

The Impact on the Operational Performance of Manufacturing Implementation Strategies

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Abstract — The purpose of this study is to determine the underlying magnitudes of manufacturing practices and to empirically test a structure pinpointing the interactions between manufacturing practices and operational performance, namely cost, quality, speed, and flexibility. Statistics for this paper was composed from a sample of a steel manufacturing company in South Africa. The research framework was tested using structural equation modeling approach. Based on probing factor analysis, manufacturing practices were gathered into two factors: manufacturing strategy implementation and operational performance. The results indicate that two practices have direct positive and statistically significant impact on operational performance. Likewise, this study tried to scrutinize the best apt model between manufacturing practices and operational performance.

Keywords: — Manufacturing strategies, Operational Performance, Manufacturing practices, TQM.

I. INTRODUCTION

The national academy of science and engineering and the institute of medicine (1995) defined manufacturing as all the activities involved in determining the needs of potential customers conceiving and producing products to meet those needs and marketing and delivering those products to the ultimate consumer. Nowadays technology assumes a central role in human development. Many human needs are met through its application. Technology is used to make things, it is found in products in material form, and, in the asset we call 'know how' (Rhoades, 2005:13). Rhoades (2005) puts emphasis on that in order to get the facility back on track, it is essential that manufacturers should critically look at improvement opportunities across business processes across all functions and establish way on how they can improve /build on them to deliver organizational objectives and shareholder value. This will be followed by a quick review and analysis of the products and product mix that the company is producing and also establishing if the consumer expectations are being realized, i.e. consumer value proposition.

Problem statement

A situation of low productivity at the expense of quality and quantity can be comfortably generalized. The turnover of a particular branch divided among employees at that particular branch may yield marginal profit, but not real profit. Production is directly linked to the availability of the right kind of personnel. More personnel in most instances do not improve productivity. Centralization of decision making is one of AcerloMittal greatest dilemma AMSA is also exploring the possibility of setting up its own iron ore mining operation in the Northern Cape. While the company believes such a move could circumvent some of its problems with regards to raw materials, some analysts believe this would not only be a step back in time for the steel producer, but that AMSA lacks the skills and expertise to run such an operation. Since in the industrial revolution, the introduction of machines in the manufacturing sector is to create a science of productivity.

Shipment dates are missed, the customers complain of the sales force, and the sales manager vents his anger onto the production manager. Although there appears to be high utilisation of resources, there is excessive work-in-process and most of the work is sitting in queues. In addition, a staggering amount of unplanned overtime and quality problems are mounting. This study will aim to look at the underlying issues causing all these problems. The problems have necessitated the use of hot lists, used because of frequent part shortages, some of which result from late deliveries from suppliers, late ordering by company, and poor quality of parts actually delivered. Other parts shortages result from inaccurate bills of materials and inventory record inaccuracies that report parts in stock when they are not.

Schedule change problems reported suggest a lack of a priority mechanism, or following wrong priorities such as keeping a machine busy rather than satisfying a customer. The company is neither sure what their capacity is nor does it have a mechanism to measure it. Still other problems are identifiable on the factory shop floor and these have their source in inaccurate forecasts of demand that instruct the plant to build either too much or too little. In an attempt to explain the theoretical perspectives adopted by ArcerloMittal, it is pertinent to note that no one strategy is 100% adhered to by the proponents of such a strategy. As such although management claims been practising a particular strategy of organisational theory, contingency factors within and outside the organisational environment influences the measures taken by organisational members to solve such problems. Thus, any strategy undertaken by this organisation is but a point along a continuum in which other strategies can be used, although some strategies are more prominent than others.

Objectives of the Study

To increase the understanding of the role of manufacturing strategy and its immediate impact on manufacturing capability and performance in order to propose a model for an appropriate strategy to increase productivity and global competitiveness in the manufacturing sector in South Africa. The overall objective of this study is to investigate how manufacturing companies make use of different manufacturing practices or packs of manufacturing practices to develop certain sets of capabilities, with the crucial goal of supporting the market requirements

Specific Objectives

1. Furthermore, it analyses the conditions under which manufacturing strategy may be promoted and mainly to sensitize policy authorities with respect to the effects that obscure strategy have on the operations effectiveness. If the impact is positive, the study looks at the measures to alleviate the negative impact.
2. The research basically undertakes to bring to light certain basic views that are often overloaded or overstated when discussions on manufacturing strategy emerge.

III. METHODOLOGY

Scope and sample size

This company has staff strength of more than 1600 employees and the production unit which is of interest to the researcher. The respondents were randomly selected in the company visited. Subjects chosen were from the plant and maintenance supervisor rank downwards as well as general workers. Things changed when the researcher got to the company as no foreign people are allowed access to the plant due to health and safety regulations. In all, 100 respondents of this category of employees were selected from questionnaire administered. These categories of employees were significantly selected because most of them are engineers that work in the plant and the researcher feels that they perceive more work stress and pressure than any other unit in the operation.

As such the negative effect of organizational pressure will be pronounced in this category of employees. These samples used have attained some acceptable level of literacy from technical school or secondary schools and some have attended higher institutions of learning. As a result they did not find difficulty in responding to the substances in the questionnaire. Studies which are usually quantitative in nature aim to provide a broad overview of a representative sample of a large population (Frankel, 2000). Hair, Black, Babin and Anderson et al., (2010) explains that for every 'one' item or variable in the questionnaire there should be a minimum of five and a maximum of 10 respondents. The survey questionnaire will consist of 3 constructs, each with its own respective sub-dimensions. To justify a reliable and valid measurement of each sub-dimension, each sub-dimension should comprise of at least three questions (items). A representative sample of at least 100 respondents will therefore be required. A total of at least 100 questionnaire responses will therefore be collected.

Data collection -

The primary data

A questionnaire was used for data collection in this study. This is because the researcher feels that a more generalized data can be accumulated from such a venture within a limited time. Moreover, the use of questionnaires in previous researches affecting manufacturing strategies has been found to be reliable and statistically valid so also is performance. A comprehensive questionnaire was developed by the researcher based on the information gained from the literature study and from other similar questionnaires to determine from relevant stakeholders what the underlying reasons for staggering manufacturing capabilities to meet target goals.

The secondary data

A computer scan was conducted using the South African bibliographic and information network [cabinet] to identify sources related to the research topic. A literature survey was conducted and literature sources will comprise but not limited to academic journals, published and unpublished books, internet and articles. Furthermore, various internal documents in the form of memorandums and reports were studied. From the literature survey, a conceptual framework for understanding a good manufacturing sector was developed by synthesizing the existing theory

The data processing and analysis

According to Gravetter and Forzano (2009: 531), the statistical package for the social sciences, commonly known as SPSS, is a computer program that performs statistical calculations, and is widely available on college campuses. This research will adopt SPSS analysis, hence it is the analytic procedure associated with qualitative methodology. Data will be entered in a data matrix.

IV. RESULTS

Production, Sales and Purchases

As per the majority of the respondents, it was observed that the average age of plant's production equipment is over 20 years (Figure 4.8) and less than 3% of the annual sales are invested in new manufacturing equipment (Figure 4.9).

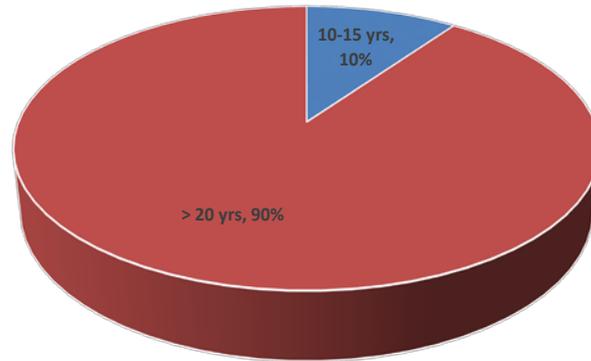


Fig 1: Average age of production equipment

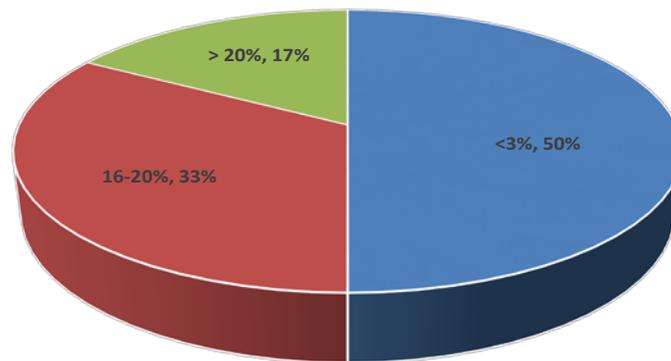


Figure 2: Annual investment in new manufacturing equipment

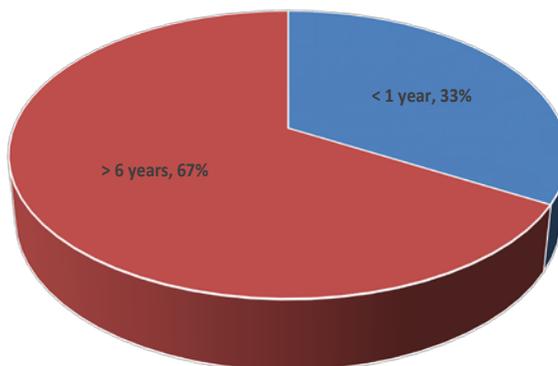


Fig 3. Product life cycle

A typical life cycle of the most important product line was observed to be more than 6 years (Figure 1) and about 90% of the plant's products were reported to be fabricated within the plant (Figure 2). The majority of the respondents mentioned that services provided by the plant do not generate plant sales and only 5% plant sales is generated from services provided by the plant (Figure 2). The survey also revealed that the new introduced products provide fewer sales (Figure 3).

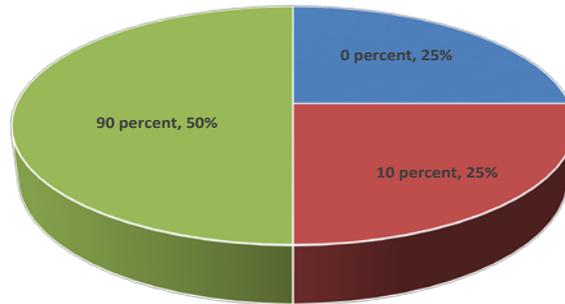


Fig 4. Fabricated with the percentage of products plant

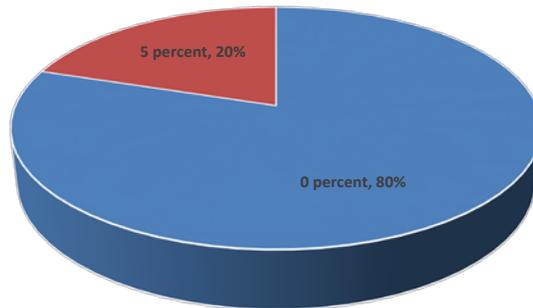


Fig 5. Percentage of plant sales generated from services provided by the plant

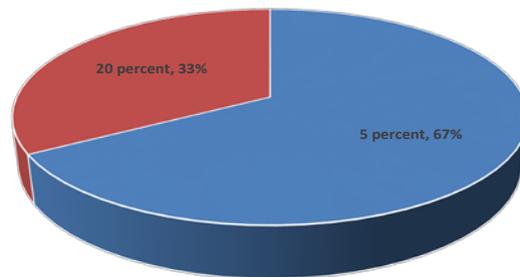


Figure 4.13: Percentage of plant sales from new products introduced in last two years

About 60% - 80% sales of the most important product line of the company comes from domestic market and remaining 20% - 40% comes from exports (Table 4.2). Similarly, about 70% - 75% purchases of the most important product line of the company comes from domestic suppliers and remaining 25% - 30% comes from foreign suppliers (Table 4.3).

Manufacturing

The majority of the respondents agreed to most of the statements about manufacturing strategy, with more than 60% of the respondents either agreed or strongly agreed (Table 4.5). Very few respondents disagreed or strongly disagreed and some handful of respondents also chose to stay neutral. Hence, it can be observed that the manufacturing strategy is aligned with corporate strategy and other functions. Manufacturing is observed to have clearly defined strategic objectives and is clearly communicated to all staffs.

Table 1. Responses to the Manufacturing Strategy

		Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Total
Manufacturing strategy is aligned with corporate strategy	Count	0	1	6	9	3	19
	Row N %	0.0%	5.3%	31.6%	47.4%	15.8%	100.0%
Manufacturing strategy is aligned with that of other functions	Count	0	3	3	9	4	19
	Row N %	0.0%	15.8%	15.8%	47.4%	21.1%	100.0%
Business functions meet frequently to coordinate activities	Count	0	2	5	8	4	19
	Row N %	0.0%	10.5%	26.3%	42.1%	21.1%	100.0%
Manufacturing is powerful relative to other functions	Count	1	2	1	10	5	19
	Row N %	5.3%	10.5%	5.3%	52.6%	26.3%	100.0%
Manufacturing has clearly defined strategic objectives	Count	0	1	3	10	4	18
	Row N %	0.0%	5.6%	16.7%	55.6%	22.2%	100.0%
Manufacturing strategy leverages existing capabilities	Count	0	1	3	11	4	19
	Row N %	0.0%	5.3%	15.8%	57.9%	21.1%	100.0%
Manufacturing strategy is clearly communicated to all staff	Count	0	2	6	8	3	19
	Row N %	0.0%	10.5%	31.6%	42.1%	15.8%	100.0%
Manufacturing strategy is frequently reviewed and revised	Count	0	1	8	4	6	19
	Row N %	0.0%	5.3%	42.1%	21.1%	31.6%	100.0%

As per the majority of the respondents, the manufacturing capabilities of the plant were observed to be average. The majority of the respondents stayed neutral when asked about the presence of the state-of-art manufacturing processes, superior technological workforce, equipment protected by the firm's patents, proprietary equipment giving competitive advantage, unique engineering skills and abilities, and engineering core strength of the plant (Table 4.6). The majority agreed on the availability of unique manufacturing process capabilities, superior technological knowledge, and high engineering capabilities. Only few respondents strongly disagreed with the capabilities of manufacturing plant.

Table 2.

		Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Total
Your plant has state-of-the-art manufacturing processes	Count	2	4	10	2	1	19
	Row N %	10.5%	21.1%	52.6%	10.5%	5.3%	100.0%
Your workforce has superior technological skills	Count	1	5	11	2	0	19
	Row N %	5.3%	26.3%	57.9%	10.5%	0.0%	100.0%
Your plant has unique manufacturing process capabilities	Count	0	4	5	9	1	19
	Row N %	0.0%	21.1%	26.3%	47.4%	5.3%	100.0%
You have superior technological know-how in your plant	Count	1	1	7	10	0	19
	Row N %	5.3%	5.3%	36.8%	52.6%	0.0%	100.0%
This plant has equipment that is protected by the firm's patents	Count	1	6	7	2	1	17
	Row N %	5.9%	35.3%	41.2%	11.8%	5.9%	100.0%
Proprietary equipment helps you gain competitive advantage	Count	1	5	6	3	3	18
	Row N %	5.6%	27.8%	33.3%	16.7%	16.7%	100.0%
Is the Engineering capability at this plant is high.	Count	0	2	8	9	0	19
	Row N %	0.0%	10.5%	42.1%	47.4%	0.0%	100.0%
Are the Engineering skills and abilities at this plant unique?	Count	0	2	11	6	0	19
	Row N %	0.0%	10.5%	57.9%	31.6%	0.0%	100.0%
Is Engineering the core strength of the plant.	Count	0	3	10	6	0	19
	Row N %	0.0%	15.8%	52.6%	31.6%	0.0%	100.0%

Based on the majority of the respondents, the plant performance was observed to be satisfactory with some exemption on delivery issues (Table 4.7). The majority of the respondents agreed that the plant performs above mediocre exertion; products confirm to customer satisfaction, satisfactory pre- and after-sales service, supreme product volume flexibility, and solemn attention on hazardous materials discharge. The majority of respondents were observed to be neutral when asked about product delivery (speed, reliability and flexibility of changing deliver dates), production variety flexibility, and prompt lead time to introduce new products or new processes. The majority of the respondents disagreed that numerous new products are introduced each year.

Table 3. Responses to plant performance

		Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Total
Product performance is above mediocre exertion	Count	0	1	2	15	1	19
	Row N %	0.0%	5.3%	10.5%	78.9%	5.3%	100.0%
	Count	0	2	0	12	5	19

The plant Products conform to customer specifications	Row N %	0.0%	10.5%	0.0%	63.2%	26.3%	100.0%
Pre-sales service and after sales service is satisfactory	Count	0	4	3	8	4	19
	Row N %	0.0%	21.1%	15.8%	42.1%	21.1%	100.0%
The plants delivery speed is highly effective	Count	0	1	9	6	3	19
	Row N %	0.0%	5.3%	47.4%	31.6%	15.8%	100.0%
Delivery reliability of the plant is sublime	Count	0	3	9	5	2	19
	Row N %	0.0%	15.8%	47.4%	26.3%	10.5%	100.0%
Response to changes in delivery due dates is flexible and prompt	Count	0	3	12	4	0	19
	Row N %	0.0%	15.8%	63.2%	21.1%	0.0%	100.0%
Production volume flexibility (increase/decrease volume) is supreme	Count	0	3	7	8	1	19
	Row N %	0.0%	15.8%	36.8%	42.1%	5.3%	100.0%
Production variety flexibility (increase/decrease product mix)	Count	0	4	7	5	3	19
	Row N %	0.0%	21.1%	36.8%	26.3%	15.8%	100.0%
There is numerous of new products introduced each year	Count	2	7	6	2	1	18
	Row N %	11.1%	38.9%	33.3%	11.1%	5.6%	100.0%
Lead time to introduce new products is prompt	Count	2	2	8	7	0	19
	Row N %	10.5%	10.5%	42.1%	36.8%	0.0%	100.0%
Lead time to implement new or change existing processes is minimal	Count	1	4	12	1	1	19
	Row N %	5.3%	21.1%	63.2%	5.3%	5.3%	100.0%
Lost time accidents are few	Count	1	4	6	6	2	19
	Row N %	5.3%	21.1%	31.6%	31.6%	10.5%	100.0%
Discharge of hazardous materials is taken into solemn attention	Count	0	2	4	8	5	19
	Row N %	0.0%	10.5%	21.1%	42.1%	26.3%	100.0%

V. Conclusions

The study explored the strategies employed by manufacturing for their business sustenance. This is the first time that this research has been conducted. The results offer insights into the importance of this new business segment particularly with regards to manufacturing and impacts of manufacturing strategies. From the results the research disclosed that white male employees dominate the manufacturing entity compared to women. The reason being indefinite as it was not part of the study but other studies highlight that a high proposition of males are in manufacturing. Majority of the employees lies within the ages of 24 - 55. This is an indication that most individuals in the manufacturing industry are still economically active and have the ability to work for their families.

This study intended to scrutinize the manufacturing strategies at length which could keep the company sustainable and the performance, thereof, with the assumption that longer the business trades, the more performance is qualified. Within the manufacturing, however, it was found that most employees are not to say that the business is not sustainable as the financial strategy works and the manufacturing strategy employed demonstrated to be favourable for the business. It is comprehended that performance of the business gradually underperforms as the time goes by, however the underperformance is not so significant that the operation is forced to face certain pitfalls. However when performance exceeds ambition, the overlap is called success. In this study, the impact of WCM implementation strategies on the operational performance of a firm is analysed. It is well understood that many firms are trying to implement many of WCM strategies.

VI. Recommendations

It's important that WCM implementation strategies have to be revised by taking into account the effects of these strategies on the operational and managerial performances of the firms.

With respect to the responses given by the blue and white collars workers who participated in the survey, descriptive statistics, validity and reliability analysis, factor analysis and regression/correlation analysis were performed. WCM implementation strategies of the firm were collected by 8 factors namely CSCM-Customer & Supply Chain Management, TPM-Total Productive Maintenance, EHS-Environment and Health and Safety, QUAL-Quality, FCL-Facility Control, INV-Innovation & Technology, PM-Process Management, LEAD Leadership. Examined the relationship between 8 factors, there found some significant and strong relationship between CSCM and PM, and also between TPM and QUAL factors.

It is thought that the result of this finding was positively affected by highlighting the importance of good & information flowing from supplier to the customer in a good condition during the activities in the firm. It is observed that WCM strategies have a high effect on the operational performance identified by the managers. The two WCM strategies having the biggest effect on the operational performance are TPM and EHS. Considering the order-based production structure and raw material-based product structure of the firm, obtained statistical results become more important. In order to meet the orders in time, fast mould changes, planned maintenance practices and the efforts to reduce duration of production are thought to be unavoidably achieved targets. Likewise, the use of substances which contain high degree risk in production forces the “environment, health and safety regulations” to be the main priority. With regards to the firm that started WCM implementations three years ago, it is important that they ought to monitor their strategies as frequently as possible. Hence, the same firm could easily self-evaluate and also create more efficient WCM strategies, which can be another study subject for the future.

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BIOGRAPHY

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