

An Analytical Study of Determinants of Operational Productivity and its Management: An empirical study

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ABSTRACT

This study sought to establish the factors affecting the operational productivity of the small and medium sized manufacturing firms in Ahmedabad and to establish the challenges facing small and medium sized manufacturing firms in achieving optimal operational productivity. The study utilized a survey research design. The population of this study was the small and medium sized manufacturing firms registered with the Ministry of Industrialization and whose headquarters are based in Ahmedabad. A semi-structured questionnaire was administered to the persons heading the production and / or operations departments in the small and medium sized manufacturing firms. Sample size of 120 managers was taken in the study and data was collected by personal interview method. Cross tabulation, correlation analysis, multiple regression analysis and factor analysis were used to determine the relative significance of the factors. The study reveals the major factors that affects operational productivity in the manufacturing firms.

1. Introduction

Productivity is of great interest to the operations manager and of course, to all those who have a stake in the success of a country's organizations. Increases in productivity underpin increases in the standard of living. In fact only through increases in productivity can lead to an improvement in the standard of living (Naylor 2002). Productivity is a common measure of how well a country, industry, or business unit is using its resources (or factors of production). Since operations management focuses on making the best use of the resources available to a firm, productivity measurement is fundamental to understanding operation – related performance. In its broadest sense, productivity is defined as outputs divided by inputs (Chase et al, 2007). The important role played by the small and medium sized manufacturing firms in India's economy cannot be overemphasized. The small and medium sized manufacturing firms contribute immensely to the economic development and wealth creation through employment creation, generation of incomes, increasing productivity, facilitating technological transfers and creation of market linkages among other benefits.

2. Factors affecting Operational Productivity

Factors affecting operational productivity consist of capital, quality, technology, management, standardization, quality differences, use of the internet, computer viruses, searching for lost or misplaced items, scrap rates, new workers, safety, shortage of IT workers and other technical worker, layoffs, labor turnover, design of the workplace, incentive plans that reward productivity increases and equipment breakdown among others (Stevenson, 2009). Operational productivity variables include flexibility which leads to frequent new products and services, or a wide product and service range; reduced/short delivery time which leads to faster operations; improved quality of products and services resulting in no errors in processes and thus no wastage of time or effort in having to re-do things; dependable delivery; reduced cost of operations and so increased profitability; increased efficiency leading to a reduction in operational costs; and increased employees

productivity so that employees are able to do more within a shorter period of time.

3. Literature Review

Productivity is the most widely used measure of operations. It shows the amount produced for each unit of the resources used. There are several kinds of productivity. The broadest picture of operations comes from total productivity, which relates production to all the resource used (Walters 2002).

Total productivity is thus defined as the ratio of total output to total input. By inputs is meant all the resources, employees, raw materials, energy, building equipment and so on that are required to manufacture a product or deliver a service (Williams R.S, 2002). Input indices include number of employees, hours worked, staff costs, area of sales space available, units / cost of energy used and amount /cost of raw materials used. Reducing inputs - essentially, cutting costs for the same (or greater) levels of outputs is commonly adopted as means of increasing productivity (William R.S, 2002).

Output is typically taken to mean what an organization produces or the service it delivers. Examples of outputs include number of passengers carried, number of surgical operations carried out, number of units sold, shilling value of units sold and number of users of a leisure centre (Williams R.S., 2002). However there are practical difficulties in defining „total“ output and/ or „total“ input. Because of these practical difficulties, most organizations use partial productivity, which relates the output to a single type of input. If a process uses 25 hours of machine time to make 50 units, then the productivity is two units per machine-hour (Walters, 2002). Partial productivity is thus defined as the ratio of total output to units of a single resource used. Partial measures of productivity in a restaurant may be customers (meals) per labour hour; in a chicken farm it may be kilograms of meat per kilogram of feed; in a supermarket it may be sales per square foot and in a paper mill it may be tonnes of paper per cord of wood (Jacobs F R et al, 2009). Partial productivity includes: equipment productivity, labor productivity,

capital productivity, energy productivity (Walters, 2002; Walters, 2006).

Productivity changes can either be caused by either movements in the “best practice” technology, or changes in the level of efficiency. Some of the basic measures of productivity are output, labour and capital. Output can be defined as the real output produced in a set time limit. The sales or revenue figure normally reported in accounts can be used as a measure in comparison with previous years or other firms in the industry (Mark, 1998). Labour quantity is normally measured in terms of the number of employees. In theory labour could be split into various separate inputs depending on skill, education, or other classifications (Bii, 2008).

Productivity measurement may be made at various levels. The levels at which productivities are to be measured for the uses of different purposes are international level, national level, industrial level, and company or organizational level. For example, productivity measurement at the industrial level can be of use as economic indicators. This may also be used to analyze the manpower utilization or company performance. On the other hand, productivity measurement at company or organization level will help to study the productivity of resources used. Higher company productivity will guarantee higher real wages. Public will realize greater social benefits. Consumer will pay lesser price from increased use value through increased productivity (Rama Murthy, 2005).

4. Objectives of the study

The study had two objectives:

- i. To establish the factors affecting the operational productivity of the small and medium sized manufacturing firms in Gujarat State
- ii. To establish the challenges facing small and medium sized manufacturing firms in achieving optimal operational productivity.

5. Importance of the study

To the manufacturing industry, the study will provide the firms with information on the general factors affecting their

operational productivity, which they can use to enhance their competitiveness. To the consumers of the products, the study will provide the consumer with information that they need in their choice of the small and medium sized manufacturing firms and subsequently their products. To the researchers, the study seeks to stimulate further interest in research in other areas of the small and medium sized manufacturing firms as well as in operational productivity in other industries such as large manufacturing firms and service industries.

6. Research Methodology

It is simply known as the complete blue print of the research carried out by the researcher. The methodology of the present study is as follows.

- **Contact Method:** Personal Interview by self-administered structured questionnaire
- **Sample Unit:** Production managers/in charge of SMEs and MSMEs in Ahmedabad District.
- **Sample Size:** 120
- **Sampling Technique:** Non Probability Convenience Sampling
- **Research Instrument:** Structured Likert Scale Questionnaire

7. Data Analysis:

The purpose of carry out multiple regressions is to understand significant relations between all the independent variables and dependent variables. Multiple regressions also help to understand contribution of all the independent variables in relationship with dependent variable.

In the next part of the study carry forward same hypothesis using multiple regression. All six factors are inserted as independent variables combined and consumer experience inserted as the dependent variable. Mean score was taken as the representative value for that particular variable. Person correlation was performed first to make base for the multiple regression. Table 4.61 provides the Coefficient of relation between all independent variables and dependent variable.

Table 1 correlation for multiple regressions

| Correlation | | | | | | | |
|--------------------------|--------------------------|-----------------|--------------------|-------------------|--------------------|-------------------------|--------------------|
| | Operational Productivity | Quality factors | Technology factors | Personnel Factors | Managerial Factors | Capital related factors | Ergonomics factors |
| Operational Productivity | 1.000 | .824 | .734 | .887 | .823 | .711 | .803 |
| Quality factors | .824 | 1.000 | .456 | .534 | .611 | .622 | .701 |
| Technology factors | .734 | .456 | 1.000 | .455 | .635 | .589 | .505 |
| Personnel Factors | .887 | .534 | .455 | 1.000 | .519 | .551 | .439 |
| Managerial Factors | .823 | .611 | .635 | .519 | 1.000 | .456 | .569 |
| Capital related factors | .711 | .622 | .589 | .551 | .456 | 1.000 | .704 |
| Ergonomics factors | .803 | .701 | .505 | .439 | .569 | .704 | 1.000 |

N= 520, All Correlation are statistically significant at 5% level of significant

Coefficient of correlation was positive for all the variables and varied between 0.439to 0.887. All coefficient of correlation

were statistically significant at 5% level of the significant. It proves that there is very good relationship amongst all the

determinants. Correlation summary provides the good base for the multiple regressions.

The model summary of Operational Productivity and all six explored variables is given in Table and it shows the coefficient

of determination (R^2) under model which is 0.912, which meant all six factors combine explained 91.2 percent of the variations in Operational Productivity. Value of 0.897 is really very positive and establishes very strong relationship between all the independent variables and dependent variables.

Table 2 Model summary for multiple regressions

| Model Summary ^b | | | | | | | | | |
|---|-------------------|----------|-------------------|----------------------------|-------------------|----------|-----|-----|---------------|
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics | | | | |
| | | | | | R Square Change | F Change | df1 | df2 | Sig. F Change |
| 1 | .956 ^a | .912 | .896 | .21345 | .843 | 701.321 | 6 | 113 | .000 |
| a. Predictors: (Constant), Ergonomics factors, Personnel Factors, Technology factors, Managerial Factors, Quality factors , Capital related factors | | | | | | | | | |
| b. Dependent Variable: Operational Productivity | | | | | | | | | |

Table 3 ANOVA for multiple regressions

| ANOVA ^a | | | | | | |
|---|------------|----------------|-----|-------------|---------|-------------------|
| Model | | Sum of Squares | df | Mean Square | F | Sig. |
| 1 | Regression | 132.10 | 6 | 23.091 | 701.321 | .000 ^b |
| | Residual | 32.33 | 113 | .034 | | |
| | Total | 163.43 | 119 | | | |
| a. Dependent Variable: Operational Productivity | | | | | | |
| b. Predictors: (Constant), Ergonomics factors, Personnel Factors, Technology factors, Managerial Factors, Quality factors , Capital related factors | | | | | | |

Table 4 Coefficients of Regression

| Coefficients ^a | | | | | | | | |
|---|-------------------------|-----------------------------|------------|---------------------------|--------|------|-------------------------|-------|
| Model | | Unstandardized Coefficients | | Standardized Coefficients | T | Sig. | Collinearity Statistics | |
| | | B | Std. Error | Beta | | | Tolerance | VIF |
| 1 | (Constant) | -.078 | .065 | | -1.763 | .000 | | |
| | Quality factors | .270 | .019 | .213 | 9.345 | .000 | .432 | 2.760 |
| | Technology factors | .120 | .017 | .114 | 4.321 | .000 | .612 | 1.231 |
| | Personnel Factors | .302 | .015 | .376 | 17.345 | .000 | .609 | 1.007 |
| | Managerial Factors | .176 | .013 | .201 | 8.098 | .000 | .342 | 1.890 |
| | Capital related factors | .287 | .017 | .305 | 11.212 | .000 | .498 | 2.576 |
| | Ergonomics factors | .177 | .019 | .189 | 5.321 | .000 | .433 | 2.410 |
| a. Dependent Variable: Operational Productivity | | | | | | | | |

The ANOVA Table is used to assess the overall significance of the regression model. In Table, the F-value (701.321) and the p-value is 0.000. This meant that model is significant as p-values less than 0.05 at $\alpha = 0.05$ level. It further said that explored six variables significantly contribute in the variation of the Operational Productivity.

Further Table provides the coefficient of the model. According to the table it can be said that all explored factors is significantly influence on the Operational Productivity. All factors are statistically significant as the p value of all the factors are less than 0.05. Among all the factors Personnel Factors, Capital related factors and Quality factors are mainly contributors which influence mostly in the Operational

Productivity. Other factors are also statistically significant but the intensity of the influence is low compare to other factors.

8. Conclusion

Analysis of the factors indicated that quality, human resource issues, management and technology related issues had a strong effect on operational productivity. On the other hand, capital and ergonomics/safety had a small to very small effect on operational productivity. Correlation analysis indicated that four of the six independent variables (quality, technology, management and human resource issues) had strong correlations with operational productivity. Multiple linear regressions clearly indicated a link between safety as a business objective and increased levels of production, quality, and cost efficiency.

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