: *Nowadays, in order for small and medium scale enterprises to excel in performance, it is necessary to have congruency among the manufacturing functions and the operational priorities. In this paper a model is presented to know the relationship between the manufacturing functions, operation priorities and manufacturing performance. Using data collected from small and medium scale manufacturing enterprises in Mumbai and suburban region, this study examines the seven hypothesis based on the relationship between manufacturing functions, priorities and performance. The structural equation model is tested using Amos7 software to test the hypothesis. The results show that there exists a positive relation between manufacturing functions and operation priorities as four out of six the dimensions measured such as Process control and implementation, Management of resources, Management of people, and Partnership with supplier are positively related, while two dimensions Training and developing and Teamwork are not positively related. Findings also support strong impact of operation priorities with growth in productivity as a measure of performance.*

Keywords: *Manufacturing functions, operation priorities, manufacturing performance, structural equation model.*

1. INTRODUCTION

In present era of globalization, small and medium scale manufacturing enterprises in India are facing intense competition. Some industries are consistently achieving the growth under competitive conditions while others are not. As a result of this, new opportunities and threats have emerged.

Mumbai is called the Commercial or the Business capital of India. Many manufacturing and service firms have grown up in Mumbai and suburban region. Almost 60% of the industries are service based while remaining are manufacturing industries.

This sector provides nearly 40% of the state's GDP, as compared with the national average of 29%. Many small and medium scale industries have grown up and supporting the needs of the local big manufacturing industries as well as exporting their products (Statistical out line of India).

Various studies are carried out on business performance and manufacturing strategies. Utilization and deployment of resources in manufacturing plant is very vital and which directly affects the plant performance and so business performance as well. The relationship
between manufacturing functions that is operation level factors, operation priorities and manufacturing plant performance is very important in this regard.

This study is concerned with the content issues of manufacturing strategy, the central question being what relationship if any between operational level factors, operation priorities and manufacturing plant performance.

The relationship among these three things forms a conceptual model for this study. Manufacturing performance here is measured in terms of growth in productivity (Ram Narsimhan and Jayanth Jayram, 1998).

Seven hypotheses are examined with the help of structural equation modeling and tested with 167 samples from the manufacturing Small and Medium Enterprises (SMEs) from Mumbai, India.

Micro, small and medium enterprises as per MSMED Act, 2006 Government of India are defined based on their investment in plant and machinery (for manufacturing enterprise) and on equipment for enterprises providing or rendering services. The present ceilings on investment for enterprises to be classified as micro, small and medium enterprises are as shown in Table 1 (Annual report 2008-09).

The paper is organized as follows. First, the relevant literature is reviewed and conceptual framework of the study is presented.

Then research method followed by analysis and results and finally the discussion and conclusion is reported. In this study the path analysis approach to test the three hypothesis models is used.

Table 1 Ceiling on investment for micro, small and medium scale enterprises

Classification	Manufacturing Enterprises	Service Enterprises
Micro	Rs. 2.5 million / Rs. 25 lakh (US$ 50,000)	Rs. 1 million / Rs. 10 lakh (US$ 20000)
Small	Rs.50 million / Rs. 5 crore (US$ 1 million)	Rs. 20 million / Rs 2 crore (US$ 0.4 million)
Medium	Rs 100 million / Rs 10 crore (US$ 2 million)	Rs. 50 million / Rs 5 crore (US$ 1 million)

2. LITERATURE REVIEW

Skinner (1969) conceived a model for manufacturing strategy in which the competitive environment suggest a basic business strategy which in turn suggest the manufacturing mission or strategy. This mission can be encapsulated in to choices made with respect to four competitive priorities: cost, quality, delivery and flexibility. The design of the manufacturing system can be made to fit the strategy by making appropriate tradeoff or decisions in key areas. Further, Skinner suggested five areas where tradeoff decisions had to be made to assure a fit between business strategy and manufacturing: 1) plant and equipment 2) production planning and control 3) labour and staffing 4) product design/engineering; and 5) organization and management. Haynes and Wheelwright (1984) added process and infrastructure in the list of strategic choices. The key competitive priorities are quality, flexibility, delivery, and cost. The key structural issue involves process technology; capacity etc. and infrastructural issues include quality management, human resource management, organizational culture etc. Infrastructural issues are very important for an organization to achieve sustainable competitive advantage.

Tufan kok and Erhan Bozdag (2009) concluded in their study that the statistical association between manufacturing parameters and firm performance indicate that product design performance, fixture utilization, setup and production planning performance have positive impact, while capacity utilization and finished product inventory need have negative impact on firm performance. Kitazawa and Sarkis (2000) concluded in their study that employee empowerment and their willingness to make suggestions for improvement are critical elements in manufacturing performance. Organization culture plays an important role in organization processes, the extent of team work and reward/ recognition system which may drive people towards the organizational goals.

Bryan D. Prescott (1995) has presented ten essentials for business success such as customer centered organization, customer centered leadership, customer centered strategy, management of people, training and developing people, management of resources, process control and improvement, customer satisfaction, employee satisfaction and; community satisfaction.

So based on literature review for this study we selected the six independent (observed) variables as a measure of operating level factors namely Process control & improvement, Management of resources, Management of people, Training & developing people, Team Work and, Partnership with Suppliers.

The first construct process control and improvement refers to the productivity and flexibility are as good as, or better than, the best of competition; processes are under control and innovation and continuous improvement are encouraged (Bryan D. Prescott, 1995, Skinner W.,1974, Haynes R.H., Wheelwright S.C., 1984, T. J. Hill ,1992, Eve D. Rosenzweig, and George S. Easton, 2010, Tufan kok and Erhan Bozdag, 2009).

The second construct management of resources refers to utilization of resources is on a par with the best of the competition and technology is effectively used to improve productivity and flexibility (Bryan D. Prescott, 1995, Haynes R.H., Wheelwright S.C., 1984, Eve D. Rosenzweig, and George S. Easton, 2010, Tufan kok and Erhan Bozdag, 2009).

The third construct management of people refers to the employing flexible leadership style, insist on personal responsibility for quality and provide the tools, information, empowerment, and support required for people to participate in a quest for excellence in all aspect of the business (Bryan D. Prescott, 1995, Skinner W.,1974, Haynes R.H., Wheelwright S.C., 1984, T. J. Hill ,1992, Buffa,1984, Fine & Hax, 1985, Peter T. Ward et.al.1998, Eve D. Rosenzweig, and George S. Easton, 2010)

The forth construct training & developing people refers to the supply of qualified, competent and flexible people which are sufficient to meet operational demands and contingencies and training is cost effective and based on company standards (Bryan D. Prescott, 1995, Fine & Hax, 1985, Ricardo M. Pino 2007, Eve D. Rosenzweig, and George S. Easton, 2010).

The fifth construct team Work refers to the cumulative actions of the team (group of people) during which each member of the team subordinates his individual interest and opinions to fulfill the objectives or goals of the group (Besterfield Dale H. et.al., 2003, Flynn Barbara B; Sakakibara Sadao; Schroeder Roger

G., 1995, Eve D. Rosenzweig, and George S. Easton, 2010)

The sixth construct supplier partnership refers to long term commitment to achieve quality, increased efficiency, lower cost, innovation and continuous improvement of products and services between two or more organizations (Ricardo M. Pino, 2007, Eve D. Rosenzweig, and George S. Easton, 2010)For operations to function as a coordinated unit, the decisions and actions of the different departments within operations should be guided by a common set of competitive priorities. Hayes and Wheelwright (1984) have proposed that congruency among operations managers should exist at two levels. They should agree on (1) where the organization is trying to go (competitive goals or priorities) and (2) the day-to-day decisions that involve trade-offs among priorities and that, over time, create a pattern of manufacturing strategy. Various manufacturing practices such as TQM, JIT etc. are followed in industries to excel in organizational performance. The objective of the practices, as management commitment and training to workers, is to produce improvement in operative and business performance (Powell, 1995). Operation level factors considered in this literature are the one which followed by this practices.

2.1 Operations (competitive) priorities

Competitiveness refers to a firm's ability to develop strategies to cope with the changing business and manufacturing environment, and the firm's ability to respond to the uncertainties in the dynamic business environment of recent times. Much research has been conducted in relation to competitiveness. Kim and Arnold (1992) defined the competitiveness of a firm as quality, cost, lead time and flexibility level Kim JS, Arnold P (1992). In this study these four competitive priorities cost, quality, delivery and flexibility are considered and its effect on productivity as a business performance is selected.

Various studies have suggested different dimensions of manufacturing capabilities (White, 1996). For instance, Wood et al. (1991) examined the dimensions of manufacturing capabilities that focus on the following capabilities: low price, high product performance, high durability, high product reliability, short delivery time, delivery on due date, product customization, number of features, product cost, conformance to design specifications, improved manufacturing quality, cost, on-time delivery, product cost, quality consistency, quality perceived by customer, and product price. Likewise, Vickery et al. (1993) suggest a list of production competence characteristics including product flexibility, volume flexibility, process flexibility, low product cost, delivery speed, delivery dependability, production lead time, product reliability, product durability, quality, competitive pricing, and low price. In these studies, several items are very similar and they offer opportunity for combination (White, 1996). For instance, production lead time can be categorized as a sub-dimension of delivery. Also, it seems reasonable to combine product cost, low price, and competitive pricing under the dimension of cost. Recent studies on manufacturing performance also support the dimensions of operation priorities as cost, quality, delivery, and flexibility (Jorn-Henrik Thun,2008, Tufan kok and Erhan Bozdag, 2009, Natasa Vujica Herzog, Stefano Tonchia, Andrej Polajnar, 2009). The notion of manufacturing capability is well-established in the manufacturing/operations management literature. Being a part of the strategic objective, manufacturing strategy has an impact on the development of competitive capabilities (Vickery et al., 1997). Driven by its business strategies, a firm sets competitive priorities and develops action plans. As action plans are implemented, manufacturing competencies are developed and these competencies allow a firm to build manufacturing capabilities that enable them to compete in the market (Koufteros et al., 2002).

Based on the literature review, consensus on the dimensions of manufacturing capability exists within the empirical literature. Hayes and Wheelwright (1984) have defined this term as price (cost), quality, delivery dependability, and flexibility. Similarly, Ferdows and De Meyer (1990) identified four dimensions: cost, quality, dependability, and flexibility. The competitive priorities or operation performance can be measured in terms of cost, quality, flexibility delivery and productivity of labour.

2.2 Manufacturing plant performance

Measuring business performance is an essential process that must be executed in order to gain a competitive edge in the market, and to promptly and flexibly cope with customer needs. This metric enables efficient internal operations of the firm. The attainment of quality and flexibility leads to lower cost and productivity improvement due to reduced inventory, scrap, and rework cost and external failure costs. Lower costs, flexibility and improved delivery dependability, in turn lead to superior level of customer satisfaction, resulting in better sales and profits (Ram Narsimhan, Jayanth Jayram, 1998). Performance measurement of manufacturing is an important issue to measure the effectiveness in qualitative and quantitative metrics. Lockamy (1998) have suggested a model for development of quality focused performance measurement system. Bititci et al. (2000) described specifications for framework for dynamics of a performance measurement system. Medori and Steeple (2000) have suggested a framework for auditing a performance measurement system. Manufacturing performance is operationalized in this study in terms of growth in productivity.

3. CONCEPTUAL FRAMEWORK

The investigation in the scope of research problem is governed by the conceptual framework presented in Figure 1;

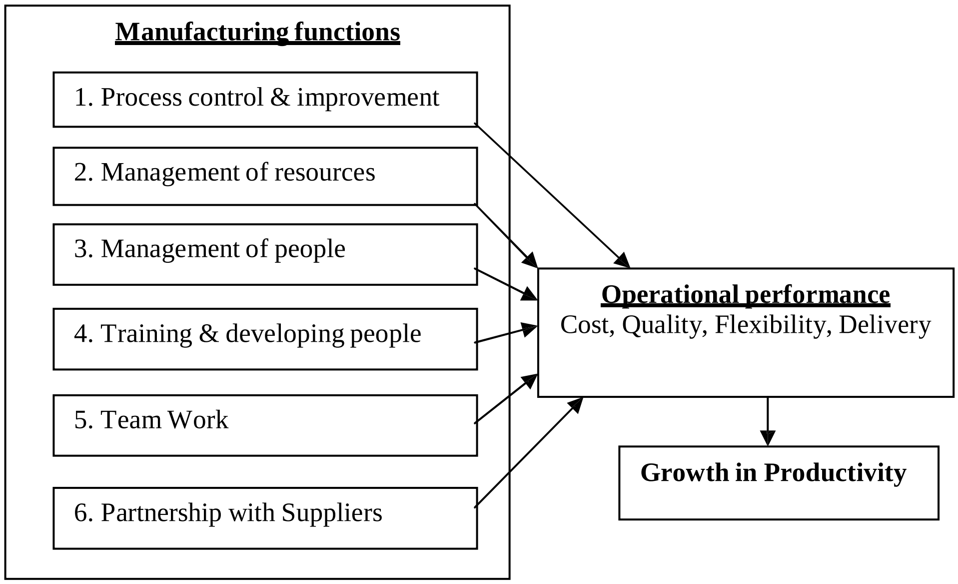

Figure1 Conceptual framework for the study

4. HYPOTHESIS

Based on theoretical framework the following hypotheses are investigated in the empirical analysis:

H1: Process control and implementation is positively related to operational priorities of SMEs.

H2: Management of resources is positively related to operational priorities of SMEs.

H3: Management of people is positively related to operational priorities of SMEs.

H4: Training and developing people (continuous improvement) is positively related to operational priorities of SMEs.

H5: Partnership with supplier is positively related to operational priorities of SMEs.

H6: Teamwork is positively related to operational priorities of SMEs.

H7: Operational priorities have a strong impact on growth in productivity.

These hypotheses will be tested empirically in the following based on data collected from the manufacturing SMEs in Mumbai and nearby area.

5. RESEARCH METHOD

5.1 Data collection

The initial sampling that is list of SMEs in Mumbai and nearby areas such as Thane and NaviMumbai is obtained from the district industrial centers of Mumbai and Thane region and Mumbai yellow pages. While the Mumbai Yellow Pages databases did not provide details of firm size.

The criterion of selection is the turnover of industry as per the definition of SMEs in Indian context. This left a final list of 2100 sampling units.

5.2 Procedure

Anticipating 15-18 percent response rate postal questionnaires were sent to 900 owners.

The questionnaire was addressed personally to the Managing Director/ Works Manager/ Owner of each firm. In the first six weeks, 167 SMEs responded, a rate of 18.55 percent.

5.3 Data Entry

Each business owner was required to make responses on the questionnaire, which were coded and manually entered into SPSS version 15.0.

Accuracy of the data file was ensured by careful proofreading of the original data against the computerized data file, as well as examination of descriptive statistics and graphic representations of the variables (Tabachnick & Fidell, 2007).

Table 2 shows descriptive statistics of respondent companies.

Table 2 Profile of respondent SMEs

Parameter	Number of companies	Percentage
Number of		
employees	14	8.38
1. <6	34	20.36
2. 6-20	45	26.95
3. 21-50	53	31.74
4. 51-100	21	12.57
5. >100		
	167	100
Total		
Sales turnover		
(US $)	72	43.11
1. <50000	95	56.89
2. 50000-		
100000	167	100
Total		
Sector		
1.machinary and	39	23.35
equipment	23	13.77
2.packaging	21	12.57
3.autobile	29	17.37
4.chemical	19	11.38
5.food processing	36	21.56
6.metal		
processing	167	100
Total		

5.4 Measures

The perceptual measures of operational level factors, manufacturing competitive priorities, and manufacturing plant performance used in this study were mostly drawn from existing scales found in various research studies. Appendix-A provides the measurement scales.

In the case of operational level factors, respondent were asked to rate the extent to which statements regarding practice implementation applied to their plant , as compared to their industry average (1=strongly disagree, 6= strongly disagree). Respondent were asked to rate their plants manufacturing competitive capabilities as indicated by performance relative to that of their principal competition (1= poor, 2=average, 3=good, 4= very good, 5= excellent).

For manufacturing plant performance we used two measures of growth in productivity that is percentage change in output and percentage change in productivity.

For the multi-item scales we executed principle components factor analysis in order to determine scale unidimensionality.

In each case all the items loaded significantly on only one factor with an eigenvalue greater than 1. For each scale (except one) the item scores explained more than 50% of the factor variance. Coefficient alpha exceeded .70 for each of the scales.

There were no significant difference between small and medium scale manufacturing firms studied (based on t-test).

5.5 Reliability and validity analyses

The reliability and validity of the measures were assessed through the determination of the Cronbach alpha coefficients, content validity and the use of factor analyses. The correlations of each measure are shown in Table 3.

The reliability coefficients are shown at the bottom and ranges from 0.637 to 0.951.

Acceptable value of alpha is 0.60; several researchers have noted that alphas of between 0.50 and 0.60 are generally acceptable for exploratory research (Srinivasan, 1985; Nunnaly and Bernstein, 1994; Gupta and Somers, 1996).

Last, Gupta and Somers (1996) argued that since alpha is a function of the number of items in the composite, it tends to be conservative and thus our alpha values indicate acceptable levels of reliability

Table 3 Principal component analysis

Construct	KMO-MSA	Bartlett sphericity (p value)	Number of factors indicated	% Variance
Process control and implementation (Pc)	0.634	0.00	2	75.57
Management of resources (Mr)	0.596	0.00	2	75.04
Management of people(Mp)	0.493	0.00	2	78.96
Training and developing people (Td)	0.625	0.00	2	78.26
Partnership with supplier (Ps)	0.779	0.00	1	72.79
Teamwork (Tw)	0.557	0.00	1	42.40
Cost	0.500	0.00	1	82.58
Quality	0.500	0.00	1	82.51
Flexibility	0.596	0.00	2	95.51
Delivery	0.500	0.00	1	84.25
Growth in productivity	0.500	0.00	1	82.08

We used factor analyses to examine measurement convergent and discriminant validity. Convergent validity is typically considered to be satisfactory when items load high on their respective factors. All items had high loadings (greater than 0.40) on their respective factors, signifying desirable measurement convergent validity. Discriminant validity was assessed by examining whether each item loaded higher on the respective factor than on other constructs. The overall results indicated minimal cross-loadings signifying that reasonable discriminant validity has been achieved (refer appendix-A).

Principal component analysis was performed with SPSS on all the constructs. An important assumption for EFA is that measured variables are sufficiently inter-correlated to produce representative factors. Three criteria were used to assess whether this assumption was met by the data. First, the Bartlett test of sphericity was used to assess whether the correlation matrix was an identity matrix. A significant value would indicate that there were significant correlations among at least some of the variables. Second, the Kaiser-Meyer-Olkin (Kaiser, 1974) overall measure of sampling adequacy (MSA) should exceed 0.5 before proceeding with factor analysis. Third, MSA values for each individual variable should be above 0.5 (Sharma, 1996; Hair et al., 2006).

The results for these tests are summarized in Table 3;

Table 4 Correlations

	Mean	Std. Deviation	pc	mr	Mp	Td	Tw	ps	cost	delivery	Flex	Quality	Productivity
Pc	5.03	1.374	1										
Mr	4.44	1.468	.469**	1									
Mp	4.66	.935	-.196	.223	1								
Td	4.69	1.113	-.063	.195	.259*	1							
Tw	5.00	1.239	.060	.136	.025	.116	1						
Ps	5.27	1.346	.077	.411**	.233	-.135	.000	1					
Cost	3.80	1.257	-.136	.163	-.133	-.237*	.093	.051	1				
Delivery	3.49	.992	.263*	.328**	.176	.170	.000	.208	-.184	1			
Flex	3.94	1.293	.161	.007	.028	-.063	.045	.005	-.218	-.187	1		
Quality	3.70	1.407	.123	.011	.164	.038	-.009	-.060	.051	-.072	.228	1	
Productivity	3.71	1.335	.178	.199	-.083	.049	.045	.002	.277*	-.194	.215	.522**	1
Cronbach α			0.951	0.909	0.842	0.894	0.637	0.915	0.772	0.771	0.785	0.728	0.740

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

6. RESULTS

The structural equation modeling approach is employed to test the hypothesis and to gain interpretational clarity of the relationships among the constructs. The figure 2 shows the path analysis model for the constructs.

The overall fit for the model was very good chi square=27.776; df=24; CFI=0.921; RMSEA=0.048; GFI=0.936 and AGFI=0.824).

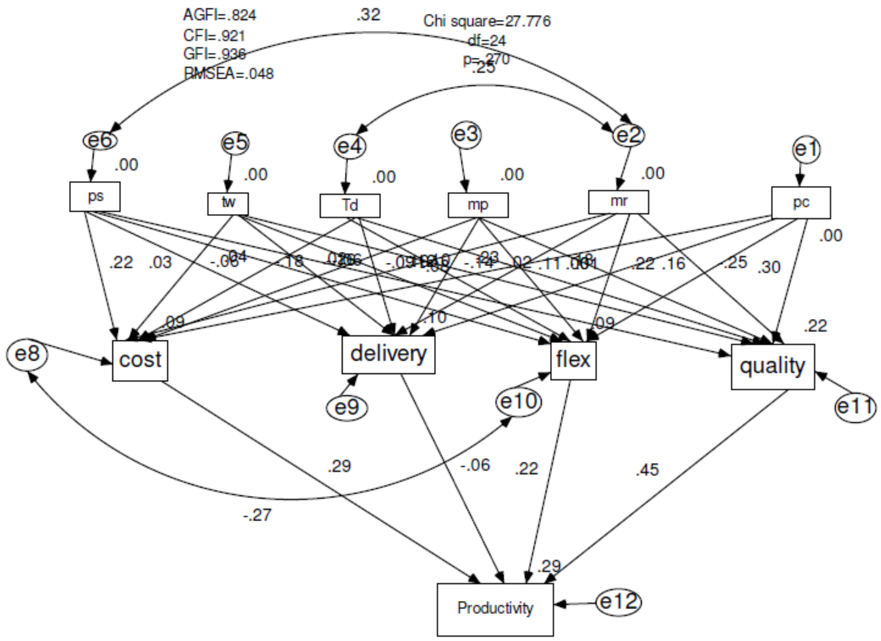

Figure 2 Results of path analysis model

Table 5: Path coefficients of the model

Impact of	**Path coefficient**
Process control and implementation on	
Cost	-.10289642
Quality	.29965303
Flexibility	.16153149
Delivery	.18115451
Management of resources on	
Cost	.05661217
Quality	-.24941077
Flexibility	.01111151
Delivery	.22799770
Management of people on	
Cost	-.17514994
Quality	.21973219
Flexibility	.11225527
Delivery	.11980642
Training and developing people on	
Cost	-.05878985
Quality	-.00364437
Flexibility	-.13722079
Delivery	-.08715154
Partnership with supplier on	
Cost	.21592144
Quality	-.07625419

Flexibility	-.15656011
Delivery	.03600243
Teamwork on	
Cost	.03135462
Quality	-.02490837
Flexibility	.09528353
Delivery	.01571512
Cost on	
Growth in productivity	.28846117
Quality on	
Growth in productivity	.44590453
Flexibility on	
Growth in productivity	.21791484
Delivery on	
Growth in productivity	-.05576850

Our first hypothesis is,

H1: Process control and implementation is positively related to operational priorities of SMEs.

For this hypothesis to be supported, at least one significant path from the process control and implementation to the operation priority should exist. The result from table shows that all the path except cost are positive and **supporting** the hypothesis.

The second hypothesis is,

H2: Management of resources is positively related to operational priorities of SMEs.

Management of resources not significantly affects the cost, quality and flexibility but affects significantly delivery of operation priority. So this hypothesis is **supported**.

The third hypothesis is,

H3: Management of people is positively related to operational priorities of SMEs.

Quality, delivery and flexibility is significantly affecting the operation priority while cost is not affecting significantly, so this hypothesis is **supported**.

The fourth hypothesis is,

H4: Training and developing people is positively related to operational priorities of SMEs.

This hypothesis is **not supported** as no path significantly affects the operation priority.

The fifth hypothesis is,

H5: Partnership with supplier is positively related to operational priorities of SMEs.

This hypothesis is **supported** as cost is affecting operation priority significantly while others not so significantly. The sixth hypothesis is,

H6: Teamwork is positively related to operational priorities of SMEs.

This hypothesis is **not supported** as none of the component of operation priority is significantly affected by teamwork.

H7: Operational priorities have a strong impact on growth in productivity.

Cost, quality, flexibility are significantly affecting growth in productivity while delivery not affecting significantly, so this hypothesis is **supported**.

7. DISCUSSION

The goal of the study was to find out effect of manufacturing functions on operations priority and plant performance. Several notable findings are evident from our results.

The literature has noted that infrastructural issues are very important for an organization to achieve sustainable competitive advantage. Therefore the impact of manufacturing functions considered in this study is seen on operations priorities such as cost, quality, flexibility and delivery (Łukasiński, 2011).

Table 6 depicts values of overall mean, standard deviation and means for small and medium scale industries.Figure 3 gives average values of operations priorities for different priorities of small and medium scale industries. Note that values are unstandardized values on five point Likert scale.

Many small and medium scale industries are giving more importance to lower cost as evident from mean 3.18. Whereas small scale industries mean is 3.92, which shows these industries gives more importance to cost compared to medium scale.

While quality, flexibility and delivery means of medium scale industries are more 3.79, 4.11 and 4.19 respectively as compared to small scale industries, which show these priorities, are given more importance by medium scale industries in Mumbai and nearby area. Growth in productivity is more for medium scale industries as compared to small scale industries as evident from means 3.98 and 3.35 respectively.

The reason may the manufacturing functions are well managed be in medium scale industries to achieve the operations priorities.

Table 6 Means of small and medium scale industries.

Construct	Mean	Std. Deviation	Small scale industries	Medium scale industries
Manufacturing functions:				
Process control and implementation (Pc)	5.03	1.374	4.79	5.21
Management of resources (Mr)	4.44	1.468	4.23	4.59
Management of people(Mp)	4.66	.935	5.00	4.40
Training and developing people (Td)	4.69	1.113	4.35	4.95
Partnership with supplier (Ps)	5.00	1.239	4.60	5.30
Teamwork (Tw)	5.27	1.346	5.09	5.40
Operation priorities:				
Cost	3.80	1.257	3.92	3.70
Quality	3.49	.992	3.10	3.79
Flexibility	3.94	1.293	3.71	4.11
Delivery	3.70	1.407	3.05	4.19
Growth in productivity	3.71	1.335	3.35	3.98

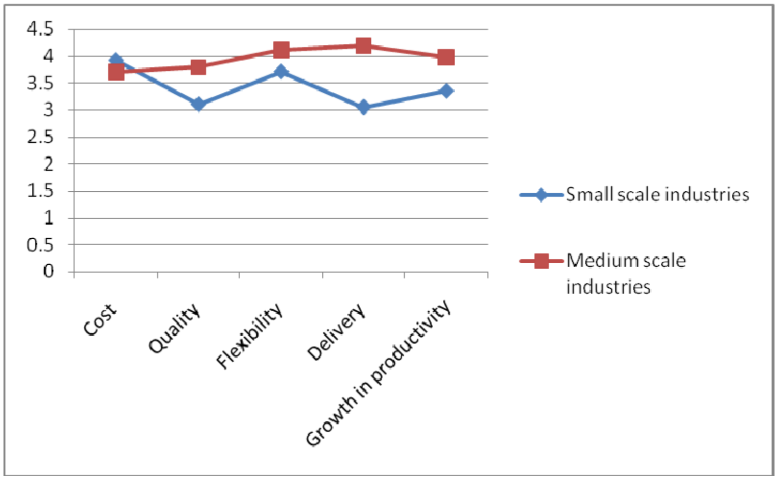

Figure 3 Comparison of means of operations priorities.

Figure 4 gives an overview of the mean values for manufacturing functions, whereby the ordinate represents the unstandardized values on a 6-point Likert scale.

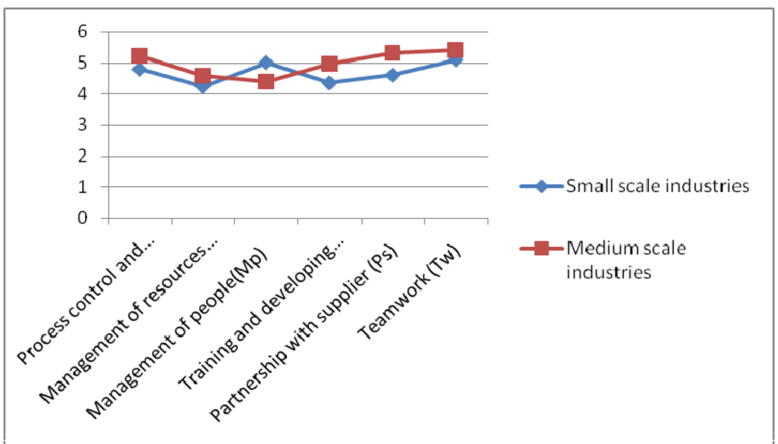

Fig 4 Comparison of means of manufacturing functions.

7. LIMITATIONS AND CONCLUSION

This study focuses on relationship between manufacturing functions, operation priorities at the plant level, as opposed to more operational activities enacted at business unit levels. These differences should be considered when our results are compared to prior research. Another limitation stems from our reliance on sole respondents as sources of data. The positions of the respondents, as well as steps taken in data collection and analysis argue against serious effects of bias and common method variance. However, the potential of these threats to validity cannot be completely ruled out. We also address a somewhat very limited performance measures. Growth in productivity is insufficient to provide a more comprehensive set of measures of business performance (Eve *et al.*, 2003).

Using data from a variety of manufacturing industries, this study examines the seven hypotheses formed on the basis of conceptual model. The results show that there exists a positive relation between manufacturing functions and operation priorities as four out of six the dimensions measured such as Process control and implementation, Management of resources, Management of people, and Partnership with supplier are positively related, while two dimensions Training and developing and Teamwork are not positively related. Findings also support strong impact of operation priorities with growth in productivity as a measure of performance. Several notable findings are evident from our results. The literature has noted that infrastructural issues are very important for an organization to achieve sustainable competitive advantage. Many small and medium scale industries are giving more importance to lower cost as evident from mean 3.18. Whereas small scale industries mean is 3.92, which shows these industries gives more importance to cost compared to medium scale. While quality, flexibility and delivery means of medium scale industries are more 3.79, 4.11 and 4.19 respectively as compared to small scale industries, which show these priorities, are given more importance by medium scale industries in Mumbai and nearby area. Growth in productivity is more for medium scale industries as compared to small scale industries as evident from means 3.98 and 3.35 respectively. The reason may the manufacturing functions are well managed be in medium scale industries to achieve the operations priorities.

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Appendix A: Construct reliability and validity analysis

Construct item	Factor loading	Construct statistics		
		Eigenvalue	%Variance	Cronbach alpha
Process control and improvement		1.893	75.57	0.951
1. We have identified all key processes.	892			
2. All key processes have been customised and brought under control.	.670			
3. Major supplier's processes have been customised and brought under control.	.861			
4. Regular quality audits (at least annually) are conducted	.870			
5. System, methods and procedures are regularly reviewed and updated in line with best current practice.	.921			
6. In our industry process is controlled and improved by adopting statistical tools and techniques	.888			
7. We use concurrent approach while designing product and processes.	.872			
8. Organisations have been identified which could be used for benchmarking for process planning and control	.926			
9. Quality improvement team has been formed and given the information, tools, training and empowerment they need to do the job effectively.	.874			
10. People have been trained to carry out their task to standard.	.855			
11. Written standardised work procedures have been prepared and are strictly enforced.	.777			
12. Productivity is constantly monitored and analysed	.479			
13. Our manufacturing facilities are flexible enough to adapt the design changes and customer demands	.495			
14. Unit labour cost is an important aspect for being competitive.	.495			
Management of resources		1.394	75.04	0.909
1. We have a system for measuring and monitoring the productivity of manpower.	.796			
2. We have a system for measuring and monitoring the productivity of machinery.(capacity planning)				
3. We have a system for measuring and monitoring the productivity of materials.(inventory control)	.939			
4. We have a system for measuring and monitoring the productivity of money.	.930			
5. Our industry has identified the best performer for benchmarking.	.726			
6. We regularly review and update our performance measures.	.842			
7. We regularly review how to use technology and resources effectively.	.540			
8. Our information system is transparent and effective.	.605			
9. We regularly do maintenance and replacement of parts and follow systematic maintenance				

programme for machineries				
Management of people				
1. All our employees knows the organizations mission and key objectives	.567			
2. Manufacturing strategy is formulated and known to all the employees in the organisation	.873	1.216	78.96	0.842
3. We involve people in planning and problem solving	.670			
4. We give constructive criticism when people's performance is not up to standard.	.895			
5. We insist on people accepting personal responsibility for the quality of their work	.858			
6. We encourage employees to use their initiative and to participate in a process of continuous improvement	.891			
7. We prevent attrition of employee by giving incentives to them	.916			
Training and developing people				
1. In our industry all levels of employees (including management) dedicate sufficient time to learn the principles and techniques of quality improvement?	.429			
2. All the employees capable of applying the knowledge and skills learned in training to their work	.661	1.40	78.26	0.894
3. The organization have an incentive or recognition program to reward the effort of employees toward quality improvement	.957			
4. Our industry is committed for continuous training and development	.739			
5. All the employees are aware of the company's commitment to training and development	.837			
6. In our industry often performance is discussed with employees	.913			
7. The proportion of our employees with a relevant vocational qualification and skill is adequate.	.635			
8. We have identified organizations that we could use for benchmarking of training and development policies.	.801			
Team work				
1. There is effective communication amongst team members of organization	.667			
2. The purpose, method and procedures to be used is clear to all members of team	.479			
3. The team members trust one another				
4. The team members are aware of individual differences and capabilities		2.12	72.79	0.637
5. The team members create their own performance measurement system	.675			
Partnership with suppliers				
1. Management teams and major suppliers discuss on key policy issues	.804			
2. Efforts are made to solve problems related to quality, production, delivery schedule through standard procedure	.605			
3. The company shares the resources and system with major suppliers production planning system	.799			
4. The company shares the resources and system	.905			

with major suppliers quality system		4.368	42.40	0.915
5. The company shares the resources and system with major suppliers technical expertise	.743			
6. The company shares the resources and system with major suppliers information system	.789			
Cost				
a. Operating at low unit product/service cost				
b. Operating at low unit operating cost	.866			
Delivery				
a. Meeting scheduled due dates				
b. Offering short delivery lead time	.937			
Flexibility				
a. Responding to volume changes	.820			
b. Responding to new product/service changeovers				
C .Offering wide range of products/services				
d. Introducing new products/services quickly	.813			
Quality				
a. Meeting customer specifications				
b. Offering good product/service design/ and performance	.810	1.652	82.58	0.772
Growth in Productivity	.945			
a. Percentage change in output				
b. percentage change in productivity				
	.847	1.685	82.51	0.771
	.920			
		1.122	95.51	0.785
	.968			
	.920			
	.725			
	.947			
		1.650	84.25	0.728
	.786			
	.801			
		1.642	82.08	0.740
	.696			
	.836			

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