

Performance Measurement Factors for Steel Casting Industries in Vidarbha Region-India**Ketki Kaskhedikar^a, Mrunal Ingle^a and Mamta Pawar^a**^a Department of Mechanical Engineering, DBACER, Nagpur University, Maharashtra, India

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Abstract

The study aims to investigate the Performance Measurement Factors (PMFs) for Steel Casting Industry in Vidarbha Region-India. The term 'PMF' is defined as an effectiveness of the project or performance in industries and said as effectiveness factors. The literature was reviewed to find out items relevant for Steel Casting Industries. Data analysis technique was carried out by using one of the popular analysis methods for qualitative research works. The results on the PMFs for Steel Casting Industries can be grouped into 4 factors: 1) Process Performance, 2) Productivity Improvement, 3) Business Results, 4) Employee Development. Each of these 4 factors includes several important attributes that can assist to enhance efficiency of Steel Casting Industries. It is an effort to lead functions of a Steel Casting Industry in all levels to the same directions for achieving the success and to make Managers and executives know what they have to do for the success of Steel Casting Industry.

Keywords: Performance Measurement Factor; Steel Casting Industry**1. Introduction**

The unfavorable effects of globalization has resulted in increased competition amongst industries. The most successful Industries are those that are able to meet the customer expectations and as such managers are increasingly in search of dissimilar ways for accomplishing the organizational performance and competitive advantage. It is widely recognized that Small and Medium Sized Enterprises (SMEs) form the backbone of the private sector at all levels of developing countries. Cheng & Choy (2007) mentioned that the success and survival of the shipping industry is critically important for international trade and global economic growth, given that the role played by the shipping industry has no immediate or direct substitute. Like other industries, the shipping industry is confronted with traditional and new challenges, which prompt shipping companies to seek improvement through quality management in the performance of their core processes and services in order to stay competitive.

Numerous studies have discussed the influences of a variety of organizational traits such as quality of human resources, top management commitment leadership skills, organizational support, organizational culture and organizational sizes as the effort factors leading to the success of the companies. Consequently, if these firms implement quality management the impact on different industries performance and growth will be significant, surely the practice of quality management enhance the

chances of their products being accepted on the international markets to compete with other similar products worldwide. Additionally it has been noticed that there has been very less researchers examining the role of quality management practices in different industries.

Although few studies have reported about the quality management aspects practiced in different industries, the study of quality management practices and their impact on organizational performance is scanty. In context of this, the present study was carried out to elaborate the PMF's that influence the organizational performance. The study done by other researchers which were justified in the published literature, were systematically assessed. The various aspects of the Total Quality Management (TQM) and the implementation of their principles resulting in the good performance of the organizations have been widespread & universally accepted now. As per Lepmets et. al., (2012) Continuous improvement of service quality results in enhanced customer satisfaction, increased efficiency and maximization of business value of the service within the company. Amuthakkannan (2012) mentioned that the increasing demand on quality and productivity of products and services has changed the industrial dynamics in many of its core technology areas. In pursuit of this various authors have contributed their valuable contributions by identifying the factors that are critical to the success of the industries over a period of time. Most of the authors have identified and ranked the critical success factors, some have related them with the various effectiveness factors resulting from the

implementation of the effort factors; However it was noticed that the studies focusing purely on identifying the Performance measurement factors are very few in numbers. In Context of this the presented study is discussed herein and elaborated.

Salaheldin (2008) contributed effectively in performance measurement in industrial sector (Doha) by finding out the effect of operational performance on the organizational performance of small & medium sized enterprises. Asika & Awolusi (2013) examine the effectiveness of the critical success factors (CSFs) of BPR on both primary (operational) and secondary (organizational) measures of business performance in Nigerian oil and gas industry. A study done by Gupta & Chaudhuri (2012) examines the contribution of the service elements to customer perceived value and explores the service gap model for delivering experiential value across restaurants. Talib, et. al., (2013) developed a conceptual framework of Quality management practices in relation to the organizational Performance of the SMEs in the Food Processing industry in Malaysia. As per Pourakbar et. al., (2013) to have information about the performance of units under supervision in an organization is the most important task of management regarding appropriate decisions for leading. In this regard, improving the efficiency and effectiveness of units and their ranking is of particular importance to manager and the physical education organization is not exceptional for this rule. The study done by they aimed to evaluate the performance of 21 physical education divisions in Isfahan Province using data envelopment analysis (DEA).In addition to this Singh et. al., (2013) identified performance measures for environmentally Conscious Manufacturing (ECM).

2. Performance Measurement Factors and its Need

Accountable factors for improving effectiveness in industries are the performance measurement factors or effectiveness factors. Usually there exists a relationship between CSF's (Critical Success Factors) & PMF's more specifically CSF's are the input factors or independent variables and PMF's are the output factors or dependent variables. Saraph, et. al., (1989), identified the eight Critical Success Factors in manufacturing Firms in U.S. and relates them with the factors such as Financial Performance, Quality performance which are the effectiveness factors or performance measurement factors. Omran., et., al., (2012) mentioned that Research on the critical success factors (CSFs) is considered to be a means to improve the effectiveness of the construction project and to achieve project objectives. A study done by Chittithaworn et. al., (2011) revealed that CSF's such as SMEs Characteristic, Customer and Markets, the way of doing Business & Cooperation, Resources and Finance,

and External Environment have significant positive effect on the Business Success of SMEs which is the Performance Measurement factor. Calingo, (2002) does the study to promote quality awareness, to recognize quality achievements of companies, and to publicize successful quality strategies in productivity organizations in Japan under that he studies and lists Customer-Driven Excellence, Business Result, organizational performance, customer satisfaction, financial and marketplace performance, supplier and partner performance, and operational performance, Customer Confidence, Process Results, Financial Results as an important output factors. Based on the PMFs such as Quality Performance, Customer Satisfaction, Employees Performance, Quality culture creation, As the product quality always depends upon the organization's infrastructural adequacies and abilities of the organization and how well they manage their equipment and facilities. The quality requirements all over the world had forced industries to use tools such as total quality management (TQM) and total productive maintenance (TPM), effectively to get higher achievements in business performance. Business Performance essentially is a Performance measurement factor of the Quality Management and can be viewed as quality production, cost reduction, employee safety and morale. The research findings done by them are applicable to manufacturing organizations. Cheng & Choy (2007) devoted their study to identify the factors that are critical to the successful quality management and according to them the success of quality management will led to improvement in Organizational Performance. On the other hand according to Boidoun (2003), in the model of European Foundation for Quality Management the factors customer satisfaction employee satisfaction and a favorable impact on society are the results achieved through the enablers (leadership driving and strategy, people partnership, resources and Processes), which lead ultimately to excellence in business results.

3. PMFs Identified through Literature Review

4. Research Methodology

The main purpose of this study was to identify the PMFs for Steel casting industry in the Vidarbha region of India. The literatures were reviewed to determine items relevant to PMFs for Large & medium scale steel casting industries. The topics of interest were mainly the items related to process management (steel casting industry is a process industry). A bunch of papers, published during 2000-2012, were selected for sorting out the items relevant to steel casting industries. The research instrument was data analyzing form. The methodology for this research was analyzing and synthesizing data using one of the popular qualitative techniques with content analysis.

Table 1 Judgemental Grouping of PMFs with Reference

Judgemental Grouping of The PMFS	References
Customer Satisfaction Greater Customer Loyalty which in turn Help to Secure Future Revenues, i.e. Customer Retention Low Customer Complaints. Sense of Satisfaction to the Customers For the Amount of Money Spent.	Arumugam, et. al., (2011), Fard & Mansor, (2011), Kshirsagar & Gorantiwar, (2011), Melia (2011), Asawin Pasutham (2012), Koilakunthla, et. al., (2012), Talib, et. al., (2013).
Employee Satisfaction Better Safety to Employees. Empowered Employees i.e. Significantly Competent Employees. High Amount of Human Resource Utilization. High amount of Value addition to Employees. High level of Productivity of Employees Improvement in Communication skill of Employees. Improvement in Job satisfaction to Employees which positively influences work Productivity, work effort, staff turnover Reduction in employee absenteeism.	Sila & Ebrahmpour, (2003), Jose et. al., (2004), Milkavoch, et. al., (2004), Chang, (2005), Singh, et. al., (2006), Lewis, et. al. (2007), Kumar, et. al., (2008), Alonso & Fuentes, (2011), Kshirsagar & Gorantiwar, (2011), Melia (2011), Asawin Pasutham (2012), Talib, et. al., (2013), ec.europa.eu/consumers/topics/Customer_Satisfaction_final_rep_en_Pdf.. S.Chand Publications Organizational Behavior by Dr. S.S. Khanna.
Financial Performance Generation of Accurate records of sales and expenses. Good product at competitive price. High Capital Productivity i.e. Productivity from machines/Equipments. High Return on Investment for Goods & Services (ROI) Optimum Capacity Utilization. Significant increase in Market Share. Sustainable increase in Net Profit.	Sarah, et. al. (1989), Calingo, (2002), Milkavoch, et. al., (2004), Chang, (2005), Kumar, et. al., (2008), Vinuesa & Hoque, (2011), Talib, et. al., (2013).
Operational Performance Good Service Productivity i.e. How Effectively Input Resources In a Process are Transformed into Good Results for the Producing Firm. High level of Flexibility in operations High Process Accuracy Rate. Improved Delivery Performance. Increase in process Efficiency. Increased Operational Productivity. Less Work in Process i.e. less process through time. Optimum inventory utilization. Production Cost & waste Reduction. Reduction in Process Variation Significant Scrap Reduction.	Calingo, (2002), Sila & Ebrahmpour, (2003), Milkavoch, et. al., (2004), Kumar, et. al., (2008), Salaheldin, (2008), Arumugam, et. al., (2011), Vinuesa & Hoque, (2011), Asawin Pasutham (2012), Talib, et. al., (2013), S.Chand Publications Organizational Behavior by Dr. S.S. Khanna.
Quality Performance Ensured Quality reliability. Improved Quality of Products. Improved Quality of the Processes. Less number of defectives in finished Products. Low Cost of Quality. Quality improvement in Design and Process. Reduction in costs associated with defective goods & Services such as warranty costs, Field service, reworking replacing defective goods.	Sarah, et. al. (1989), Jose et. al., (2004), Dilber, (2005), Kumar, et. al., (2008), Fard & Mansor, (2011) Vinuesa & Hoque, (2011), Asawin Pasutham (2012) Rashmi & Swamy, (2012) Munizu, (2013), Talib, et. al., (2013), Visit to various steel casting plants.

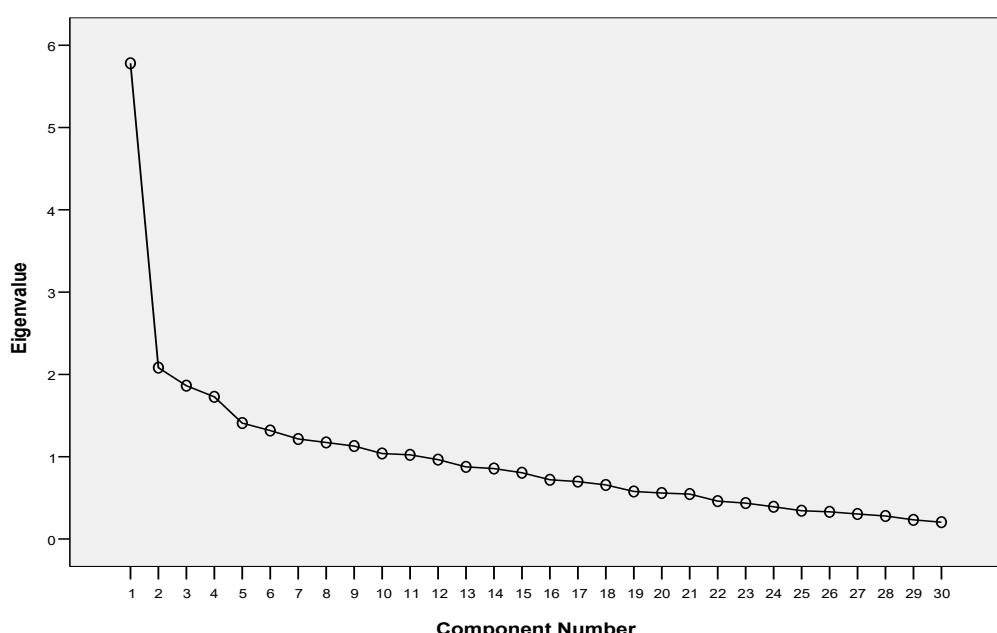
Scree Plot**Figure 1** Scree Plot

Table 2 Research Instrument Output Attributes

No.	ATTRIBUTES
OP-1	Greater Customer Loyalty which in turn Help to Secure Future Revenues, i.e. Customer Retention
OP -2	Low Customer Complaints.
OP -3	Sense of Satisfaction to the Customers For the Amount of Money Spent.
OP -4*	Better Safety to Employees.
OP -5	Empowered Employees i.e. Significantly Competent Employees.
OP -6	High Amount of Human Resource Utilization.
OP -7	High amount of Value addition to Employees.
OP -8	High level of Productivity of Employees
OP -9	Improvement in Communication skill of Employees.
OP -10	Improvement in Job satisfaction to Employees which positively influences work, Productivity, work effort, staff turnover.
OP-11	Reduction in employee absenteeism.
OP P-12	Generation of Accurate records of sales and expenses.
OP -13	Good product at competitive price.
OP -14#	High Capital Productivity i.e. Productivity from machines/Equipments.
OP -15	High Return on Investment for Goods & Services (ROI)
OP-16	Optimum Capacity Utilization.
OP P-17	Significant increase in Market Share.
OP -18	Sustainable increase in Net Profit.
OP -19	Good Service Productivity i.e. How Effectively Input Resources In a Process are Transformed into Good Results for the Producing Firm.
OP -20	High level of Flexibility in operations
OP -21*	High Process Accuracy Rate.
OP -22*	Improved Delivery Performance.
OP 23	Increase in process Efficiency.
OP -24#	Increased Operational Productivity.
OP -25	Less Work in Process i.e. less process through time.
OP -26#	Optimum inventory utilization.
OP -27#	Production Cost & waste Reduction.
OP -28*	Reduction in Process Variation
OP -29*	Significant Scrap Reduction.
OP -30	Ensured Quality reliability.
OP -31	Improved Quality of Products.
OP -32#	Improved Quality of the Processes.
OP -33*	Less number of defectives in finished Products.
OP -34*	Low Cost of Quality.
OP -35#	Quality improvement in Design and Process.
OP -36	Reduction in costs associated with defective goods & Services such as warranty costs, Field service, reworking replacing defective goods.

* indicates the attributes (no. 4, 21, 22, 28, 29, 33, 34) deleted after analysis of data and discussion with respondents during collecting the responses, and after collecting more information about the industry. Hence, attributes (no.4, 22) are deleted from the Main Study. Certain attributes appeared to be suitable for deletion through data analysis, however they found significant during discussion with casting employees & were retained (21, 28, 29,33, 34). # indicates the attributes (no. 14, 24, 26 & 27;32 & 35) combined to form new attribute in final instrument.

Table 3 Data Analysis

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.706
Bartlett's Test of Sphericity	Approx. Chi-Square	837.995
	Df	435
	Sig.	.000

Table 4 Factor Rotation

Factors	1	2	3	4
2-Low Customer Complaints.	0.4963			
3-Sense of Satisfaction to the Customers For the Amount of Money Spent.	0.4336			
10-Reduction in employee absenteeism.	0.564			
11-Generation of Accurate records of sales and expenses.	0.638			
13-High Return on Investment for Goods & Services (ROI)	0.5338			
14-Optimum Capacity Utilization.	0.5864			
18-High level of Flexibility in operations	0.5835			
19-High Process Accuracy Rate.	0.5522			
20-Increase in process Efficiency.	0.5533			
21-Less Work in Process i.e. less process through time.	0.5407			
30-Reduction in costs associated with defective goods & Services such as warranty costs, Field service, reworking replacing defective goods	0.5184			
1-Greater Customer Loyalty which in turn Help to Secure Future Revenues, i.e. Customer Retention		0.6368		
5-High Amount of Human Resource Utilization.		0.5674		
9-Improvement in Job satisfaction to Employees which positively influences work, Productivity, work effort, staff turnover.		0.4965		
12-Good product at competitive price.		0.5757		
17-Good Service Productivity i.e. How Effectively Input Resources In a Process are Transformed into Good Results for the Producing Firm.		0.4645		
23-Reduction in Process Variation		0.5291		
24-Significant Scrap Reduction.		0.7213		
25-Ensured Quality reliability.		0.6071		
4-Empowered Employees i.e. Significantly Competent Employees.			0.5218	
15-Significant increase in Market Share.			0.6309	
16-Sustainable increase in Net Profit.			0.5445	
22-Optimum inventory utilization.			0.5456	
26-Improved Quality of Products.			0.3713	
28-Low Cost of Quality.			0.5792	
29-Quality improvement in Design and Process.			0.6167	
6-High amount of Value addition to Employees.				0.720326
7-High level of Productivity of Employees				0.706239
8-Improvement in Communication skill of Employees.				0.698091

5. Research Findings

The result from data analysis and synthesis method of literature review is to specify the CSFs for Steel casting industries.

It can be grouped into 5 factors: 1) Process Performance, 2) Productivity Improvement, 3) Business Results, 4) Employee Development. Each factor included several elements that can be explained as follows:

Table 6 Loaded variables

Factor Name	Variables loaded in OP Factors
OF-1- Process Performance	2-Low Customer Complaints. 3-Sense of Satisfaction to the Customers For the Amount of Money Spent. 10-Reduction in employee absenteeism. 11-Generation of Accurate records of sales and expenses. 13-High Return on Investment for Goods & Services (ROI) 14-Optimum Capacity Utilization. 18-High level of Flexibility in operations 19-High Process Accuracy Rate. 20-Increase in process Efficiency. 21-Less Work in Process i.e. less process through time. 30-Reduction in costs associated with defective goods & Services such as warranty costs, Field service, reworking replacing defective goods.
OF-2- Productivity Improvement	1-Greater Customer Loyalty which in turn Help to Secure Future Revenues, i.e. Customer Retention 5-High Amount of Human Resource Utilization. 9-Improvement in Job satisfaction to Employees which positively influences work, Productivity, work effort, staff turnover. 12-Good product at competitive price. 17-Good Service Productivity i.e. How Effectively Input Resources In a Process are Transformed into Good Results for the Producing Firm. 23-Reduction in Process Variation 24-Significant Scrap Reduction. 25-Ensured Quality reliability.
OF-3- Business Results	4-Empowered Employees i.e. Significantly Competent Employees. 15-Significant increase in Market Share. 16-Sustainable increase in Net Profit. 22-Optimum inventory utilization. 26-Improved Quality of Products. 27-Improved Quality of the Processes. 28-Low Cost of Quality. 29-Quality improvement in Design and Process.
OF-4- Employee Development	6-High amount of Value addition to Employees. 7-High level of Productivity of Employees 8-Improvement in Communication skill of Employees.

Conclusions

Steel Casting Industry is surely having providing a competitive advantage over the other industries worldwide. Steel casting industries forms the backbone of Industrial sector for the developing countries like India. Therefore, identifying PMFs is necessary to determine the direction of the steel casting industries towards success and these identified PMFs must be implemented properly if organization wants to be successful. In conclusion, the "PMFs for steel casting industry" found are: 1) Process Performance, 2) Productivity Improvement, 3) Business Results, 4) Employee Development. It is suggested that each of these 4 factors is important to enhance efficiency of steel casting industries in Vidarbha region. It is a concrete approach to lead steel casting industry in all levels to the same directions for achieving the success and to make employees and executives know what they have to do for the success of steel casting plants.

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