An Assessment of Performance Drivers Used in the Manufacturing Sector

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Abstract

This research study sought to evaluate performance drivers and measures used in the manufacturing industry, establish effectiveness of various measurement approaches and indicators used, and the relationship between approaches to performance drivers and organizational performance. The research study adopted an interpretive research stance; supplemented by a mixed research approach. A case study focusing on the Boeing Company was analyzed, data was collected using secondary sources, and content analyzed. The findings indicate that the key performance drivers include order to delivery speed, innovation, process automation, brand reputation, and customer acquisition. Various financial and non-financial performance measures include operating cash flow, net earnings, operating margins, revenues, earnings per share, production rate, order backlog, airplane deliveries, carbon emission reductions, water intake, energy use, hazardous waste discharge, employee giving back to the community, new product development, customer churn, new total orders, net orders, and orders cancelled. The study concluded that the ability to integrate the non-financial measures with the financial ones provides a balanced picture to the organization. Performance measurement is purposeful in establishing areas of weakness, which provide the basis for improvement, accountability purposes, evaluation and control, and benchmarking against competitors. No evidence indicating the use of performance measurement for purposes of employee motivation and reward, accomplishment of budgeting activities, and proper resource allocation. Although the performance measures and indicators used are broadly effective, key weaknesses exist.

Keywords: Performance drivers; Measures; Organization; Evaluation; Financial; Manufacturing

JEL Classification – M00 General, C02 Mathematical Methods, L1 Market Structure, Firm Strategy, and Market Performance, L2 Firm Objectives, Organization and Behavior

1. Introduction

A. Research Background

The central goal of organizations is to remain relevant in the long term by maintaining a continuous production of essential outputs. Usually, in the manufacturing sector it is mandatory that firms retain their target market and adhere to their uniqueness if they are to survive in the long run (Hansen, 2001). Therefore, performance drivers need to be put in place to realize objectives of firms in the manufacturing sector. In the contemporary world, ancient ways of sustaining production and performance are no longer useful. On this note, Brigham and Houston (2009) elucidate that the manufacturing sector has been sparked by climate change, globalization, new technologies, economic recessions, as well as political instability. For this reason, Bureau of Labour Statistics (BLS) (2014) explicates that firms in the manufacturing sector have been rocked by quick adaptations to remain lucrative and relevant. All in all, strategies have remained the most sought and essential part of business process (Gibson, 2010).

Manufacturing relies on three fundamental pillars that include the factors, costs and standards. The factors in the manufacturing process are the means that are used to carry out the manufacturing and refer to the common factors of production, namely, capital, labor, land, resources, market and infrastructure (Mehrabi, Ulsoy and Koren, 2000). On the other hand, the standards are the levels at which the factors of production are used effectively in terms of the operational and regulatory framework. The use of the factors of production under particular standards comes at a cost; and viewed as a comparative framework, these three must be made operational optimally in order to guarantee the desired performance by the firm.

Each business including manufacturing firms that deals in production needs to be monitored closely and carefully managed in order to ensure that the investment and growth plans are attained at the right manner and the time (Wangwe et al, 2014).
In most instances, business managers feel far much unattached or remote from the operations and growth of the business. This results from the absence of performance assessment systems that can be used to keep track of the operations of the business. The performance assessment indicators are usually used in the provision of important information of the current happenings within an entity, provision of the point within which to begin setting the targets and how to implement the strategies for growth within the organization. In present day manufacturing organizations, having the requisite performance assessment tools have been shown to have benefits to the entire operations of the business as they enable it to evaluate its operations while to the same time to set targets for future operations. Therefore, manufacturing entities that have put in place the performance assessment indicators have done so based on the realization that it is meant to increase their profitability and competitive advantage.

In the assessment of the performance of the manufacturing firms, they have to decide what they should measure, the measurement of the financial performance as well as the measurement of the performance of its customers as well as human resources served by it. In addition, in a competitive environment that manufacturing firms operate in, they are often called upon to measure their activities against other businesses dealing in almost the same trade, referred to as benchmarking. In order to achieve all these, these manufacturing firms have to ensure that they have and set useful and viable targets for their businesses.

Performance drivers play an indispensable role in formulating strategies and in the developmental process of a business. Usually, performance drivers are enshrined for economic uncertainty. It is essential to ensure that businesses maintain the effectiveness as well as the efficiency in satisfying needs of their target market. A lot of dynamism characterizes the manufacturing sector. For example, manufacturing firms should be ready to maintain high standards of operational efficiency in their operations; especially during their business processes. Identification and monitoring of important performance drivers is fundamental. Scholar experts assert that performance drivers are factors that have a huge significance in the performance of business operations. The argument is supported by the observation that performance drivers should be measurable, depict progress and performance of the organization, and comparable to a standard such a budget, or industry average. Many businesses use sales revenue to monitor their progression. However, it is important to note that sales alone cannot be used as an actual driver. The goal of this research paper, therefore, is to evaluate performance drivers and measures used in the manufacturing industry, establish effectiveness of various measurement approaches and indicators used, and the relationship between approaches to performance drivers and organizational performance.

**B. Research Rationale**

In order to meet the set objectives and goals, a newly incorporated business need to be monitored closely and managed thoroughly. On the other hand, newly incorporated business needs to institute performance drivers in order to survive aggressive competition in the manufacturing industry. In the invention of new technology, firms in the manufacturing sector are being built on foundations, which trigger fierce competition on the innovation front. During this stage, consideration of performance drivers is essential. Therefore, it becomes paramount for managers to know which performance drivers are suitable for their businesses. Usually, performance drivers can be used as instruments of optimizing operational performance or efficiency as well as appraisal indicators. Therefore, the necessity of comprehending the role of performance drivers in determining the realization of organizational objectives, increasing competitive advantage, as well as in enhancing the market share of firms in the manufacturing sector was the rationale for this study.

**C. Significance of the Research**

This research was significant because it sought to enhance a deeper understanding of performance drivers in measuring the improvement of firms in the manufacturing sector. This research will therefore, be useful to managers of firms in the manufacturing sector in understanding the advantages as well as drawbacks of not utilizing performance drivers in the development of their business operations. It is essential to assess the performance drivers in the manufacturing sector because the area is dynamic, experiences rapid advancement in technology, and both shareholders and stakeholders need to understand the role of performance drivers. The understanding will ensure organizations do not lag behind in economic development and competing favorably in the market.

**D. Scope of the Research**

The scope of this research study was on performance drivers in the manufacturing sector. It also established and evaluated specific performance drivers and measures, measured indicators, and the linkages between performance drivers and organizational performance. For example, performance drivers determine different approaches used by an organization in overcoming competition and developing in terms of technology. The research reviewed the available literature to understand the wide knowledge available in this area, emphasized the use of a case study to provide a clear understanding on the performance of these drivers, and compared the findings to the earlier studies.
to make reliable and valid conclusions. The analysis and interpretation was restricted to the findings of the case study, and only compared to the literature reviewed. The selected scope of the research was expected to evaluate performance drivers and measures in manufacturing industry, establish their effectiveness and measured indicators, and the relationship between performance drivers and organizational performance.

E. Research Aim and Objectives

The aim of this research paper was to evaluate performance drivers and measures used in the manufacturing industry, establish effectiveness of various measurement approaches and indicators used, and the relationship between approaches to performance drivers and organizational performance.

The objectives of this research study were:

- To establish the correlation between approaches of performance drivers and performance of the organization.
- To assess the effectiveness of the various performance measurement drivers used by firms in the manufacturing sector.

2. Literature Review

In the manufacturing sector, there may be different parameters that can be assessed in order to find out the performance of the firm. These can be classified under the efficiency measures, the operational measures and the financial measures. The efficiency measures is expressed in terms of the economist’s production efficiency that refers to the productive efficiency that requires the operation at the least costs and the allocation efficiency, which requires operations that secures the good it desires. According to Inman et al (2011), the operational measures of firm includes the physical and financial measures that can be used to benchmark the growth of the firms. The financial operating measures relate to the costs that the firm incurs in issues such as research and development as well as training that have a bearing on the overall performance of the firm. In addition to this, financial ratios such as liquidity ratios, profitability or efficiency ratios and market ratios may be used in order to assess the performance of the business entity. Arguably, the performance measures aforementioned can be used in the assessment of the performance of the business entities, and these can be emphasized according to the different models used for assessing the growth and performance of manufacturing firms.

In another research, Lopez (2003) has made a discussion of the drivers of the performance of manufacturing firms and found out that such organizations are driven by the company reputation, product reputation, human capital and organizational structure to business performance. In the analysis of the reputation of the company as a driver of its performance, Lopez (2003) hypothesized that the better the assessment attached to the reputation of the company, the higher the organizational performance. However, he argued that this would only be possible if studies are directed at analyzing the opinion of users on the quality of products that it deals in. Further, Lopez (2003) hypothesized that the human capital consists of three items, namely; focus on training, adaptability of the employees and the social-collaborative skills exercised by the employees and these are key drivers of the firm. In addition, product reputation will be a driver of the firm if it is assigned a better reputation by the managers. Finally, Lopez (2003) also argues that a better assessment of the organizational culture of affirm becomes a significant driver of its operations.

Similarly, Nair and Prajogo (2009) carried out a study that analyzed the antecedent role of functionalist and institutional drivers and performance implications in firms and found out that there is a correlation between the motivation to attain ISO 9000 certification and internalization of practices underlying ISO 9000 standards. In this study, the researchers linked the motivation with the internalization of ISO 9000 standards through the use of a path model to show how these affect the performance of the entity. Nair and Prajogo (2009) therefore found out that the internalization of the ISO 9000 standards leads to enhancement in the operational performance that in turn also has a positive effect on the business performance of the entity. Further, Nair and Prajogo (2009) also split the samples between the low and high performing entities and found out that the internalization of the functionalist and institutionalist motives are more pronounced in the low performing firms, while in the high performing firms, only the functionalist drivers, influence the internalization of ISO 9000 standards.

On the other hand, Barnes et al (2015) carried out a study to find out the interpersonal factors that act as the drivers of quality and performance through a comparison between the Western and Hong Kong inter-organizational business relationships. This focused on the relationship between Chinese importing companies based in Hong Kong and their relationships with the Western export manufacturers. In this study, Barnes et al (2015) emphasized the impact of cultivating interpersonal factors so as to increase the performance of the company with regards to its financial positioning. These were found to be dependent on the trust and relationship quality amongst the Hong Kong business entities and the Western businesses. In arriving at these conclusions, Barnes et al (2015) used structural equation modeling that found out that, firstly, interpersonal relational dimensions; personal communication (sijiao,), personal crediblity (xinyongj, and personal affection (fganqingj) have a positively impact on the trust between the firms. Secondly, they found that trust is instrumental in improving the components
that encourage the quality of relationship between firms that include; cooperation, commitment, and satisfaction. Thirdly, Barnes et al (2015) found out that the relationship quality between the firms have a positive correlation to the financial performance of the firm. It was also confirmed that most of the associations between each of the interpersonal factors and the trust between the firms were influenced by the size of the Hong Kong importer and the origin of the foreign supplier as well as the length of the relationship and the party that commenced it.

Another study by Lerner, Schoar and Wang (2008) analyzed the drivers of university endowment success and found out that these endowments have had a significant growth of 7.4 percent per year and a median return of 6.9 per cent. In addition, the study found out that the top 20 endowments increased by more than 9 per cent between the periods 1992 to 2005. A major driver of this growth was found to be the investment performance. This shows that the performance has a positive correlation with the size of the endowment, the quality of the students within the institution and the appropriate use of alternative investments.

Kaur and Sharma (2014) evaluated the relationship and the influence of the Critical Success Factors of TQM on the performance of businesses by focusing on the evidence from SMEs of manufacturing sector. This research was based on the recognition that Total Quality Management (TQM) is a key indicator of enhancing business performance, improving the customer satisfaction, and attaining quality and competitive advantage, mostly in the manufacturing sector. In this study, Kaur and Sharma (2014) showed that there is a positive correlation between the elements that make up the TQM and the performance of the business, hence underscoring the significance of their model. This can be represented in the model showed in the figure below:
Liao, Rice and Martin (2011) examined the role of the market in transforming training and knowledge to superior performance by analyzing the Australian manufacturing sector. Having appreciated that the training and development of the employees can increase their capabilities and knowledge, they developed and tested a model that tests the training and the organizational performance. The results indicated that there was no direct correlation between the training and the performance. However, Liao, Rice and Martin (2011) found out that there is a significant and positive relationship between training and the performance of the employees when there is input in terms of engagement with the market.

In an earlier study, Katou and Budhwar (2006) carried out a study that analyzed the human resource management systems and organizational performance as a test of a mediating model in the Greek manufacturing context. In this study, a mediation model was tested in order to examine the correlation between the human resource management and the performance of the organization. The findings by Katou and Budhwar (2006) confirmed the assertion that the relationship between the human resource management systems of resourcing development and reward-relations and the performance of the organization can be mediated through the HRM results of the attitudes and skills. Therefore, this study supported the position that the human resource management systems enhance the performance of the organization including its mechanisms. The mediating model as proposed by Katou and Budhwar (2006) can therefore be presented as shown in the figure below:
have their disadvantages and may not be a driver of the processes of the business. This is because they may not reduce the health system costs or improve the quality of the systems. Additional findings by these researchers indicated that the punishment of participants for poor performance may lower their productivity especially when involvement is required. Therefore, the suggestion was that the optimal P4P systems must reward the participants for the performance improvements while the P4P program designs that offer incentives while at the same time improving the quality and costs are important if the entity intends to be neutral and it has limited resources. These can be shown as the models below indicate:

![Figure 6: P4P Systems That Are Budget Neutral but Not Optimal (Rosenau, Lal and Lako, 2012)](image)

The study by Franklin and Diallo (2012) on ‘Valuing Real Options for Network Investment Decisions and Cost-Based Access Pricing’ came up with a model and methodology for valuing the option to defer network investment decisions as well as calculate the cost-based access prices. The model for the value option to invest in each network was modeled as a function of two stochastic variables: the flow of total variable profit from the service provided by the network element and the cost of new investment in that network element. Thereafter, they calculated the option value multiple to be applied to the investment cost component of three main network elements, conduct sensitivity analyses, and highlight key findings.

In subsequent studies, Leonard and Waldman (2007) estimated an empirical model of the sources of innovation in the U.S. manufacturing sector and came up with several indicators of product and process innovation. They found that the drivers of innovation in a firm not only includes spending on research and development but also includes capital investment, cutting-edge scientific output from academic institutions, and the growth of the science and engineering. Therefore, those charged with making policies in firms must incorporate both the short-term and long-term initiatives in the realization of innovative performance.

**Distinction between performance measures and drivers**

Different scholars perceive different notions as far as definition of performance measurement is concerned. Easterby-Smith, Thorpe and Jackson (2008) elucidate that performance...
measurement is the process through which business quantifies the efficiency and the effectiveness of their business operations. Similarly, Drury (2008) explicates that performance measures are metrics that quantify the efficiency as well as the effectiveness of business activities. On the other hand, Hallgreen (2007) asserts that performance drivers constitute tactical or critical enablers that enhance the performance or enable the achievement of long term goals. This definition of performance measurement has found tremendous acceptance within the literature of performance management. In most cases, designing of organization’s strategic goals is essential prior to designing performance measurement systems. In this case, strategic goals could entail future production levels of the firm, and results in terms of profits (Easterby-Smith, Thorpe, & Jackson, 2008). The relationship between performance drivers and performance measurement is as shown in figure 8.

As an organization continues to seek the fulfillment of strategic objectives such as increased employee success, low cost per resolution, and increased customer satisfaction, it is paramount for firms to ascertain the success of the leading indicators of these outcomes. That is, increased proficiency, increased productivity, and low average time to resolution. Fundamentally, performance drivers are integral variables, which propel the performance of the organization, while performance measures are fundamental metrics that quantify to what magnitude the performance of an organization has satisfied the anticipated outcomes, that is strategic objectives (Hallgreen, 2007).

3. TRADITIONAL APPROACHES OF PERFORMANCE MEASURES

Some of the ancient performance measures in the manufacturing sector involved financial measures and the productivity measures (Hallgreen, 2007). In regard to financial measures, manufacturing firms used financial ratios such as debt, liquidity, efficiency, investor valuation, as well as the efficiency ratios. Liquidity ratios assessed the ability of manufacturing firms to offset their day-to-day debt obligations. Profitability ratios indicate how well a company is generating profits from its assets and various resources. Debt ratios depict the extent of leverage of the organization. This helps in assessing the financial risks, which a firm can face in future. Investor valuation ratios reveal the attractiveness of an investment (Hallgree, 2007). In essence, efficiency rations examine how well a firm generates sales from its resources or assets. Table 1 contains a summary of financial ratios to enhance understanding of this concept.
Despite the immense contribution in measuring the performance of firms within the manufacturing industry, financial measures have been thoroughly criticized in the past. Easterby-Smith, Thorpe and Jackson (2008) assert that by the virtue of the fact that firms in the manufacturing industry preserve their profits for exploitation of future opportunities, financial measures cannot therefore fully quantify the profitability or the gains of manufacturing firms. In addition, financial measures have also received a lot of criticism because they are derived by simplistic accounting approaches, which were developed in the early twentieth century. For this reason, financial measures do not reflect the current handling and evaluating of financial instruments as per the requirements of the International Financial Reporting Standards. Although costing institutions have developed activity based costing (ABC) to address the shortcomings of financial measures, this cannot address all the disadvantages of the financial measures (Groppelli and Nikbakht, 2006).

### Table 1: FINANCIAL RATIOS (HALLGREEN, 2007)

<table>
<thead>
<tr>
<th>Debt ratios</th>
<th>Definition</th>
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<tr>
<td>Debt to equity ratio</td>
<td>Total liabilities/total shareholders' equity</td>
</tr>
<tr>
<td>Debt ratio</td>
<td>Total liabilities/total assets</td>
</tr>
<tr>
<td>Interest coverage ratio</td>
<td>Earnings before tax/interest expense</td>
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</table>

#### Efficiency ratios

| Fixed asset turnover | Revenues/fixed assets |
| Sales/revenue per employee | Revenue/number of employees |

#### Profitability ratios

| Profit margin | Profit/net sales |
| Return on assets | Net profit/total assets |
| Return on equity | Net profit/shareholder equity |

#### Liquidity ratios

| Current ratio | Current assets/current liabilities |
| Quick ratio | (Current assets – inventories)/current liabilities |
| Cash conversion cycle | Days inventory outstanding + days sales outstanding – days payables outstanding |

#### Investor ratios

| Price earnings ratio | Stock price per share / earnings per share |
| Dividend yield | Annual dividend per share / stock price per share |
| Dividend payout ratio | Dividends per common share / earnings per share |

4. **Traditional approaches to productivity measures**

Productivity is mainly the correlation between the input and the output of the transformation process of the manufacturing industries. The traditional measures of productivity are classified into total productivity and partial productivity. Partial productivity measures determine productivity in terms of the output and one input source (Groppelli and Nikbakht, 2006). For instance, output can be defined at the ratio between the output and capital or labour. On the other hand, total productivity determines the quantity of production in terms of output and the total sum of inputs used in the process of manufacturing. The productivity measures are highlighted comprehensively in table-2.
TABLE 2: SUMMARY OF PRODUCTIVITY MEASURES (GROPPELLI AND NIKBAKHT, 2006)

<table>
<thead>
<tr>
<th>Partial Productivity Measures</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Labour productivity</td>
<td>Output to labour ratio</td>
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<tr>
<td>Capital productivity</td>
<td>Output to capital ratio</td>
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<tr>
<td>Material productivity</td>
<td>Output to material ratio</td>
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<table>
<thead>
<tr>
<th>Total Productivity Measures</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total factor productivity</td>
<td>Ratio of net output to sum of capital and labour inputs</td>
</tr>
<tr>
<td>Total productivity</td>
<td>Ratio of total output to sum of all factor inputs</td>
</tr>
</tbody>
</table>

5. Modern Performance Measurement Systems

Performance measurement systems are useful in planning as well as managing organizations. Organisations in the contemporary world use performance measurement systems in gathering, processing, in addition to coordinating the flow of information between organizational units. European Foundation for Quality Management EFQM Business Excellence Model and the performance prism are examples of the modern performance measurement systems (Calvo-Mora, Leal, and Rolda, 2005).

A. EFQM Business Excellence Model

This model came into place because of the efforts of European Foundation for Quality Management. According to EFQM business model, the success of a business is a function of eight concepts; customer orientation, involvement and development of individuals, continuous learning, innovation, accountability to the public, development of partnerships, focus on results, and management based on fact and process (Calvo-Mora, Leal and Rolda, 2005). Five of these concepts are known as enablers and they include; leadership, resources and processes, policy and strategy. The other four concepts are known as results and they include; individuals, society, customers, and key performance results (EFQM, 2003). Figure 9 summarizes EFQM business excellence model to ease the conception of the model.

B. Performance Prism

Performance prism incorporates five concepts, namely; stakeholder satisfaction, the contribution of stakeholders, capabilities, processes, and strategies (Johanson, Martensson and Skong, 2001). These attributes of performance prism model are demonstrated in figure 12.
Figure 10: PERFORMANCE PRISM (JOHANSON, MARTENSSON AND SKONG, 2011)

Performance prism acknowledges the role played by shareholders in the success of the organization. For this reason, performance prism model sees success of the firm as the function of the contributions of its shareholders. However, prism model suffers from a number of criticisms. Performance prism suffers from inadequate logic as well as correlation between its performance drivers and results (Johanson, Martensson and Skong, 2001). In addition, performance prism model also suffers from the impracticality of some of its performance measures, and lack of a clear schedule on the implementation of some of its performance measures.

6. Performance Drivers

Manufacturing organizations are known for using various performance drivers. The perspective of cost accounting identifies structural and execution as examples of performance drivers (Gosselin, 2005). Structural performance drivers are vital elements that enhance the performance of a firm during the execution of its economic activities. Structural performance drivers include the number of organization’s plants, scale of operation, as well as firm’s degree of centralization (Gosselin, 2005). For this reason, large scale of production leads to division of labour, high levels of specialization, deployment of specialist machines, experience curve effects, as well as favourable credit terms from the financial institutions.

On the other hand execution performance drivers are used in the execution of daily obligations of the firm. Examples of executional performance drivers include employee empowerment, capacity utilization, and the layout efficiency of the organization. Execcutional performance drivers are intangible (Mowen and Guan, 2007). The success of an organization depends immensely on the intangible factors such as the attitude of the employees, motivation, innovation, as well as the brand value of the company.

7. Methodology

This section explicates the methodology used by the researcher in carrying out the research. The section constitutes of the research purpose, design, strategy, tools of data collection, and the instruments of data analysis, ethical considerations and limitations of the research study.

A. Research Purpose

This was a descriptive research study with a goal to interrelate several cause or conditions with their situations as well as events. The purpose of the research was to provide evidence supported outcomes in order to formulate theories that can be advanced further through experimental research, or investigate their applications in the real scenario. The main purpose of the research was, in this context, to evaluate performance drivers and measures used in the manufacturing industry, establish effectiveness of various measurement approaches and indicators used, and the relationship between approaches to performance drivers and organizational performance. Through literature review and a case study the research described performance drivers, established indicator measures, their effectiveness, and linked performance drivers to the organizational performance. This study selected a descriptive study because there is considerable amount of knowledge in this area that can be obtained from secondary data in form of case studies or review of literature.

B. Research Design

This research adopted the use of secondary data collected from a case study; empirical evidence from peer reviewed literature, and interpreted the findings through analysis as well as mathematical formulations to produce reliable and valid conclusions. The case scenario was an actual case of evaluating performance drivers and measures used in the manufacturing industry;
establishing effectiveness of various measurement approaches and indicators used, and the relationship between approaches to performance drivers and organizational performance. Mathematical formulations assisted in comprehending the phenomena arising from the case study. The knowledge from literature review was crucial in comparing the findings of the case study to the general and wide body of knowledge. The research design was selected because it needed less expenditure, time, miscellaneous resources, and enabled the researcher to compare actual case scenario with the wide body of empirical knowledge available in the public domain to ensure validity and reliability.

C. Research Strategy

Creswell (2003) explicates that research strategies are categorized as case study, experiment, action research, grounded theory, survey, and ethnography. In this case, this study adopted a case study as the research strategy. This entailed focusing on one organization, which is Boeing Company. Focusing on one organization (Boeing Company) helped the researcher to carry out a comprehensive and detailed investigation. Apart from being a manufacturing organization, Boeing Company is also one of the listed and the largest manufacturing companies in the world.

D. Data Collection

There are two types of data sources, namely primary and secondary data. Primary data includes data collected for the first time while secondary data includes data that has been used before. Secondary data can also be used in subsequent studies. This study used secondary data. Sources of secondary data were retrieved from Boeing’s annual reports, journals, Boeing’s official website, industry publications, internet articles, as well as trade publications.

E. Data analysis

Traditional performance measures were mainly financial. Traditional performance measures were criticized for being unbalanced, backward looking, and completely focused on short-term interests rather than the long term interests of the organization (Creswell, 2003). In assessing the performance measures used in manufacturing industry, the study adopted an analysis of performance measurement systems like balance scorecard and triple bottom-line, because these measurement systems address some of the disadvantages of traditional performance measures. The study also used financial measures such as operating cash flow, operating margins, net earnings, and earnings per share. In addition, the study used non-financial measures such as production rate, airplane deliveries, customer acquisition as well as churn, environmental performance, and organization performance.

In assessing performance measures, Drury (2008) reveals that one can benchmark such measures against targets, previous performance measures, and against other firms in the manufacturing industry. For this reason, this study sought to benchmark the performance measures used for the study against targets as well as against previous performance. This provided a template against which comparative analysis, which is based on authoritative checklists, could be done and inferences derived.

8. Ethical Considerations

The researcher obtained approval to research on the topic and permission from relevant stakeholder or shareholder authorities prior to embarking on research. Secondary data such as articles and facts on the case study available in the public domain were used because the researcher expected them to be approved as ethical before their publication for the consumption of the general public. The interpretation adhered to ethical principles because the researcher expected the findings to be used in policy drafting, decision making, and planning on programs that required accuracy as well as impact positively on human lives. Optimal accuracy of data was fundamental to eliminate errors that can mislead the consumers of information due to biases. The study was performed with integrity as pertains to the ethical code of conduct. The study obeyed copyright legislations, did not present duplicated redundant data, and avoided plagiarism, rejected sources with ethical inadequacies and publications that contravened ethics recommendations. The research study acknowledged all sources of information, appreciated contributors to successful completion of the research, and declared conflicts of interest in spite of the position of the shareholders or stakeholders in the conflict.

9. Limitations

One of the limitations included limited peer reviewed papers and books published in this area. Although there are some current relevant articles, they could not be accessed in full because they are not yet released into the public domain; therefore, the researcher was limited in
the number of secondary sources. The findings of the literature review could not be generalized easily because they were carried out in different times, regions, and manufacturing sectors in relation to the case study. The researcher afforded to maneuver the limitations, obtained substantial data, and made reliable and valid conclusions.

10. Case Study

This chapter presents the case study analyzed; assesses the performance measures and performance drivers of the named case study, which is the Boeing Company, with the intentions of fulfilling the objectives of the study. This section starts by giving brief background information about Boeing Manufacturing Company. Then, the subsequent sections of this chapter are divided according to the research findings of the research objectives of the study and interpretation of each finding; to establish the correlation between approaches of performance drivers and performance of the organization; and to assess the effectiveness of the various performance measurement drivers used by firms in the manufacturing sector.

- Boeing Manufacturing Company

Situated in Chicago, in United States, Boeing is one of the world’s biggest aerospace manufacturing firms. Boeing mainly deals with designing, manufacturing, assembling, as well as selling of military and commercial aircrafts, satellites, missile, and weapon systems. In addition, Boeing also gives aviation support services. Boeing has 174,000 employees and operations spanning across 70 countries (Bureau of Labour Statistics (BLS), 2014). Notably, Boeing Company has a market share of 43% of the global commercial aircraft. Its dominance in the global commercial aircraft market is attributable to various reasons. The main reason for the dominance is the formulation of sustainable performance drivers and enshrining of modern performance measurement systems (Hoque, Mia and Alam, 2001). Boeing Company has been able to stay competitive with the likes of European giant Airbus and Embraer.

11. Findings, Interpretation, and Analysis of the Results

This section outlines the findings from the secondary data about Boeing Company, interpret each finding, and analyze the results. It is the most indispensable section of the paper because it provides the actual case scenario. The results are compared to the findings of literature review to make reliable and valid conclusions.

A. The correlation between approaches of performance drivers and performance of the organization

This section outlines the performance drivers adopted by Boeing Drivers and their impact on Boeing’s performance.

- Performance Drivers

(i) Order to Delivery Speed

Just like other companies in the aircraft-manufacturing sector, Boeing Company uses a build-to-order basis rather than build to stock basis. With the bruises of 2008 financial crisis still hurting most of the aircraft manufacturing industries in the world, Boeing continues to experience the challenge of increasing the order to delivery speeds in order to eliminate order backlogs. The discovery of fuel-efficient aircrafts in the recent past has led to backlogs and record orders in the aircraft manufacturing industry (Boeing, 2013). Specifically, this discovery had led to the increase in orders for Boeing 737, Boeing 777, and Dreamliner. In addition, as a result of this discovery, A320 aircraft family has also increasingly received orders. These new order have resulted to order backlogs of 6,100 aircrafts for Boeing Company valued close to $410 billion dollars. Airbus specifically has an order backlog of 5, 449 planes (Bureau of Labor Statistics (BLS), 2014).

(ii) Innovation

Innovation is another performance driver that has also played an integral role in Boeing’s performance in the last two decades. There are several factors that make innovation a necessity in the aircraft manufacturing industry. The pressure to innovate is driven by the targets of the aviation industry to minimize greenhouse gas emissions by 50% by year 2050, enhance yearly fuel efficiency rates by 1.5%, and achieving the requirements of European Union on Emission Trading Scheme. A key innovation in the aircraft manufacturing industry includes the Boeing’s new Dreamliner, which has wireless avionics systems that run on a 5.5 million software code. Other innovations in the aircraft manufacturing industry include the replacement of jet fuel with fossil-based jet fuel. Boeing Company estimates the replacement to be 40% to 80% by year 2021. Incorporation of such
innovations into the operations of Boeing Company has had tremendous impact on the performance of Boeing in the last decade. Adoption of fossil based jet fuel saved Boeing Company $1.8 million in the 2010/2011 financial year (Bureau of Labor Statistics (BLS), 2014). Therefore, the ability to innovate remains a critical performance driver in the manufacturing industry.

(iii) Customer Acquisition

The future performance of manufacturing industry depends on the ability to acquire customers (Boeing, 2013). The inability to acquire customers leads to reduced backlog because it slows down the movement of orders, scales up production cost, and reduces sales of the company, thus, leading to poor performance.

(iv) Brand Reputation

Another significant performance driver in the aircraft manufacturing industry is brand reputation. Manufacturing firms’ behavior towards the environment has become critical to the way their brands are perceived, and this directly impacts on their performance. The growing dangers posed by global warming have increased the pressure to reduce the emission of greenhouse gases, and particularly carbon dioxide emissions. The pressure for aircraft manufacturers such as Boeing to reduce carbon and other greenhouse gas emissions is particularly strong, especially considering that commercial aircraft account for up to 2.5% of all carbon emissions globally (Bureau of Labour Statistics (BLS), 2014). Apart from behaving responsibly towards the environment, other issues which have the capacity to affect the brand perception and therefore performance of Boeing include its behavior towards its stakeholders, and particularly, the community in which it operates. This notion of brand reputation is supported by earlier studies (Hallgreen, 2007).

B. The effectiveness of the various performance measurements drivers used by firms in the manufacturing sector

(i) Performance Measures for Boeing

Previous sections presented an outline of the critical performance drivers which are likely to determine the performance of Boeing Company. This section presents Boeing’s performance measures.

- Production Rate

It was mentioned that a key driver of performance for Boeing involves increasing the rate at which its aircraft are manufactured with a view of reducing its order backlog and enhancing the speed at which orders are delivered to its customers (Boeing, 2013). This is achieved by means of the production rate. Boeing Company define production rate as the number of airplanes, which are produced per month.

- Order Backlog

Although the large order backlog at Boeing provides some degree of assurance that Boeing has booked orders that are likely to last it over seven years, this backlog has the potential to adversely affect Boeing’s future earnings should it fail to complete order fulfillment (Boeing, 2013). This can be measured either in terms of the number of units pending to be delivered or in terms of the monetary value of the undelivered orders. In the case of Boeing, this is measured in terms of the monetary value of the undelivered order.

- Community Involvement Measures

In a bid to enhance its brand reputation, Boeing involves itself in a number of corporate social responsibility activities (Boeing, 2013). These are measured using the amount of financial giving by its employees expressed in dollar terms, the amount of charitable grants given by the company expressed in dollar terms, and the amount of business-related donations given by the firm (Harbour, 2011).

- Innovation and Product Development Measures

Boeing also measures its performance along the innovation dimension. This is measured by at least three performance metrics which have been provided in its annual report. The first metric used by Boeing to measure innovation is the Research and Development (R&D) expense. The other is the products and services which the firm has in the development pipeline. The last metric used by Boeing to measure its performance along the innovation dimension is the number of new product introductions or modifications (Boeing, 2013).

- Customer Acquisition Measures

To measure Boeing’s performance as far as customer acquisition and retention is concerned; Boeing uses at
least four performance metrics which are also provided in its annual report. The first performance measure used by Boeing is the number of new orders per year. The second performance metric used by Boeing is the net new orders metric, which is defined as the total number of new orders less the number of cancelled orders. The final customer metric used by Boeing is the customer churn, which is defined as the number of cancelled orders per year (Boeing, 2013).

- **Financial Measures**

Boeing also uses a number of financial measures to assess its performance. From Boeing’s annual financial report, some of the key financial performance metrics used to assess its performance include the operating cash flow, net earnings, operating margins, revenues, and earnings per share (EPS) (Boeing, 2013).

Financial health of an organization such as Boeing is monitored regularly by considering revenues, expenses, taxes, and interests. For example, assuming the company records its revenue ($R$), expenditure ($E$), taxes ($T$) and depreciation and amortization ($D$), the financial health ($FH$) of an organization is calculated as:

\[
FH = R – E \text{ (Excluding T, I, and D)}
\]

The financial health margin = \(FH/ R\)

\[
= R – E \text{ (Excluding T, I, and D) } / R
\]

However, it is also important to understand the operating income of the company which considers the total expenses, cost of goods, labor, tax, and miscellaneous expenditure.

Operating cost = revenue – total expenses

\[
OC = R – TE
\]

In order to measure the performance of an investment, it is indispensible to evaluate its efficiency. The best financial measure of investment performance in the case of the Boeing Company can be the return of investment that is calculated by considering gains from the investment versus the cost of investment.

Return of Investment = (Gain from Investment – Cost of Investment) / cost of Investment

\[
ROI = (GFI – COI) \div COI
\]

(ii) **Boeing’s Performance among the Performance Metrics**

Based on Boeing’s annual report, the firm’s performance along the performance drivers and measures can be presented. Boeing’s annual report shows that one of Boeing’s key strategic goals is to drive higher performance through enhancing efficiency (Boeing, 2013). In this regard, the firm’s key performance drivers include its production rate, order backlogs, and airplane deliveries. The measures for these drivers are presented in table 3 together with how Boeing performed in its most recent financial year, up to year 2012.

**TABLE 3: BOEING’S PRODUCTIVITY PERFORMANCE (BOEING, 2013)**

<table>
<thead>
<tr>
<th>Goal</th>
<th>Performance drivers</th>
<th>Performance measures</th>
<th>Performance (2012)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive higher performance through enhancing efficiency (lean and process improvement)</td>
<td>Production rate</td>
<td>Airplanes per month</td>
<td>38 (for the 737s, up from 31.5), 2 (for the 747-8, up from 1.5), 8.3 for the 777 (up from 7), and 5 (for the 787, up from 2.5).</td>
</tr>
<tr>
<td>Order backlogs</td>
<td>Value of undelivered orders</td>
<td>$390.2 billion (up from $355.4 billion in 2011)</td>
<td></td>
</tr>
<tr>
<td>Airplane deliveries</td>
<td>Number of airplanes delivered per annum</td>
<td>601 deliveries</td>
<td></td>
</tr>
</tbody>
</table>

As shown in table 13, the production rate for the various types of commercial airplanes manufactured by Boeing increased in 2012 up from the previous year. In spite of
the production rate accelerating, it is shown that Boeing’s order backlog continued to grow, suggesting that the increase in the firm’s production rate was not fast enough to catch up with the firm’s customer acquisition. This implies that the firm needs to step up its production rate further. As shown in figure 13, the data from Boeing’s annual report shows that Boeing was only able to deliver 601 aircraft for the whole of 2012, but provides no comparative statistics (Boeing, 2013).

Boeing also aspires to improve its brand reputation and standing in the communities in which it operates by behaving responsibly towards both the environment as well as through giving back to the society. This goal, together with the accompanying measures and performance are presented in table 4.

<table>
<thead>
<tr>
<th>Goal</th>
<th>Performance Drivers</th>
<th>Performance Measures</th>
<th>Performance (2012)</th>
<th>developme nt</th>
</tr>
</thead>
<tbody>
<tr>
<td>To enhance Boeing’s reputation and performance by behaving ethically and responsibly towards the environment and community</td>
<td>Community involvement</td>
<td>Employee financial giving</td>
<td>$42 million</td>
<td>Boeing 777, and Next-Generation 737-700, -800 and -900ER models.</td>
</tr>
<tr>
<td>Environmetal footprint reduction (with 2007 as the base year)</td>
<td>Charitable grants</td>
<td>$66 million</td>
<td>Products and services in the pipeline</td>
<td>Boeing 787-9, Boeing 787-10X, and Boeing 787-9</td>
</tr>
<tr>
<td>Business-related donations</td>
<td>$71 million</td>
<td>R&amp;D Expense</td>
<td>$3.3 bn., down from $3.9 bn. in 2011.</td>
<td></td>
</tr>
</tbody>
</table>

As revealed in the table 4, in 2012, Boeing engaged in corporate social activities through employee financial giving, charitable rants, and business-related donations, all valued at $179 million in total. Its carbon emissions reduced by 26% from its base year, while its energy use, hazardous waste, and water intake declined by 21%, 33%, and 20% from the base year (Carson, 2009). Overall, the measures show good performance by the firm with regards to its environmental performance, but provide no comparative metrics against which its community involvement can be assessed (Boeing, 2013).

As far as product innovation is concerned, Boeing had a number of new product introductions, including: the Boeing 737 MAX, Boeing 777, and Next-Generation 737-700, -800 and -900ER models. It also had new products in the development pipeline. These new products suggest responsiveness towards the innovation drivers cited as being critical levers for the firm’s growth, but the decline in Boeing’s R&D indicates reducing innovation which contradicts the performance drivers for innovation (Boeing, 2013).
TABLE 5: BOEING’S CUSTOMER PERFORMANCE

<table>
<thead>
<tr>
<th>Performance Drivers</th>
<th>Performance Measures</th>
<th>Performance (2012)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer acquisition</td>
<td>Number of new orders</td>
<td>1,339 new orders</td>
</tr>
<tr>
<td></td>
<td>Net new orders</td>
<td>1203</td>
</tr>
<tr>
<td>Customer churn</td>
<td>Number of cancelled orders</td>
<td>136 orders</td>
</tr>
</tbody>
</table>

The number of new orders significantly exceeded customer churn, resulting in an overall growth in net customer acquisition. However, the firm’s annual report shows no comparative data against which benchmarking can be done. The Boeing’s customer acquisition performance is shown in Table 5.

Finally, the case study also found the financial measures along performance of the firm as shown in Figure 16. Boeing’s operating cash flow increased by $3.5 billion between 2011 and 2012, suggesting that Boeing’s ability to generate adequate positive cash flows to finance its operations without the need for relying on external sources of finance had improved. Its net earnings and profitability, however, reduced by $0.1 billion, although its revenues were up by approximately $13 billion. The corresponding decline in net income against a background of increasing revenues suggests a steeper increase in costs, an area which the firm’s management should look into. The higher revenues may be attributable to the high customer bookings made for the firm’s aircraft.

TABLE 6: PERFORMANCE MEASURES IN TERMS OF FINANCE

<table>
<thead>
<tr>
<th>Performance Measures</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating cash flow</td>
<td>$7.5 billion (up from $4.0 bn.)</td>
</tr>
<tr>
<td>Net earnings</td>
<td>$3.9 billion, down from 4.0 bn.</td>
</tr>
<tr>
<td>Operating margins</td>
<td>9.6%</td>
</tr>
<tr>
<td>Revenues</td>
<td>$81.6 bn., up from $68.7 bn.</td>
</tr>
<tr>
<td>Earnings per share</td>
<td>5.11, down from 5.33</td>
</tr>
</tbody>
</table>

When performance is measured in terms of profitability ratio, further information about production cost is accrued. Assuming a company has gross profit (GP) and net sales (NS), the gross profit margin (GPM) is the product of quotient and 100.

\[ GPM = \frac{GP}{NS} \times 100 \]

Operating margin (OM) considers production cost and indirect product or services and is calculated getting the product of the quotient, of operating profit (OP) and net sales (NS) and 100.

\[ OM = \frac{OP}{NS} \times 100 \]

Return of assets (ROA) of a company such as Boeing is a measure of effectiveness of a company to generate income from assets. It is calculated by getting the product of 100 and the quotient of net income (NI) and the current value of assets in a company (A).

\[ ROA = \frac{NI}{A} \times 100 \]

However, it is cumbersome to turn assets into finance, and liquidity ratios must be used to make decisions and improve performance. The financial strength of a company is measured by current ratio which is a quotient of total current assets versus total current liabilities

\[ \text{Current Ratio} = \frac{\text{Total current Assets}}{\text{Total current Liabilities}} \]
For the year 2012, Boeing’s can be determined using the current ratio formula as follows, based on data obtained from the company’s financial statement:

\[ \text{Current Ratio} = \frac{TCA}{TCL} \]

\[ TCA = $67,785 \]
\[ TCL = $56,717 \]
\[ CR = \frac{$67,785}{$56,717} \]
\[ CR = 1.20 \]

Another liquidity ratio that can be used to test the market before investing is the quick ratio (QR). It is calculated by considering cash available (C), government securities (GS), receivables (R), and total current liabilities (TCL).

\[ QR = \frac{(C + GS + R)}{TCL} \]

Lastly profitability ratio can be expressed as return of equity (ROE) that measures the amount of profit the company is generating for every dollar invested. It is calculated by getting the product of 100 and quotient of net income (NI) and the total shareholder investment amount (SI).

\[ \text{ROE} = \frac{NI}{SI} \times 100 \]

For instance, from the firm’s annual reports, the ROE for Boeing in 2014 can be estimated, using the above formula, as follows:

\[ \text{ROE} = \frac{\text{Net Income}}{\text{Shareholders’ equity}} \times 100 \]
\[ \text{ROE} = \frac{NI}{SI} \times 100 \]
\[ NI = $5,446 \text{ bn} \]
\[ SI = $8,665 \text{ bn} \]
\[ \text{ROE} = \frac{($5,446 \text{ bn})}{($8,665 \text{ bn})} \times 100 \]
\[ \text{ROE} = 62.85\% \]

12. Discussion and Conclusion

This section presents a discussion on the study, compares the outcome with the earlier studies to make valid and reliable conclusion, and to propose necessary informed changes. The section is important because it will allow the researcher to propose models for adopting the changes required in order to improve the performance of Boeing Company. A conclusion of the study will also appear in this chapter.

The aim of this research study was to evaluate performance drivers and measures used in the manufacturing industry, establish effectiveness of various measurement approaches and indicators used, and the relationship between approaches to performance drivers and organizational performance. The objectives of the study were a guide towards achieving the aim. The objectives of this research study were to establish the correlation between approaches of performance drivers and performance of the organization, and to assess the effectiveness of the various performance measurement drivers used by firms in the manufacturing sector, in the context of Boeing Company.

The findings showed that there is a close correlation between approaches of performance drivers and performance of the organization. Various performance measurement drivers, both financial and non-financial, were established to be effective in improving the performance of firms in the manufacturing sector. It was established that the main reason for the dominance of Boeing Company in the manufacturing sector is the formulation of sustainable performance drivers and enshrining of modern performance measurement systems. However, the research found that the Boeing Company has under-utilized the large human labor, of at least 174000 employees, as a driver to performance. Employees are a latent factor of performance which, with appropriate strategies, can improve return of investment. A change in this sector was recommended by the researcher in order to ensure the Boeing Company optimizes its return of investment.

The evidence accrued from the case study agrees largely with the findings of the literature reviewed. Boeing Company uses various performance drivers in the perspective of cost, structural, and execution as demonstrated in a study by Gosselin (2005). However, the company puts minimal emphasis on the execution
Drivers such as employee empowerment, capacity utilization, and efficiency in layout (Mowen and Guan, 2007). Boeng Company uses its performance measures to innovate changes ensuring effectiveness of the business operation. This agrees with assertions in the earlier studies claiming that performance measurement is the process through which business quantifies the efficiency and the effectiveness of their business operations (Easterby-Smith, Thorpe and Jackson, 2008; and Drury; 2008). Financial ratios have been a significant measure of Boeing’s performance. This agrees with earlier studies where it was pointed out that firms in the manufacturing industry preserve their profits for exploitation of future opportunities, financial measures cannot therefore fully quantify the profitability or the gains of manufacturing firms (Thorpe and Jackson, 2008). It is therefore evident that the findings of this research study correlate well with earlier studies except that the Boeing Company put less emphasis on execution drivers as opposed to the suggestions in earlier studies.

Having laid the foundation for the fact that manufacturing performance is important in guaranteeing the success of many manufacturing firms as it enhances their competitiveness, it is important to have a discussion on how the models of assessing performance can be interpreted. The interpretation of the above data is dependent on the model adopted by the manufacturing firms evaluated or concerned. In understanding these, it is first important to develop the performance assessment test by having a consideration of the performance activity to be evaluated. Thereafter, a scoring criteria s developed for measuring the efficacy and viability of the performance assessment model that the manufacturing firms intend to put in place in order to operate optimally and have a competitive advantage.

For instance, in the interpretation of the Performance Measurement System for Apparel Sector Lean Manufacturing Organizations in Sri Lanka (Perera and Perera, 2013), one has to understand that the overall manufacturing practice is dependent on factors such as the manufacturing costs, capabilities, best practices, employee satisfaction and external resource development. These can be operationalized together in order to assess the performance of the entity by eliminating zero-value activities, continuous improvement and having multifunctional teams within the firm. It can also enhance the delivery of products, integrating suppliers within the manufacturing system, enhancing flexible information system, safety and boosting morale of the human resources within the firm.

The model proposed above for the assessment of performance of manufacturing firms may therefore be recommended as it ensures that the processes within the firm are lean so that therefore is easier execution of the lean tools. Therefore, in the implementation of the manufacturing requirements the players in the assessment of the organization need to incorporate all the factors, standards and costs that are required to make the model viable.

The upshot of the aforementioned discussed literature review is that the assessment of the performance of manufacturing firms is that it involves the analysis of different parameters that make the firm successful. This includes models that incorporate the inputs in terms of resources and processes, and the expected returns before, during and after these have been initiated and implemented. It is only through this that the manufacturing firms can determine whether they have experienced growth, are profitable or have attained a competitive advantage over its competitors in the same line of trade.

13. Recommended Change

The Boeing and other manufacturing companies should increase investment allocation in improving drivers of new technology development. The Boeing Company is one of the best companies in the manufacturing sector to embrace adoption of new technology in order to improve performance. Drivers promoting the development of new technology are development spending, business research, capital investment, scientific output, engineering workforce, and growth of science. However, the Boeing Company has not put emphasis on the drivers of developing new technology and instead waits to adopt new technology and considers it as one performance drivers.
Indicators of functional new technology include improved lags, size of input versus output, and benefits. The researcher recommended a model of new technology drivers, new technology, and indicators of outcome, which can improve the performance in manufacturing sector. Manufacturing companies should increase their resource allocations to developing drivers of new technology.

**FIG 17: THE DECLINE IN BOEING’S R&D EXPENDITURE**

- **Drivers:** development expenditure, investment research, capital investment, scientific output, expert workforce, and science advancement
- **New Technology**
- **Outcome Indicators:** lags, realizing input, and benefits

**FIG 18: A MODEL OF NEW TECHNOLOGY DRIVERS AND OUTCOME INDICATOR**

The second recommendation is that Boeing and other manufacturing companies need to put emphasis on employee development in knowledge as a driver of performance. The market is dynamic and an informed workforce can work through the dynamic market to improve performance.

The Boeing Company has not exploited the potential of employees in transforming their knowledge and training into superior performance. Effective commercialization of knowledge capabilities is indispensable in transforming breadth and values of employees’ knowledge into performance, and drive improved competitive performance. The model below demonstrates the relationship between employee capabilities and superior company performance through market dynamics.

**FIG 19: A MODEL OF EMPLOYEE KNOWLEDGE, MARKET DYNAMICS AND COMPANY PERFORMANCE**
The model demonstrates two main paths to company performance with confounding factors.

The performance of a firm depends on several factors, employee knowledge (EK), market dynamics (MD), and company performance (CP), and each variable has a path towards the improved performance of a company.

Path 1; MD → CP

Path 2; EK → MD

Employee’s knowledge cannot influence company growth directly, but through market dynamics. The Boeing Company can use this model to exploit the latent factors in improving or driving the performance of the investment. Company performance (CP) is dependent on sales growth (SG) and expected sales growth (ESG).

\[ CP = K \times (SG \text{ and } ESG) \]

where K is a constant of performance.

\[ SG = \frac{(Sales_t - Sales_{t-1})}{Sales_{t-1}} \]

It is important to note that performance depends on all the inputs including investment on new technology drivers for resource development. In assessing the economic growth (Y) of an investment, Cobb-Douglas function is fundamental in estimations.

\[ Y = A^N X^B_i; \] where \( i = 1 \)

The parameters estimated are constant elasticities. The input (Xi) encompasses capital and labour which can benefit from augmentation. The parameter (bi) represents the way investment inputs operate together to provide output. It is expected that the inputs produce returns to a scale. Increasing the percentage of inputs is likely to increase the returns by a constant percentage. The following expression relates inputs to returns when differentiated over time.

\[ \frac{dY}{dt} = b_1 \frac{dx_1}{dt} + b_2 \frac{dx_2}{dt} + b_3 \frac{dx_3}{dt} \]

The Boeing Company can analyse the new technology demands of clients to be consumer oriented. The total cost driver volume assessed in the case study can be measured over time to provide consumer demands for new technology as in the following equations.

\[ dx = \alpha x dt + \sigma x dz \]

The price is calculated from time to time because the total cost of production changes with time. Changes in cost of production are attributed to new technology or the acquisition of recent efficient technology. In the case of Boeing Company, new technology that is environment friendly was adapted at a cost, however, the strategy derived performance because most consumers opted for the new technology.

If the unit of production (NEi) is the difference between price and variable cost, the price (P) changes exponentially over time.

\[ P_t = p_0 e^{\alpha_pt}; \]

\[ \frac{dp}{dt} = \alpha p \]

Therefore, the total variable profit accrued (II) from production unit is calculated by the following equation.

\[ II_t = P_t X_t \]

The volatility of total variable profit (\( \sigma II \)) accrued and volatility parameters (\( \sigma II \)) are calculated by the following equation.

\[ dII = \alpha II dt + \sigma II dz_{II}; \] where
The Boeing Company must constantly invest and adopt new technology because with competition, improvements, and dynamics in the market some of its assets can reach the end of economic life. The company must adopt the capital asset pricing mathematical model provided below to calculate fundamental equilibrium condition of the investment.

\[ \alpha II = \alpha x + \alpha p \]
\[ \sum \sigma II = \sigma x \]

The ability to clear this backlog, for example by raising production rates, is important to Boeing’s improved production. Process automation is likely to lead to improved quality, reduced occupational incidents at the workplace, improved productivity, and reduced costs. The ability to identify performance drivers which are causally linked to performance is central to the improvement of outcomes in any manufacturing organisation. However, the case study provides no evidence that the drivers were identified through either statistical analyses or benchmarking, and this can be reflected in the fact that certain strategic objectives, for example leveraging on Boeing’s global reach, have not been cascaded down into drivers and measures.

The study evaluated the effectiveness of different performance measurement indicators used in the manufacturing industry. The key performance measurement indicators, which were found to dominate in the case of Boeing, included the operating cash flow, net earnings, operating margins, revenues, earnings per share, customer acquisition, customer churn, employee financial giving, charitable grants, business-related donations, CO₂ emission reductions, energy use reduction, hazardous waste reduction water intake reduction, new product introductions or modifications, products and services in the pipeline, and R&D expense. The study concluded that the ability to integrate the non-financial measures with the financial ones provides a balanced picture to the organization. The study also recommended Boeing Company to improve employee knowledge as this will work through market dynamics to increase performance, and to increase investment allocation in improving new technology development drivers. Future research is important in this field to improve performance drivers in the manufacturing industry.

14. Conclusion

In this section, a concise summary of the key findings of the research project are presented. The first objective of the study was to link the performance drivers to the firm’s performance. The key performance drivers for Boeing include innovation, brand reputation, order to delivery speeds, and customer acquisition. It has been demonstrated that the key contributor to the huge revenue growth at the firm has been Boeing’s customer acquisition, which has also led to huge order backlogs.

Assessment of performance drivers of Boeing Company has shown that a balanced equilibrium of investment assets, resources, and consumer satisfaction are crucial in optimizing investment return. The main aim of a company is to make profits from investments. Rate of return for an investment can be calculated as follows:

\[ A = P (1 + i)^n \]  
\[ \text{Value (A) is the accumulated value after (n) years when (P) amount of money is invested from zero time with interest rate of (i) per year. In calculating the present value (P), of A amount of money over (n) years at (i) interest rate per annum where P< A is calculated as;} \]
\[ A = P (1 + i)^{-n} \]

Therefore, the Boeing Company has to optimize the efficiency of employees and support drivers of new technology development to maximize the investment return because increasing input increases output by a constant percentage.

15. References


Author Profile –

Mr. Irfan Sayyed earned his Bachelors of Commerce at Ness Wadia College of Commerce, Pune in 2015. Currently he is pursuing his diploma in Banking and Finance from Ness Wadia College of Commerce and is the Head Teaching Assistant; conducting courses in Advanced Accounting and Financial Modeling.