THE STATUS OF STRUCTURAL AND INFRASTRUCTURAL DECISIONS OF OPERATIONS STRATEGY IN A NICHE STEEL PRODUCING FIRM AND THEIR EFFECT ON FIRM PERFORMANCE - A CASE STUDY

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DECLARATION

I, **BADNOCK MANDA**, declare that this research report is my own work. It is submitted in partial fulfilment of the requirements for the degree of Master of Science in Engineering at the University of the Witwatersrand, Johannesburg.

It has not been submitted before for any degree or examination in any other University. I further declare that I obtained the necessary authorisation and consent to carry out this study

BADNOCK MANDA

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Signature Date

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ABSTRACT

This study was commissioned to study the status of the structural and infrastructural practices that affect operations strategies and to investigate the effect of these decisions on firm operational performance. The study was in an operational environment in a niche steel making industry in the South African context. Operations strategy is conceptualised as a set of decisions or practices with regard to structure and infrastructure variables. These strategic decisions influence a firm's abilities to successfully to attain competitive priorities such as cost, quality, delivery and flexibility.

The research was quantitative. Primary data on competitive priorities, decision areas and manufacturing strategies was collected through a questionnaire from a sample of 86 managers while secondary data on organisational performance was collected from the financial data on the public domain and customer feedback surveys. The response rate was 66%.

The study found high levels of strategy awareness, strategy formality and a dominant top-down approach to strategy formulation. A trade-off between flexibility, costs, quality and delivery existed. The niche producer is pursuing a flexibility priority while sacrificing the other objectives. On one hand, the results did not support the 'sandcone' theory.

The existence of strong relationships between priorities [flexibility, cost and delivery] with structural decision [plant production capacity] was evident as well as that of flexibility and cost with facilities outstanding. The manufacturing strategy could not be clearly delineated: the niche producer is pursuing a mixed approach with elements from several manufacturing strategies.

The financial performance of the organisation was poor over the five year period of study. Despite the strategy efforts, the manufacturing strategy is not attaining the desired organisational performance. Therefore, the company is urged to re-consider its manufacturing strategy approach.

Table of Contents

LIST OF FIGURES

LIST OF TABLES

LIST OF ACRONYMS AND DEFINITION OF TERMS

Coke : a product from the combustion of coal in the absence of oxygen

Casting: a practice of pouring molten steel into predetermined shapes so that it can become solid.

HRM : Human Resources Management

JSE : Johannesburg Stock Exchange

MBV : Market Based View

MS : Manufacturing Strategy

PCA : Principal component analysis

RBV : Resource Based View

ROA : Return on Assets

ROE : Return on Equity

ROIC : Return on Invested Capital

Rolling: a process of converting hot solid steel into final desired shapes and smaller sizes

CHAPTER ONE: INTRODUCTION AND PROBLEM DEFINITION

1.1 Introduction to the Research

In the existing dynamic business world, operations strategy is becoming more pivotal to a firm's success (Aboelmaged, 2012; Boström & Krol, 2018). In order to sustain competitive advantage, as opined by Hanafizadeh and Osouli (2011), firms are expected to continuously adapt their business operations in response to the inevitable changes. These changes are not limited to shift in markets and competition, but extend to innovations and adaptive knowledge capability that sustain operation and process practices (Soosay, et al., 2016).

Furthermore, businesses should offer competitive products in relation to quality, cost, delivery and flexibility in order to match customers' needs. Businesses that practice this are in a superior position to create and maintain sustainable competitive advantage (Rosenzweig & Easton, 2010). According to Aboelmaged (2012), operations strategy therefore echoes the key means by which firms can impact and shape their competitive position and thus attain desired goals.

Thus this study is being undertaken in the operations or manufacturing strategy set-up. It is a case study of a manufacturing company in a niche steel market segment in the South African context. The research focuses on the structural and infrastructural decisions at play in the creation of a firm's competitive advantage and operational performance. Russel and Millar (2014) alluded that the strategic concept of operations as a competitive weapon is indispensable. Therefore to attest and assess this, a local firm that produces niche steel products has been selected for study.

A descriptive research approach is adopted where the status of the decisions at play and the operations performance is derived and evaluated. The aim is to provide the status evidence of a relationship between the organisational performance and the decisions at play in a niche environment. From this, the manufacturing strategy or strategies being pursued will be established.

In this chapter, a background to manufacturing strategy and the problem statement will be introduced; the aim and objectives of the study will also be introduced together with the method to be used to achieve the objectives. At the end, an overview of the research report will be given by briefly describing the contents of each chapter

1.2 Background to Manufacturing and Performance

The existence of a connection between manufacturing strategy and business performance has been supported by research. Several studies have attested to this notion (Diallo & Mingaine, 2013). Manufacturing companies make products that are offered to customers for profits (Pearce, 2009). These companies have to deploy their scarce resources into the process of transforming inputs into useful outputs. In doing this, the central goal of the manufacturing function is to ensure long term survival and profitability of the companies (Doane and MacGillivray, 2001; Silva, et al., 2016; Boström & Krol, 2018).

In his ground-breaking work 'Manufacturing – the missing link in corporate strategy', Skinner (1969) emphasised the importance of the operations function in the planning and achieving of a competitive edge. An operations strategy is viewed therefore as the effective use of resources to achieve business and corporate goals (Kim and Arnold, 1996; Maldaner & Kreling, 2019).

According to Bradford (1994), a firm establishes critical micro economic foundations for competitiveness based on variables such markets, operations and delivery systems. Most of these elements can be directly controlled by the firm. It therefore follows that such manufacturing companies need to be strategically aware in order to be successful in today's dynamic and uncertain as well as globalised environments (Diallo & Mingaine, 2013; Soosay, et al., 2016;).

Operations management can be deliberated as an operations instrument to achieve these competitive goals defined at strategic business level (Hayes & Wheelwright, 1988). In their research, Papulova and Papulova (2006) posited that genuine competitive advantage means that companies are able to fulfil customer needs more effectively than their competitors. Lear (2012) summarised up and stated that any

decision by management has strategic implications on competitiveness and translates to a highly important component for organisational success.

As suggested by Russel and Millar (2014), a strategy is a mix of firm's structural and infrastructural manufacturing decisions and its competitive priorities. Tomas and Antonia (2015) identified that structural decisions require significant investment and have a long-term impact concurring with several authors (Swamidass & Darlow, 2000; Russell & Millar, 2014; Rodriguez-Espino & Gil-Padilla, 2015). These refer to decisions about capacity strategy, location, process technology, vertical integration / relationships with suppliers and development & organisation. They have a significant effect on physical assets, and once they have been implemented, they cannot be modified in the short term (Silva, et al., 2016).

On one hand, infrastructural decisions have a short-term impact and serve to support the production processes. They include the organisational structure; work force management; and the systems for planning, stock control and quality management (Bakare, 2016; Camfield & Sellitto, 2018; Maldaner & Kreling, 2019). According to Slack and Lewis (2011), these are the operations' resources. Furthermore, infrastructural decisions serve to support the production processes and have short term effects on firm's performance because they do not require large investments (Diaz-Garrido, et al., 2007)

As stated by Diaz-Garrido, et al., (2007), content dimensions include strategic decisions in structure (technology process, plant capacity and location, vertical integration) and in infrastructure (quality management systems, planning and control process that influence a firm's ability to successfully obtain their competitive priorities (cost, flexibility, delivery and service).

Furthermore, Leong (2015) advanced that within manufacturing, there are five dimensions of competitive priorities: cost, flexibility, quality, speed and dependability. These are the aspects that satisfy market requirements. Slack and Lewis (2011), categorically said that any manufacturing operation is expected to pursue and satisfy these.

In addition, Leong (2015) argues that any organisation needs to make trade-offs within competitive priorities. In a competitive market, no business can normally be on top in all aspects. He states that the purpose of the priorities is to assist in the mission of positioning an organisation with an advantage over its rivals.

However, it is vital for niche producers to maintain competitiveness since their customers often order small quantities of highly value–added products at infrequent intervals (Yannopoulos, 2011). Usually, successful strategies become subject to price competition, and current market leaders are therefore continuously seeking to reduce cost and develop new attractive strategies as opined by Storck (2009).

Rodriguez-Espino and Gil-Padilla (2015) posited that operational performance can be undertaken from two different standpoints. One refers to the results achieved in the different competitive priorities such as cost, quality and service while the other dwells on the overall performance resulting from the application of policies and practices (Hwang, et al., 2014; Azim, et al., 2015). Performance measures are necessary for managers to understand the state of the system and take appropriate corrective action when required (Diallo & Mingaine, 2013).

Garrido et al., (2007), observes that there is a growing interest in the study of relationship between operations strategy and competitiveness in different fields such tourism, hospitality, IT and vehicle assembly industries. By contrast, the effect of structural and infrastructural decisions of operations strategy and their effect on performance in a niche steel manufacturer have received less attention worldwide. Such a study has not been undertaken especially in a South African setting.

Therefore, the study aims to fill the gap. There is no significant academic research that addresses the status of structural and infrastructural decisions areas in the targeted niche steel producing firm.

1.3 Company Context

The firm under research is an integrated steel producing company in a South African operations setting. An integrated steel mill has all the functions for primary steel production such as coke making (converting coal into metallurgical coke for feed into

the blast furnace); Iron making (conversion of solid raw materials input into liquid pig iron in a blast furnace); Steel making (conversion of pig iron into steel); Casting (solidification of the liquid steel into blooms, slabs or billets); and Rolling (conversion of the slabs, blooms and billets into final products or finishing shapes, sizes and lengths)

The firm has a multi-layered management structure complete with departments such as Human Resources, Production, Engineering & Maintenance, Sales & Marketing, Finance, Planning & Logistics, Quality, Corporate Management and Support Services.

One of the units is in a niche market and is the subject of this research. The unit employs over 640 people. Niche suppliers should be flexible as they supply small quantities of high valued products that can be ordered infrequently (Hallgren, 2007).

1.4 Problem Statement

Manufacturing strategy is designed to improve the economics of manufacturing and make companies more competitive (Hallgren, 2007; Azim, et al., 2015). Accordingly, Slack and Lewis (2009) state that operations strategy heavily impacts business competitiveness. Furthermore, operations management has to make decisions that should impact positively on the bottom-line (Lujie, 2015). Hence management has to consciously choose a calculated balance between structural and infrastructural decisions areas and the competitive priorities in order to attain and sustain competitiveness. This then is a paradox of operations strategy as the impact of such decisions may be difficult to categorise in their fullness (Pozo, et al., 2017)

The chosen firm has been in decline as evidenced by the poor performing share price on the Johannesburg Stock Exchange. Share price was R420 in February 2014 but was trading at R12 per share in January 2020. Figure 1 below show the trend of the share performance.

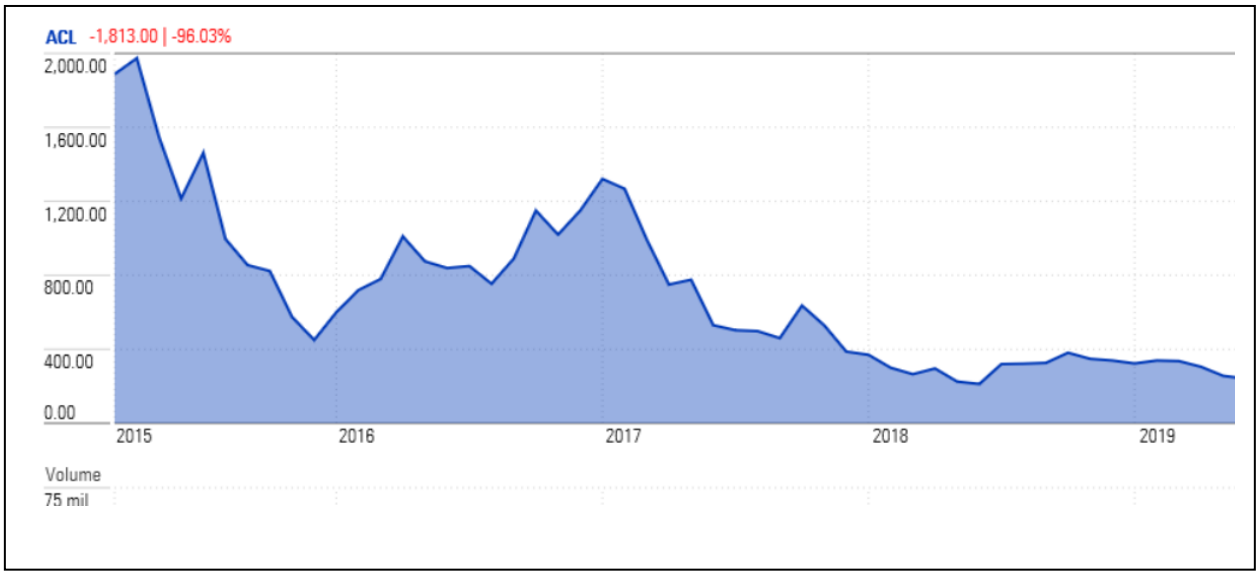


Figure 1. Share Price performance in 2020 (Source: Fin24)

The figure above attests to the steady decrease the share price since 2015 for the niche company. If shares falls by a large amount, a company might be forced to borrow to raise money instead, which is usually more expensive (Barney, 1986). Declining shares are symptoms of an unhealthy organisation (Harshaw, 2015).

In addition, the Return on Assets (ROA) values from 2014 are shown in table 1 below. This financial ratio is indicative of the operations' efficiency in utilising assets to generate profit (Tugas, 2012).

Table 1.Average ROA since 2011. (Source fin24)

Financial parameter	2014	2015	2016	2017	2018	2019	Industry Index
Return on Assets	-0.48	-26.99	-15.28	-16.58	4.59	-18.33	8.65
Return on Equity	-0.76	-50.52	-34.84	-47.48	17.1	-82.21	17.93
Return on Invested Capital	-0.03	-39.98	-24.7	-28.46	18.7	-39.31	15.26

In this case, the figures are negative since 2014. However, they were positive in 2018 although they were still below the industry index. This 2018 high ROA was due to the capital injection from disposal of capital assets – a division was sold (Faku, 2018). The negative return on assets (ROA) for the selected firm is a general symptomatic indicator of problems in effectively harnessing the structural and infrastructural decisions areas for competitive advantage (Barney, 1986).

While writing in the Engineering News, Montiea (2015) stated that the global oversupply of steel compounded by shrinking demand and heavy subsidies especially on imported Chinese steel (comes in cheaper than local) are some factors that have contributed to the decline in steel industry. This has inevitably led to a decrease in global steel prices, further squeezed the profit margin and reduced capacity utilisation. The steel industry is associated with high fixed costs and running at less capacity means reduced efficiencies (Harshaw, 2015). This further compounds the problem.

However, since organisations are continuously seeking to reduce production cost while maintaining quality, quantity, flexibility and shareholder value, it is imperative for management to get a handle on what drives the competitive edge (Storck, 2009). Given this, steering the strategic course of large organisations becomes a competing exercise in a quest to satisfy the diverse approaches (Pozo, et al., 2017). Therefore, there is need to evaluate the status of the content structural and infrastructural decisions in the firm and relate them to the resultant operations' performance.

The research will examine the existing status of the decision areas. These will be used to explain their effect on firm performance in terms of financial ratios and competitive priorities such as quality, delivery, cost and service matrix measurements. The role these decisions areas play in shaping the manufacturing strategy and competitive advantage will be examined and the relevant manufacturing capabilities identified.

1.5 Research Aim

The principal aim of the research is to determine the status of structural and infrastructural factors and their effect on operational and organisational competitiveness in niche steel producing in a South African setting. These, in turn define the operations strategy.

Furthermore, it will seek to determine whether the current status of these decision areas is commensurate with a niche sector as suggested by previous researchers. This will help the firm to define, emphasise and develop some strategies based on

these factors in order to sustain a successful competitive position given the negative return on assets values.

1.6 Research question

To what extent do decision areas affect the manufacturing strategy of a niche steel making company in South Africa?

1.7 Research Objectives

In order to meet the research aim, address the problem statement and provide answers to the research questions, the operations paradigm in the selected firm is the key focus for this study. Therefore, the objectives are

1. To determine which structural and infrastructural decisions areas are being pursued by the selected company and what the factors mean for the company

2. To establish the relationships between decision areas and competitive priorities and the operational performance.

3. To determine the dominant manufacturing strategy or strategies being employed.

4. To compare the findings to the existing theory on manufacturing strategy

1.7 Scope of Study

Due to the size and complexity of the steel manufacturing industry, the study is limited to niche steel manufacturing firm that deal with high value (less volume) products: as a case study. The primary data will include a measure of the status of the decision areas in the operations mix while the secondary data will include the financial performance measurements, the end user evaluations of the competitive aspects such as quality, price, service and service delivery.

1.7.1 Delimitations of the study

This research work is taken in South Africa within the steel manufacturing industry. The scope of the study is limited to one selected company which is a niche steel producer. This study confines itself to interviewing a sampled population,

inclusive of all managers to make a sample of 86 participants. As an academic research, the sample size so determined satisfies the minimum regulations regarding the depth of the study.

1.7.2 Assumptions

A fundamental assumption has been made that key custodians that influence the manufacturing strategy of the niche company are managers at all levels. Secondly, it was assumed that management personnel formulates and enforces the operations strategy. Furthermore, the third assumption was that the company has a functioning manufacturing strategy and that it has been in place for at least five years.

1.7.3 Ethics Clearance

Permission to conduct this research on this case was granted. All ethical issues were cleared

1.8 Chapter Outlines

Chapter 1: Introduction and Problem Statement - This chapter introduces the research by providing the background on the subject matter. The aims and objectives of the study are presented, and the problem statement and research question with associated objectives defined.

Chapter 2: Literature Review - This chapter contains a comprehensive review of the manufacturing strategy literature as it has evolved through the years.

Chapter 3: Research Methodology - This chapter outlines the methodology used to conduct the research, which includes the research design and research instruments used, the approach taken for data collection, and analysis and a discussion on the validity and reliability of the study.

Chapter 4: Results and Analysis - The chapter presents and analyses of data collected

Chapter 5: Discussion of Research Findings – This chapter discusses the findings of the study

Chapter 6: Conclusion and Recommendations - This chapter contains the final conclusion of the research and recommendation on possible further work.

CHAPTER TWO: LITERATURE SURVEY

2.0 Background to manufacturing strategy

Manufacturing strategy matters as it provides clear-cut path to firms (Agigi, et al., 2016). By implementing a strategy, a firm defines its manufacturing position relative to its rivals and this is expected to translate into a competitive advantage (Pisano & Hitt, 2012). Viewing manufacturing strategy as an intended direction has implications for almost every aspect of managing a firm. It implies that the key to a long-term success is being able to outperform the competition (Thomson, 1998; Dekkers, 2000; Wang, 2014; Soosay, et al., 2016).

In a stable environment, a competitive manufacturing strategy is about staking out a position, and the manufacturing strategy focuses on streamlining the aspects necessary to defend that position. In turbulent environments, however, the goal of manufacturing becomes of strategic importance (Pisano & Hitt, 2012; Boström & Krol, 2018).

Today's manufacturing enterprises are operating in fiercely competitive markets (Raj-Reichert, 2018). Customer demands are changing rapidly (Egboro, 2015). The business environment has become technologically innovative. Technological innovation and adaptive customer needs have always influenced the organisation of manufacturing companies (Hofmann & Knébel, 2013). Henry Ford moving assembly line is a typical example of technological innovation (Henry Ford Foundation, 2016).

According to Raj-Reichert (2018), such turbulent environments are inherently characterised by low profit margins. This, in turn, unavoidably influences the organisation of manufacturing companies as opined by Singh (2016).

Furthermore, as explained by Hayes and Pisano (2004), in such competitive environments, a firm has to search for strategies that specify the sought after or desired competitive advantage in the marketplace and articulate how that advantage

is to be achieved. Thus the operations strategy of successful enterprises has always been a key part of their competitive advantage (Wang, 2014; Katz, et al., 2016).

In a world dominated by transformation and growing globalised economy, leaders should understand that operating with the old mind-set will not suffice in facing customer behaviour changes or new types of competition (Stucke, 2013). Companies should look for ways to improve their market share (Anon., 2016). In addition, many excellent firms have learned how to beat competition through the implementation of new management and manufacturing techniques (Dirisu, et al., 2013).

Likewise, having the power of constantly challenging the status quo will allow leaders and their organisations to positively embrace a culture of change (Morrison, 2013). As stated by Motorcycle USA (2008), Harley-Davidson is one of those companies that challenged the traditional mind-set when they faced imminent solvency issues in 1985.

In support of the above approach, Brannen, et al., (2012), opined that in 1985, the CEO of Harley Davidson (Richard Teerlink) convinced lenders to accept a restructuring plan. Using management principles and manufacturing techniques adopted from the Japanese, Harley improved quality and began the long battle to regain its market share. In 1987, a complete turnaround was registered (Brannen, et al., 2012).

On one hand, Nokia's demise from being the world's best mobile phone company to losing it all by 2013 is a classic case of business failure. According to Jia and Yin (2015), Nokia ignored that consumer needs had changed from a mobile phone to a smart phone. The executives continued to focus on perfecting the mobile cell phone as a priority instead of embracing the smartphone era.

Therefore manufacturing strategy concerns the problem of how to pursue specific competitive priorities efficiently and effectively in cognisance of the current changes in corporate strategy as well as the internal and external environment (Kathuria, et al., 2018). In addition, manufacturing strategy involves the setting of goals, policies,

and constraints. According to Camfield and Sellito (2018), the primary objectives of executing a production strategy is to achieve the competitive priorities assigned to the manufacturer. These objectives are to adapt the processes and improve basic capabilities. Such initiatives can create a competitive advantage for the company in the industry in which it operates, they further opined.

Manufacturing strategy is associated with primary factors such as capacity strategy, location, process technology, vertical integration / relationships with suppliers and development & organisation] and other factors [organisational structure; work force management; and the systems for planning, stock control and quality management] (James, 2011; Slack & Lewis, 2011; Lewis, 2015). An operations or manufacturing strategy is viewed as the effective use of these resources to achieve business and corporate goals (Kaviani & Abbasi, 2014).

However, these various dimensions of manufacturing performance often conflict. For example, low cost and high varieties often require different types of equipment and different plant layouts. Moreover, a manufacturing system, like any other engineering design, cannot optimize all dimensions simultaneously (Skinner, 1969; Hayes & Wheelwright, 1988; Pagell, et al., 2000; Russel & Millar, 2014; Kathuria, et al., 2018)

In addition, the question of which dimension is the most important constantly shifts in many firms. Near the end of the month, delivery is most important. After the first of the month, labour cost is most important. In the same vein, when an important customer complaints, quality is most important (Slack & Lewis, 2011)

2.1 Definition of manufacturing strategy

Manufacturing strategy has undergone considerable development as well as debate over the years (Dangayach & Deshmukh, 2001). According to Slack and Lewis (2014), there is no universal agreement on how operations strategy should be described. They argued that different authors have varying views to the subject. However, all researchers seem to agree that it is a plan specifying how an organization will allocate resources in order to support infrastructure and production

Skinner (1969) was the forerunner in giving manufacturing strategy its prominence. Skinner (1969) noted that manufacturing was not being rendered its appropriate role and place in corporate strategy development. Firms had simplistic views of manufacturing and therefore missed several critical aspects of manufacturing (Jimenez, et al., 2019).

According to Skinner (1969), manufacturing strategy refers to harnessing certain properties of the manufacturing function as a competitive weapon. On one hand, Hayes and Wheelwright (1985) have defined the same as a consistent pattern of decision making in the manufacturing function which is linked to business strategy. In the same vein, Hill (1987), Swamidass and Newell (1987) described it as a tool and a coordinated approach which strives to bring consistency and effective use of manufacturing strength as a weapon to bring success in the market.

Furthermore, Cox and Blackstone (1988) saw it as a collective pattern of decision that acts upon the formulation and deployment of manufacturing resources. On one hand, Lim, et al., (2007), defined manufacturing strategy as ‘a pattern of decisions, both structural and infrastructural, which determine the capability of a manufacturing system and specify how it will operate to meet a set of manufacturing objectives which are consistent with overall business objectives

Slack and Lewis (2011) expressed manufacturing strategy as a total pattern of decisions that shape the long term capabilities of any type of operation and their contribution to overall strategy through the reconciliation of market requirements with operations resources.

A more detailed review of the literature on Manufacturing will be given in section 2.6.

2.2 The Manufacturing Strategy mix

Camfield and Sellitto (2018) indicated that there has to be compatibility between the content of the production strategy and the competitive priorities of the company in order to increase the strategic performance. Slack and Lewis (2011) had pointed to operations strategy as the intersection of the performance objectives / targets with its structural and infrastructural decisions areas. In order to create value, an operations

strategy needs to achieve these performance objectives or targets (Awwad, et al., 2013; Fiorentino, 2016).

The nature of company operations are determined by structural and infrastructural decision areas of its production process (Slack and Lewis, 2011; Varakavi, 2015). This is summarised this in figure 2 below.

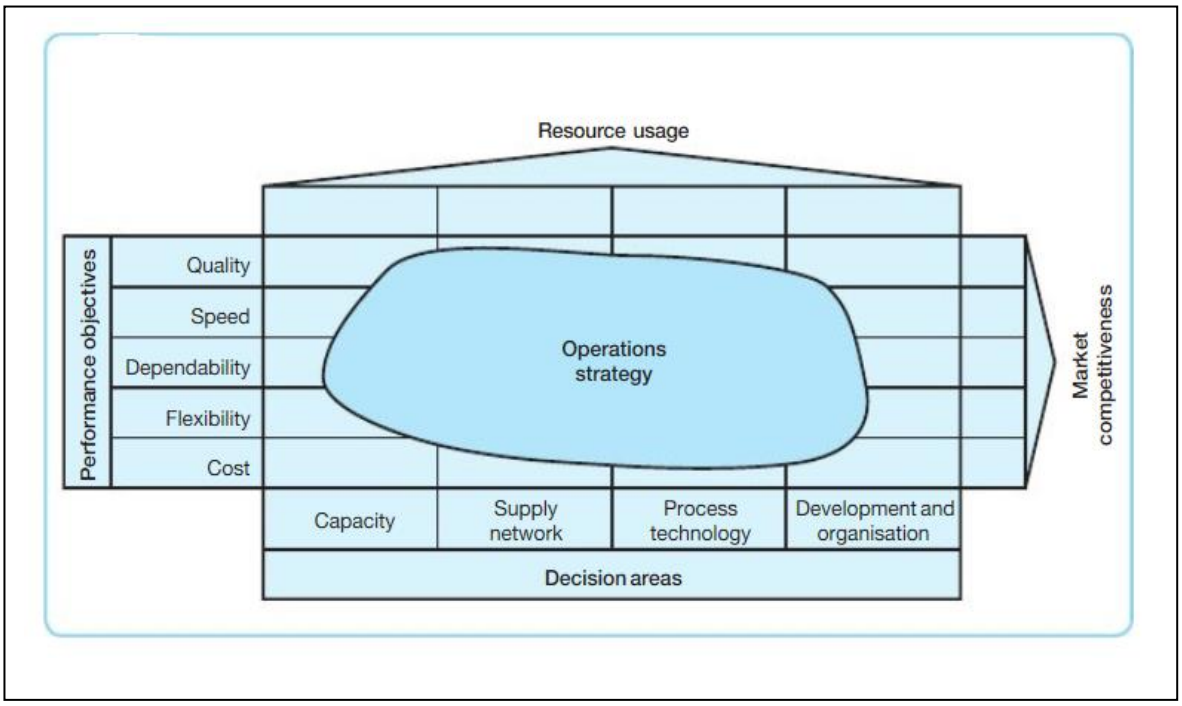


Figure 2.The operations strategy mix which shows the meeting points between objectives and decision areas. Source Slack and Lewis (2011)

The resource usage interrelations can be classified too indicate which relationship is pivotal, very critical, critical and secondary for an organisation as per Slack and Lewis (2011).

2.2.1 Performance Objectives / Competitive Priorities

Previous research on manufacturing strategy has covered extensively the competitive priorities that act as strategic capabilities. These, in turn help firms to create, develop and sustain the competitive edge (Awwad, et al., 2013). Krajewski and Ritzman (2001) defined competitive priorities as the dimensions that a firm's production system should possess in order to support the demands of the markets.

Further, Berglund and Stohm (2015) stated that competitive priorities are objectives that a firm sets up in order to guide management's decisions and actions. These represent the company's future emphasis of the manufacturing. Additionally, they indicate the strategic position desired in the marketplace and supports the corporate strategy as well (Hung, et al., 2015)

Manufacturing firms are forced to respond efficiently and effectively to changing business environment (Coetzee, et al., 2014). One of the strongest challenges that firms face is gaining and developing competitive advantage in such changing environments (Brauns, 2015). The main challenge is the extent to which a firm is able to create and maintain a defensible position over its competitors under such circumstances (Awwad, et al., 2013). The findings of their research suggested that linking competitive priorities to competitive advantage is the master key for a firm to survive in a turbulent environment. Operational and marketing strategies should place emphasis on competitive priorities such as quality, cost, flexibility and delivery to achieve, develop and maintain competitive advantage, they further argued.

Competitive priorities are generally mentioned in four different dimensions. Rosenzweig and Easton (2010) identified them as cost, quality and delivery while Slack and Lewis (2011) includes flexibility. Some studies suggest four additional priorities, innovativeness (Peng, et al., 2011; Pozo, et al., 2017), after-sales services (Frohlick & Dixon, 2001), sustainability (Johansson & Winroth, 2010) and know how (Kavitha, et al., 2013). Table 2 summarises these priorities.

Table 2. Literature on competitive priorities

Identified Priority	**Authors**
Cost	(Boyer & Lewis, 2002), (Ward & Duray, 2000), (Golec, 2015) (Takala, 2002) (Nair & Boulton, 2018) (Jabbour, et al., 2012) (Swafford, et al., 2006) (Dangayach & Deshmukh, 2006) (Martin-Pena & Diaz-Garrido, 2008) (Wang, 2008) (Camfield & Sellitto, 2018) (Awwad, et al., 2013) (Jitpaiboon, 2014) (Russel & Millar, 2014) (Berglund & Stohm, 2015) (Narwal, 2014) (Slack & Lewis, 2011) (Storck, 2009) (Phusavat & Kanchana, 2007) (Russell & Millar, 2014) (Slack & Lewis, 2011) (Garo & Guimarães, 2018) (Kavitha, et al., 2013) (Pozo, et al., 2017),

	(Cai, 2018) (Maldaner & Kreling, 2019) (Rosenzweig & Easton, 2010)
Quality	(Boyer & Lewis, 2002), (Ward & Duray, 2000), (Golec, 2015) (Takala, 2002) (Nair & Boulton, 2018) (Jabbour, et al., 2012) (Swafford, et al., 2006) (Dangayach & Deshmukh, 2006) (Martin-Pena & Diaz-Garrido, 2008) (Wang, 2008) (Camfield & Sellitto, 2018) (Awwad, et al., 2013) (Jitpaiboon, 2014) (Russel & Millar, 2014) (Berglund & Stohm, 2015) (Narwal, 2014) (Slack & Lewis, 2011) (Storck, 2009) (Phusavat & Kanchana, 2007) (Russell & Millar, 2014) (Slack & Lewis, 2011) (Garo & Guimarães, 2018) (Kavitha, et al., 2013) (Pozo, et al., 2017), (Cai, 2018)(Maldaner & Kreling, 2019) (Rosenzweig & Easton, 2010)
Delivery time	(Boyer & Lewis, 2002), (Ward & Duray, 2000), (Golec, 2015) (Takala, 2002) (Nair & Boulton, 2018) (Jabbour, et al., 2012) (Swafford, et al., 2006) (Dangayach & Deshmukh, 2006) (Martin-Pena & Diaz-Garrido, 2008) (Wang, 2008) (Camfield & Sellitto, 2018) (Awwad, et al., 2013) (Jitpaiboon, 2014) (Russel & Millar, 2014) (Berglund & Stohm, 2015) (Narwal, 2014) (Slack & Lewis, 2011) (Storck, 2009) (Phusavat & Kanchana, 2007) (Russell & Millar, 2014) (Slack & Lewis, 2011) (Garo & Guimarães, 2018) (Kavitha, et al., 2013) (Pozo, et al., 2017), (Cai, 2018)(Maldaner & Kreling, 2019) (Rosenzweig & Easton, 2010)
Flexibility	(Boyer & Lewis, 2002), (Ward & Duray, 2000), (Golec, 2015) (Takala, 2002) (Nair & Boulton, 2018) (Jabbour, et al., 2012) (Swafford, et al., 2006) (Dangayach & Deshmukh, 2006) (Martin-Pena & Diaz-Garrido, 2008) (Wang, 2008) (Camfield & Sellitto, 2018) (Awwad, et al., 2013) (Jitpaiboon, 2014) (Russel & Millar, 2014) (Berglund & Stohm, 2015) (Narwal, 2014) (Slack & Lewis, 2011) (Storck, 2009) (Phusavat & Kanchana, 2007) (Russell & Millar, 2014) (Slack & Lewis, 2011) (Garo & Guimarães, 2018) (Kavitha, et al., 2013) (Pozo, et al., 2017), (Cai, 2018) (Maldaner & Kreling, 2019)
Innovation	(Peng, et al., 2011) (Russell & Millar, 2014) (Awwad, et al., 2013) (Pozo, et al., 2017), (Maldaner & Kreling, 2019) (Rajapathirana & Hui, 2018)
After sales service	(Frohlick & Dixon, 2001) (Davis, et al., 2001) (Tan, et al., 2007) (Pozo, et al., 2017),
Know how	(Johansson & Winroth, 2010) (Phusavat & Kanchana, 2007) (Nurcahyo & Wibowo, 2015) (Kavitha, et al., 2013)
sustainability	(Johansson & Winroth, 2010) (Longoni & Cagliano, 2015)

The business strategy should be aligned with the competitive priorities. Failure to recognise this important synergy could lead to less company productivity (Berglund & Stohm, 2015).

Although researchers have identified competitive priorities as quality, cost, delivery, flexibility, innovativeness, know-how and sustainability, it seems that there is general agreement that the major competitive priorities comprise the following dimensions: cost, quality, delivery and flexibility. From his study of 41 journal articles, Pakhomova (2016) made this summary below. He found that quality, flexibility, delivery and cost are the most topical priorities.

Table 3. Types of priorities studied in selected for the analysis 41 articles

Competitive Priority name	Number of times a priority was mentioned
quality	27
flexibility	27
delivery	26
cost	21
innovation	12
speed	5
After sales service	4
know how	4

Source: Pakhomova , 2016

2.2.1.1 Quality as a competitive priority

According to Awwad, et al., (2013), quality is related to low defect rate, effective performance and reliability while Camfield and Sellitto(2018) simply stated that it is to offer products with features and functionality that are superior or absent in corresponding competitors' products.

Among all competitive priorities, quality is unique in that it has been widely regarded as essential to business outcomes (Rajapathirana & Hui, 2018). Further, its importance across strategic groups is supported by strong empirical evidence. It has been commonly showed that a requirement of all permanent improvement in manufacturing capabilities is the improvement in quality performance (Cai, 2018).

As articulated by Kavitha, et al., (2013), the main factors considered under quality are given as: low-defect rate, performance quality, product durability, environmental aspects, certification and product reliability. Furthermore, Siddiqui (2018) atriculated the quality dimensions as Performance - the primary operating characteristics; Features - optional extras (the "bells" and "whistles"); Reliability - likelihood of breakdown; Conformance - conformance to specification; Technical durability - length of time before the product becomes obsolete; Serviceability - ease of service; Aesthetics - look, smell, feel, taste; and Perceived quality - reputation.

An earlier definition as “fitness for use or purpose” was promulgated by Juran (1974.p23). This invoked the customers’ perspective in defining quality. It implies that it is the customer who decides what goods or services best satisfy his/her needs. Several researchers came to this conclusion (Deming, 1986; Garvin, 1987; Ishikawa, 1989; Feigenbaum, 1991; Crosby, 1996; Narasimhan, 2011). Therefore, customer perspective is critical to any definition of quality. Achieving customer requirements can thus be viewed as a main source of competitive advantage (Awwad, et al., 2013; Csikosova, et al., 2018).

Further, researchers have linked quality to competitive advantage (Porter, 1980; Prajogo, 2007; Arasa & Gathinji, 2014; Altuntaşa, et al., 2014; Nderitu, 2015). They supported the notion that quality has evolved from an operational consideration to a strategy defining one. Consequently, in manufacturing strategy, quality is associated with both conformance to specifications and customer expectations and is a reflection of the competitive strategy for firms (Awwad, et al., 2013; Nderitu, 2015;).

This conclusion should lead firms to positively view quality as a competitive weapon. As such, quality should be adopted as a strategy to be used in creating and sustaining competitive advantage (Madadipouya, 2015). A manufacturing strategy that establishes quality as a dominant competitive capability requires higher quality among standard products or offers wider features or performance characteristics that are superior when compared with other competitors (Ocampo & Clark, 2015).

2.2.1.2 Flexibility as a competitive priority

Many researchers define flexibility similarly. The definitions share a common thread; understanding (Phusavat & Kanchana, 2007; Martin-Pena & Diaz-Garrido, 2008; Wang, 2008, Slack & Lewis, 2011), mastering changes (Wang, 2008; ; Storck, 2009; Slack & Lewis, 2011; Awwad, et al., 2013; Kavitha, et al., 2013; Russell & Millar, 2014) and meeting uncertainty resulting from internal and external business environments (Phusavat & Kanchana, 2007; Martin-Pena & Diaz-Garrido, 2008; Wang, 2008; ; Storck, 2009; Slack & Lewis, 2011; Awwad, et al., 2013; Kavitha, et al., 2013; Russell & Millar, 2014; Jitpaiboon, 2014; Russel & Millar, 2014; Narwal, 2014; Berglund & Stohm, 2015; Pozo, et al., 2017; Garo & Guimarães, 2018; Camfield & Sellitto 2018).

According to Kaschel (2014), flexibility refers to the ability of a manufacturing system in responding, cost effectively and rapidly, to changing production needs and requirements. This capability is becoming increasingly strategic for the design and operation of manufacturing systems, as today's operating environments are highly variable and unpredictable.

Awwad (2007), argued that flexibility enables firms to respond efficiently to changing circumstances, particularly, when dealing with the turbulent environment that may be characterized by rapid changes such as short and uncertain product life cycles, innovative process technologies, and customized products.

Jabbour, et al., (2012) further articulated the main dimensions of flexibility as iimplementing rapid changes in product design; implementing rapid changes in the variety of products; rapid introduction of new versions of existing products or of brand new products and offering a wide range of products; changes in production volumes in response to changing demand.

As summarised by Awwad, et al., (2013), the different types of flexibility defined within such classifications and argued in the literature are tabulated below:

Table 4. Types of flexibilities (Awwad, et al., 2013)

Type of flexibility	Description
Product flexibility	the ability to add or substitute easily new parts
Product mix flexibility	▪ the ability of a firm to produce different combinations of products economically and effectively
New product flexibility	the ability of a manufacturing system to introduce and manufacture new parts and products
Labour flexibility	the ability of the workforce to per-form a broad range of manufacturing tasks economically and effectively
Process flexibility	the ability of a manufacturing sys-tem to process a given set of components with different processes, operations sequence and materials
Machine flexibility	the ability of a machine to perform different types of operation without requiring a prohibitive effort in switching from one to another
Market flexibility	the ability to adapt to a changing market environment easily
Expansion flexibility	the ability to increase capacity and capability easily when needed
Volume flexibility	the ability of a manufacturing system to vary total production volume economically

Garg, et al., (2017), in their topical research, concluded that a substantial competitive advantage can be realised by having unique and incomparable position in the market through flexibility in a firm. Furthermore, flexibility denotes a strategy that could enable firms to introduce new products more quickly in the market or to rapidly change its capacity to address sudden demand fluctuations (Ocampo & Clark, 2015).

2.2.1.3 Delivery as a competitive priority

Delivery means ensuring the right product (as ordered by the customer) is supplied in the right quantity, right place, right time, from the right source and with the accompanying right service (Awwad, et al., 2013; Camfield & Sellitto, 2018). As argued by Ramachandran and Neelakrishnan (2017), on-time delivery (OTD) is one

of the top industrial metrics that needs to be met by the firm's original promised date (OPD) to the customer.

In the same vein, Peng and Lu (2017) postulated that delivery performance dimensions (on-time delivery rate, early delivery inaccuracy, late delivery inaccuracy, and delivery speed) are strategic in nature and have varying impacts on unit prices and future customer transaction quantities.

Furthermore, delivery measures the level of success at providing products and services to the customer. This metric cannot be substituted in supply chain management as it integrates the measurement of performance right from supplier end to the customer end (Raoa, et al., 2011). Thus delivery is a competitive priority as customers dictate their levels of needs and wants. Manufacturers are in turn forced to satisfy these.

2.2.1.4 Cost as a competitive priority

Cost is defined as offering products at a lower cost than competitors (Russell & Millar, 2014). The factors considered under the cost domain are given as: low costs, value added costs, continuous improvement, activity based measurement and quality costs (Kavitha, et al., 2013). Competitive advantage, as argued by Porter (1980), can be achieved by adopting one or more of the following generic competitive strategies:

- Cost leadership: low product cost relative to competitors, on related and standardised products, and on economies of scale. Furthermore, a cost leadership strategy requires intense supervision of labour and a tight cost control on expenses,
- Focus: this tactic implies a focus on a narrow strategic target (buyer group, product line or geographic market) through differentiation, low cost or both,
- Differentiation: this approach is described in terms of product uniqueness, an emphasis on marketing and research, and a flexible structure.

Zhao*, et al.,* (2002) described this priority as the ability to reduce overheads, labour, raw materials costs and production cycle time. The researcher reviewed 41 published papers (listed in table 2). They all categorised cost as an indispensable priority. De Melo and Leone (2015), Berglund and Stohm (2015), Kavitha, et al., (2013) linked cost leadership to competitive advantage.

Competing on cost requires a manufacturing strategy that curtails inefficiencies in manufacturing operations in order to offer products that are at a low price (Ocampo & Clark, 2015).

2.2.1.5 Innovation as a competitive priority

Russel and Millar (2014) defined innovation as the introduction of new products and processes. This includes the firm's ability to make improvements to existing products and processes. IBEF (2016), took a more similar route and argued that it is the introduction, at any level, of value additions entailed in the production process and the change successfully commercialised after. On one hand, Dangayach and Deshmukh (2001) defined it as the introduction of new product and processes.

In addition, it is the ability to implement new technologies and the ability to create new markets according to Zhao et al., (2002). This includes the adoption of new technology, reduction of product development time and introduction of new products.

IBEF (2016) and Pozo, et al.,(2017) further stated that innovation plays a strategic role in any manufacturing activity, as it brings added success in the near term, while being indispensable for sustainability in the long run.

Furthermore, it can be measured with respect to performance and growth, led by upgradation in efficiency, productivity, quality, competitive positioning and/or market share of the company (Awwad, et al., 2013; Pozo, et al., 2017).

2.2.1.6 Speed as a competitive priority

According to Slack and Lewis (2011), speed indicates the time between the beginning of a manufacturing process and its end. Competing on speed requires an organisation characterised by fast moves, fast adaptations and tight linkages.

Decision-making is pushed down the organisation as levels of management are collapsed and work is performed in cross-functional teams (Wawasan Open University, 2018).

In addition, close contact is maintained with both suppliers and customers. Forming alliances is one of the most effective avenues for competing on speed. With speed as a competitive priority, the process is designed to improve the flow of information, standardise recording systems and reduce turnaround time along the entire supply chain.

2.2.1.7 After Sales Service as a competitive priority

After sales service is the new buzz word. It refers to the care and continuous interaction given to customers by the seller throughout the post-purchase product life cycle (Ladokun, et al., 2019).

Devine (2018), in his insightful paper, argued that the rising customers' expectations and increased competition for new product sales are catapulting manufacturers to transform their after-sales service functions to maximise product uptake. The intention is to deliver a superior customer experience and improve financial performance.

It was further argued that After Sales Service is becoming increasingly important and strategic focus area for manufacturers around the world strategically (Devine, 2018). Recent studies from multiple third-party research organisations supported this notion: a report from Bain & Company 2018 (a global management company) suggested that after sales service business averaged a gross margin of thirty nine percent, which is much higher than margins on most new products being twenty seven percent. The study also revealed that manufacturing companies' after sales service business grew by nine percent annually, compared to a five percent growth rate captured on the product side of the business (Bain & Company, 2018).

2.2.1.7 Know How as a competitive priority

Know how in the manufacturing context was defined as “a package of practical information, resulting from experience and testing, which is: secret; substantial and identified” (The Manufacturer, 2015, p12).

Awwad, et al., (2013) opined that know how includes knowledge management, creativity and skills development. All this has a trend of decreasing product life development cycles which allows companies to develop new products relatively faster than competitors (Calantone, et al., 2017).

2.2.2 Decision Areas – an overview

Decision areas are both structural and infrastructural. Their use shapes the manufacturing strategy and which, in turn, permits companies to guarantee high performances (Silva and Ferreira, 2017).

However, strong manufacturing strategies are only attained if and when firms strike a balance between their structural and infrastructural decisions areas (Rodriguez-Espino & Gil-Padilla, 2015). Failure to do this leads to a company overstating one particular action while neglecting others. This may lead to underutilisation of potential and can create an imbalance in the allocation of resources leading to long term problems (UKEssays, 2018).

According to Diaz-Garrido, et al., (2007); Idris, et al., (2010) and Lewis (2015), structural decisions are the ones that define the building blocks and architecture associated with a particular operation. Structural elements are grouped as capacity, facilities location, vertical integration/networking, and process technology. They are directly related to the tangible aspects for product manufacturing

On one hand, infrastructural decisions affect the organisational culture, control systems, team management, team and quality management and leadership (UKEssays, 2018). They relate to the people, systems, and culture that tie together the operations activities (Lewis, 2015).

Over the years, researchers are increasingly in agreement that the major decision areas comprise the following elements as summarised in table 5 below. These authors researched in diverse industries where the full context of operations strategy may differ as firms elect to compete differently. This necessitates the inclusion of different areas within each of the two types of decisions and they also use different terminology (Rodriguez-Espino & Gil-Padilla, 2015)

Table 5. Content of operations decisions (summarised by researcher).

References	Structural decisions	Infrastructural decisions
Skinner (1969)	▪ Plant and Equipment	▪ Production and planning and control ▪ Organisation and Management ▪ Labour and staffing ▪ Product design/engineering
Hayes and Wheelwright (1984)	▪ Capacity ▪ Facilities ▪ Technology ▪ Vertical integration	▪ Production and planning and control ▪ Quality ▪ Workforce ▪ New product development ▪ Performance measurement system
Buffa (1984)	▪ Capacity/location ▪ Product/process technology ▪ Suppliers strategy and ▪ vertical integration	▪ Strategic implications of operations decisions ▪ Workforce and job design ▪ Position of production systems
Fine and Hax (1985)	▪ Capacity ▪ Facilities ▪ Processes and technologies	▪ Product quality ▪ Human resources ▪ Scope of new products
Kim and Arnold (1996)	▪ Capacity ▪ Facility ▪ Technology ▪ Vertical integration	▪ Workforce ▪ Quality ▪ Planning and control ▪ Organization
Krawjewsky and Ritzman (2000)	▪ Technological innovation ▪ Capacity and localization ▪ Product and process selection ▪ Definition of operations	▪ Work force ▪ Quality management ▪ Raw material supply ▪ Process and product design

	objectives	
(Boyer, et al., 2005)	▪ Processes ▪ Capacity ▪ Facility Location ▪ Facility Layout ▪ Supply distribution	▪ Human Resources ▪ Products ▪ Planning and control ▪ Organisation ▪ Work Study ▪ Quality management
Hallgren and Olhager, 2006	▪ Process technology ▪ Facilities ▪ Capacity ▪ Vertical integration	▪ Organisation ▪ Manufacturing planning and control ▪ Quality ▪ New production technology
Ward et al. (2007)	▪ Capacity ▪ Technology ▪ Supplier management ▪ New product development	▪ Workforce empowerment ▪ Workforce development programs ▪ Manufacturing planning and control ▪ systems ▪ Just in time ▪ Quality ▪ Delegation ▪ Cross-functional activities
Di´az-Garrido et al. (2007)	▪ Technology ▪ Facilities ▪ Vertical integration	▪ Production and inventory planning and control systems ▪ Organizational structure and design ▪ Work force management ▪ Quality management
James, 2011	▪ Process type ▪ Layout ▪ Facility location ▪ Process technology ▪ Product/Service design ▪ Job and work design	▪ Planning and control ▪ Inventory management ▪ Capacity management ▪ Supply chain management ▪
(Rodriguez-Espino & Gil-Padilla, 2015)	▪ Facilities ▪ Technology ▪ integration	▪ Quality management ▪ Production and planning systems ▪ Development of new services and processes ▪ Organisational structure ▪ Human resources management

(de Miranda Filho, et al., 2014)	▪ resource capacity ▪ facilities ▪ machines ▪ technologies	▪ Relationship with suppliers ▪ Managerial philosophy ▪ Production planning and control, ▪ Workforce management ▪ Quality control
Slacks and Lewis (2011)	▪ Capacity ▪ Supply networks ▪ Process technology ▪ Development and organisation	▪ Quality management ▪ Production and planning systems ▪ Development of new services and processes ▪ Organisational structure ▪ Planning and control ▪ Inventory management ▪ Capacity management

2.2.3 Structural Decision Areas

Companies have developed competitive priorities by taking into consideration the main structural and infrastructural decisions in the operations area and their relationships with organisational performance (Rodriguez-Espino & Gil-Padilla, 2015). Some companies may place certain emphasis on some as opposed to others as a response to the operations decision area or areas that influence their competitive advantage the most (Bakare, 2016).

For purposes of this study, structural decisions were identified as Capacity decisions; Supply networks/facilities; Process technology; Development and organization and Vertical integration/outsourcing (Slack and Lewis, 2011).

2.2.3.1 Capacity Decisions

Capacity decisions abound in manufacturing (Biwer, et al., 2018). Balancing various capacities reflects how a company approaches business. Capacity determines the rate of output and how a manufacturer balances raw materials, machinery, labor and storage to match demand for products. Decisions about production capacity can be strategic and operational, both in the long and short term (Bakare, 2016).

Competitive priorities most closely tied to capacity decisions are those related to output, volume, quality, delivery and flexibility (Boyer & Lewis, 2002). Factors

affecting production capacity interrelate to such a level that a change to one potentially affects all (Silva, et al., 2016; Shpak, 2019).

Closely related to capacity is capacity utilisation (Okunade, 2018). Capacity utilisation is a measure of the extent to which the productive capacity of a business is being used (Addae-Korankye & Nyamekye, 2018). When manufacturing capacity is increased (through acquisition, expanding factory, restructuring), the resulting increase in capacity will normally enable a firm to lower unit production costs, as a result of economies of scale and the experience effect. In addition, the variety of products a firm manufactures also has an influence on capacity (Urgal-González & García-Vázquez, 2007; Silva, et al., 2016).

Capacity utilisation plays a central role in evaluating economic performance of manufacturing firms (Okunade, 2018). Over- or under-utilisation of plant capacity can reduce plant competitiveness by increasing operating costs (Seguin & Sweetland, 2014). When market demand grows, capacity utilisation will follow the trend. In the same way, if demand weakens, capacity utilisation slackens. Therefore, capacity utilisation is a strategic factor to be considered when an increase in productivity and expansion of firm's production is being considered (Okunade, 2018).

2.2.3.2 Supply Network / Facilities

Supply networks comprise interconnected chains through which goods and services flow from original supply sources to end customers (Harland, et al., 2016). They describe lateral links, reverse loops, two-way exchanges and related ones, encompassing the upstream and downstream activity, with a focal firm as the point of reference, whose primary purpose is the procurement, use and transformation of resources to provide packages of goods and services (Lamming, et al., 2000; Harland, et al., 2016).

Bakare (2016) argues that if a firm is located close to suppliers, savings on transportation costs can be realised. In the same vein, shipping costs can be low if the entity is located close to customers. The opposite of this is true.

Demir (2019) argued that survival may significantly depend on the location strategy alone. The location decisions vary with the business sector. For instance, in manufacturing, location is chosen to minimising costs as the main goal, while for service organisations, the focus is to maximise revenue (Lapinskaitė & Kuckailytė, 2014). In addition, location can affect delivery times, flexibility, response and affect the efficiency of the operation (Ivanov, et al., 2018).

2.2.3.3 Process Technology

Several studies have argued positively that the use of advanced manufacturing technology is associated with a wide range of benefits such as improvements in market share and profitability (Hofmann & Orr, 2005; Swink & Nair, 2007), improved delivery (Kotha & Swamidass, 2008; Kong, et al., 2016), flexibility, cost reduction, and quality as well as enhanced manufacturing productivity and efficiency Hofmann & Orr, 2005; Swink & Nair, 2007; Kotha & Swamidass, 2008; Kong, et al., 2016). In addition, improved process technology fosters firms' competitive advantages and manufacturing performance.

Through automating a manufacturing process, labour costs and inventory on hand can be reduced as technology removes human errors, variability in quality and completion times, thereby improving quality and repeatability (Bakare, 2016).

Some companies are currently improving their processes through the Fourth Industrial Revolution (4IR) technologies. This is a collective force behind many products and services that are fast becoming indispensable to modern life. It is a fusion of advances in exponential technologies such artificial intelligence (AI), robotics, the Internet of Things (IoT), 3D printing, genetic engineering, quantum computing, nanomaterials and other technologies (Penprase, 2018; Philbeck & Davis, 2018; Xu, et al., 2018). As a result of this, a torrent of technologies, the Fourth Industrial Revolution is paving the way for transformative changes in the way we live and radically disrupting almost every business sector. However, further discussion of these technologies is outside scope of the study.

2.2.3.4 Development and Organisation

Operations management plays a crucial role in an organization as it handles issues like design, operations, and maintenance of the system used for the production of goods (Diaz-Garrido, et al., 2011). The development and organisation of operations capabilities allow firms to achieve sustainable competitive advantages (Kak & Sushil, 2002).

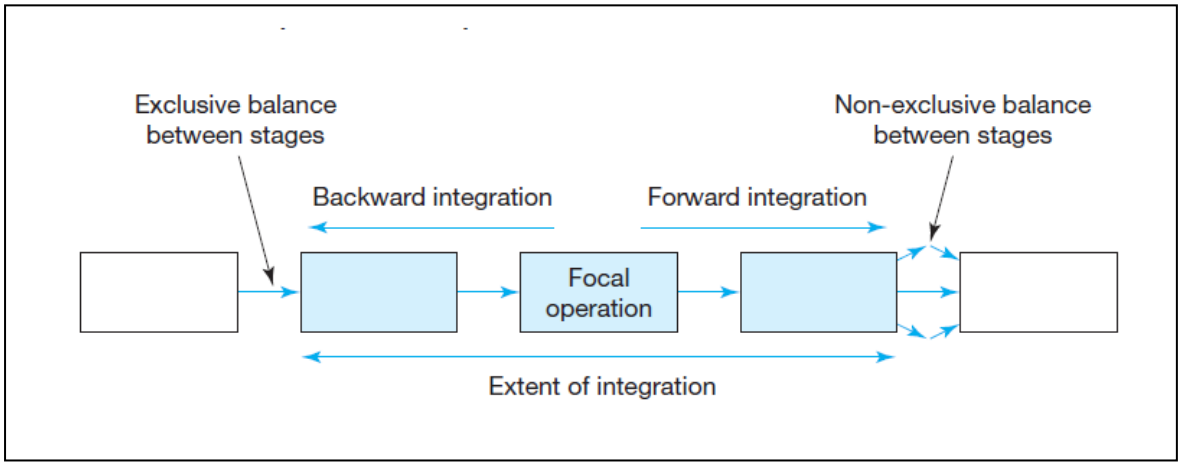
According to Nigel and Slack (2011), companies that are able to turn their organisations into sources of competitive advantage are those that can harness various improvement programs to the growth of unique operating capabilities. These programs can include; small, continuous or big radical improvement projects; learning and enhancing process knowledge through control; benchmarking against other operators; and performance measurement techniques with a view of process improvement

2.2.3.5 Vertical Integration

Vertical and horizontal integrations are strategies used by businesses in the same industry or production process (Lara, et al., 2018). According to Nigel and Slack (2011), vertical integration is the extent to which an organization owns the network of which it is part. Vertical integration benefits companies by allowing them to control the process, reduce costs, improve efficiencies and allow companies more immediate access to consumers as well as assessing the wisdom of acquiring suppliers or customers (Röder, 2007). However, vertical integration has a major disadvantage in that significant amounts of capital investment are required (Osegowitsch & Madhok, 2003).

In a horizontal integration, a company takes over another that operates at the same level of the value chain in an industry and this take over allows companies to expand in size, diversify product offerings, reduce competition, and expand into new markets (Adeleke, et al., 2018). Figure 3 below shows the extent of vertical integration.

Figure 3. Vertical integration (Slack and Lewis, 2011)



2.2.3.6 Outsourcing

Dolgui and Proth (2013) defined outsourcing as the act of obtaining semi-finished products, finished products or services from an outside company if these activities were traditionally performed internally. Mohammed, et al., (2016) positively identified the benefits gained from implementing an outsourcing strategy by industrial companies in Jordan in terms of cost reduction, focus on core competencies, and access to specialized resources and quality improvement.

However, in contrast to common belief and management practices, extensive outsourcing of manufacturing activities has a strong negative impact on a firm's profit and total factor productivity (Kinkel, et al., 2016). The advantages and disadvantage of outsourcing are outlined in the table below.

Table 6. The pros and cons of outsourcing/ vertical integration (Dolgui & Proth, 2013)

Desired objectives	Possible adverse consequences
Search for a vendor whose prices are as low as possible	- Unemployment in the country of the buyer - Permanence of a low social status in the vendor's country - Risk of quality problems if the vendor is involved recently in this type of product
Reduce staff in the buyer's company	Unemployment in the buyer's country
Taking advantage of external expertise	This is only possible if the vendor has a high technological level, but in this case the prices it offers are probably less interesting.
Free employees from tedious tasks	Unemployment in the buyer's country
Improve financial flexibility by selling assets that have become unnecessary as a result of outsourcing	The sale of assets reduces the possibility of future extensions of the buyer. This is a strategic constraint that the buyer applied to himself. In addition, he/she becomes dependent on the vendor.
Gain access to external technology	This is an advantage only if the technology is used occasionally. If the need for this technology is permanent, then this may favour the vendor who becomes dominant partner.
Vendor provide quality activities	Unwarranted assertion

2.2.4 Infrastructural Decision Areas

For purposes of this study, infrastructural decisions areas were identified as Human resources management; Planning and control; Inventory management; Quality management and Performance/reward systems (Slack and Lewis, 2011)

2.2.4.1 Human Resource Management

Human resource is a strategic field in management (Heizer, et al., 2017). In order to attain better economic performance, organisations require unmatched internal efficiencies to sustain competitiveness. The most valuable resource any organization has is its employees and this is the only competence that competitors cannot replicate (Elrehail, et al., 2019).

It is agreed that human resource activities are mostly accepted to play a central role in connecting employee capabilities with the performance requirements of a firm (Li 2000) as humans possess skills, knowledge that have economic value to organisations (Cetin, 2010). Furthermore, the objective of a human resources management strategy is to manage the workforce and design work so that employees are utilised effectively and efficiently (Heizer, et al., 2017).

Several studies have been carried out to examine the influence of human resource practices on manufacturing performance. These studies showed that HRM factors are related to specific manufacturing competitive dimensions: quality, flexibility, cost and time. It was concluded that the HRM factors are strongly related to their respective manufacturing performance dimensions (Cetin, 2010)

Of specific importance, Challis, et al., (2005) investigated the relationships between aspects of integrated manufacturing, consisting of total quality management, manufacturing technology, various organizational improvement initiatives, such as in leadership, teams, human resource management, and benchmarking, and employee and manufacturing performance. They concluded that manufacturing aspects of total quality management and delivery are pointedly connected with organisational and human resource practices.

Furthermore, it was found out that high-performing firms place substantially more emphasis on 'soft' human resource management practices and rely on total quality management principles half as much as low performing firms (Challis, et al., (2005; Izvercian, et al., 2014).

2.2.4.2 Planning and Control

Planning and control is concerned with the reconciliation between market demand and what the operations resources can deliver (Lahlouaa, et al., 2018). Accordingly, planning is a formulisation of what is intended to happen at some time in the future while control is the process of coping with changes in operational variables (Stouten, et al., 2018).

Planning and control activities provide the systems, procedures and decisions which bring different aspects of supply and demand together (James, 2011; Taylor & Francis, 2017). Customers change their minds about what they want and when they want it. Suppliers may not always deliver on time, machines may fail or staff may be absent. Control makes the adjustments which allow the operation to achieve the objectives (James, 2011)

The strategic purpose is to make a connection between supply and demand that will ensure operations processes run effectively and efficiently and produce products and services as required by customers (Du Toit & Vlok, 2014).

2.2.4.3 Inventory management

Inventory control involves managing the inventory that is already in the stock count. It means having accurate, complete and timely inventory transactional record and avoiding differences between accounting and real inventory levels (Kiisler, 2014)

Holding the inventories is associated with significant costs (Sheakh, 2018). Despite the all efforts and technological innovations, inventories essentially tie up cash. Unreasonably high inventory levels lower the company`s profit and return on assets (Atnafu & Balda, 2018).

Inventory management involves determining when, how and how much to order products as well as identifying the most effective source of supply for each item in each stocking location (Christopher, 2011).

Furthermore, inventory management includes all activities of planning, forecasting and replenishment (Afolabi, et al., 2017). The main purpose of inventory management is to minimise the variances between customers demand and availability of items (Nemtajela & Mbohwa, 2017). These differences can be caused by: customers demand fluctuations, suppliers' delivery time fluctuations, quality issues, breakdowns and inventory control accuracy (Christopher, 2011; Muchaendepi, et al., 2019)).

According to the research by Atnafu and Balda (2018), higher levels of inventory management practice can improve competitive advantage and enhanced organisational performance. In addition, competitive advantage can have a direct, positive impact on organisational performance.

2.2.4.4 Quality management

A quality product helps to maintain customer satisfaction, loyalty and reduces the risk and cost of replacing faulty goods (Handoko, 2016; Csikosova, et al., 2018). Orr (2010) examined the role of quality management in strategic manufacturing decision-making in the Australian wine industry. Strategic quality management was found as the second most important area of manufacturing process decision-making, after plant and equipment. It also found that quality is the most important competitive priority for wine producers, followed by product cost.

Increasingly, the role of quality is to protect organisations by assuring compliance to regulatory and statutory requirements, including industry-specific standards, safety, health and environmental regulations (Jacobs & Cordova, 2010). Furthermore, companies can build a reputation for quality by gaining accreditation with a recognised quality standard.

Making good decisions when it comes to quality can provide for better relationships with suppliers, better processes and ultimately less wastage (Bakare, 2016). With regard to response times, strategic quality decisions can reduce potential delays that may arise from quality problems during manufacturing, Bakare (2016) further adds.

2.2.4.5 Performance / Reward Systems

Performance incentives are to develop policies and practices which will attract, retain and motivate high quality people to the organization (Asaari, et al., 2019). Incentives are considered one of the pivotal factors that encourage workers to put forth great efforts and work more efficiently (Nwokocha, 2016)

This is because incentives and reward system direct workers capabilities to support the achievement of business goals (Asaari, et al., 2019). Employees want their performance to be appreciated (Syed, et al., 2019). Providing appropriate rewards

and benefits package can be an effective medium to ensure the continuation of relationship with talented employees in the organization (Alfandi & Alkahsawneh, 2014).

Such incentives are a significant factor in encouraging employees and increasing their enthusiasm at work which results in improving the general performance and increasing the productivity (Abuhashesh, et al., 2019). Incentives, also, help in attaining job satisfaction which increases the interaction between the employee and the organization (Nwokocha, 2016).

On one hand, the absence of the suitable incentives may negatively affect the hardworking employee's performance; it may also weaken their productivity at work which decreases the chances of attaining the goals of the organization (Syed, et al., 2019). Therefore, increased motivation from rewards will increase the quality of the employees output (Bakare, 2016).

2.3 Manufacturing Performance

Manufacturing companies strive to achieve the best operational performance in order to compete in the global markets and remain profitable (Esmaeel, et al., 2017). Profitability is the ability of a business to earn a profit (Grimsley, 2015).

According to Azim, et al., (2015), operational performance refers to the measurable aspects or metrics of the outcomes of an organization's processes. These can be financial and non-financial, such as quality, reliability, financial ratios such as return on investment, return on assets and share price.

Hwang, et al., (2014) stated that well-formulated metrics can increase the chances of organisational success. Metrics review the performance of the entire manufacturing process in the company and generate insightful details. The end result of the performance measurement delivers the company's competitive advantages through correcting the company's performance shortcomings (Asaari, et al., 2019).

Therefore performance management becomes a fundamental activity in evaluating the competitiveness of a company. In turn, operational performance affects business performance measures such as market share and customer satisfaction (Nurcahyo & Wibowo, 2015). Thus performance measurement systems were developed as a means of checking and sustaining organisational control to ensure goals are attained (Hwang, et al., 2014). In addition, operational performance has a major impact on product cost, product reliability, cycle time, etc (Nurcahyo & Wibowo, 2015.

2.3 Measures of performance

Performance measures play a vital role in any business as they are often viewed as forward- looking indicators that assist management to foresee and predict a company's economic performance and often times reveal the need for possible changes in operations (Sundström & Tollmar, 2018).

According to Hwang, et al., (2014), there are hierarchy levels in company's management components. Top management in strategic level needs financial measures for management level decisions. For example, return on investments (ROI), profitability, share price and other financial measures are usually measurements on a strategic plant level (Hallgren, 2007). On one hand, lower management involved in tactical and operational levels need operational measures for daily business. These measures are summarised in table 7 below.

Table 7. Performance measurement metrics (Hwang, et al., 2014; Azim, et al., 2015)

Level	Performance Metrics
Strategic	Return on Assets, Return on Investment, Lead time, Quality level, Cost saving, Supplier pricing, Order cycle time, Cash flow, Total cash flow time, Capacity, Rate of return on investment, Level of customer perceived value of product, Net profit vs productivity ratio, Range of product and services, Variations against budget
Tactical	Accuracy of forecasting techniques, Effectiveness of master production schedule, Flexibility, Customer service satisfaction, Customer query time, Order entry method, Flexibility
Operational	Unplanned losses, Planned losses, Machine availability, Defect free rate, Capacity utilization, Lead time, Range of product and services, Effectiveness of scheduling techniques, Incoming stock level, Work in progress, Finished goods in transit

Alfnes (2015) also summarised the items to measure the extent of success in fulfilling the performance objectives. In order to support it's performance objectives, each firm needs to determine the relevant performance measurements to use and the performance levels to achieve.

According to Slack and Lewis (2011), the five performance objectives; quality, speed, dependability, flexibility and cost are really composites of many smaller measures and operational performance of a firm or organisation should be based on them. Each of the smaller measure does give a perspective on the cost performance of an operation (Slack & Lewis, 2011). Table 8 shows some of the partial measures which are used to judge an operation's performance.

Table 8.Some typical measures of performance (from Slack & Michael, 2008)

Objective	Some typical measures
Cost	Utilization of resources Labour Productivity Added Value Efficiency Cost per hour
Speed	Customer query time Order lead time Frequency of delivery Actual versus theoretical throughput Cycle time
Quality	Number of defects per unit Level or number of customer complaints Customer satisfaction score (index) Warranty claims Prime first time quality yield Scrap & Rework
Delivery	Order lead time % of products on time and in full Actual versus theoretical throughput time Manufacturing cycle time Percentage of orders delivered late Schedule adherence
Flexibility	Time needed to develop new products or services Machine change-over time Average capacity or Maximum capacity Time to change schedules Range of products or services

Adapted from Slack and Lewis (2011, p225)

However, most researchers identify cost, quality, delivery, and flexibility as the common priorities. For purpose of the study, the measures of performance pertaining to the four priorties (cost, quality, delivery, and flexibility) will be used as measures of performances (Kyengo, 2014).

2.4 Trade-Offs and counterview point

Researchers contend that manufacturing performance is measured along competitive priorities such as cost, quality, delivery, flexibility, and innovation (Hayes, Wheelwright & Clark, (1988). This performance, in turn, depends on the firm's manufacturing strategy. The strategy is pinned on the blend of structural decision components of a firm: capacity, supply networks/location, process technology, development and organisation, and vertical integration (see section 2.2.3) and infrastructural decision components human resource management, quality control, production planning and inventory control, performance / rewards systems and organisational structure (see section 2.2.4).

According to Kathuria, et al., (2018), researchers continue to ponder whether competitive priorities are pursued at the cost of one another or in tandem. Skinner (1996, p8) articulated the strategic trade-off law….. “trade-offs are inevitable; one system cannot be outstanding enough at meeting all criteria to create competitive advantage…”. The notion of trade-offs in the manufacturing strategy literature suggests that a company cannot excel simultaneously on all competitive priorities (Russel & Millar, 2014). Furthermore, it is practically impossible for a company to perform well on all competitive criteria (Lohmann, et al., 2019). As a result, trade-offs are defined by the conflict between objectives where a better performance of a competitive criterion impairs the performance of another competitive criterion (Lohmann, et al., 2019)

The trade-offs perspective proposes that superior performance along one priority can be attained only by sacrificing performance along another priority (Skinner, 1969). Therefore, according to this perspective, a company could not simultaneously perform well on all competitive priorities (Hayes and Wheelwright, 1984). This approach is supported by many researchers (Kathuria, et al., 2018; Boyer & Lewis, 2002; Pagell, et al., 2000; Safizadeh, et al., 2000; Silveria & Slack, 2001).

According to the Massachusetts Institute of Technology (2016), different companies within the same industry have different strengths and weaknesses and choose to compete in different ways. The different production "systems" have diverse operating conditions and each involves a different set of trade-offs.

Therefore, no one operating system is entirely superior under all competitive situations and for all companies (Lohmann, et al., 2019). Every manufacturer expresses a set of trade-offs. Some will be particularly good at producing standardized products in high volume at low cost; others will excel at responding quickly to shifting demand for more customized products (Boyer & Lewis, 2002). Consequently management has to decide which priorities are critical in order to achieve a firm's success and then allocate the resources accordingly (Russel & Millar, 2014). Plants should focus on one priority at a time, because cost, flexibility, quality, and delivery capabilities require different operational structures and infrastructures for support (Ping, et al., 2006).

Some researchers actively advocate for entities to focus on a single manufacturing priority and devote their limited resources accordingly, while others claim that advanced manufacturing technology enables concurrent improvements in quality, cost, flexibility, and delivery (Boyer & Lewis, 2002).

On the contrary, there is compelling evidence in support of the argument that manufacturers can simultaneously and successfully pursue multiple capabilities (Kathuria, et al., 2018). According to this perspective, manufacturers view competitive priorities and capabilities as potentially supportive of one another. This means that manufacturers can simultaneously place high importance on multiple competitive priorities and pursue those (Nakane, 1986; Ferdows & De Meyer, 1990; Amoako-Gyampah & Meredith, 2007; Narasimhan & Schoenherr, 2013; Singh, et al., 2014; Lohmann, et al., 2019)

In their research involving over 400 Chinese firms, Cai and Yang (2014) concluded that both cost and quality are positively affected by the other's trade off, suggesting that Chinese managers consider these two priorities in parallel. That is, as they

develop manufacturing strategies, they consider whether they should focus on cost or quality. Furthermore, a trade-off involving delivery negatively affects cost efficiency, such that Chinese managers appear to believe that cost efficiency stems from delivery capabilities, consistent with the sequence suggested by the sand cone model (section 2.41).

In their study with Caribbean manufacturing firms, Russel and Millar (2014) found no evidence of trade-offs. They did not report of manufacturers experiencing tradeoffs among the competitive dimensions of quality, delivery, flexibility, and cost as suggested by the classical tradeoffs model.

Furthermore, Kathuria, et al.,(2018) concluded that a group of Indian manufacturers can compete effectively on multiple priorities simultaneously. Priorities are not viewed as trade-offs in their case.

2.4.1 Sandcone Model

This sandcone model argues that trade-offs are not necessary for two reasons. Firstly, global competition has intensified the pressure on plants to improve along all four dimensions and secondly “World Class Manufacturers” set the standard by developing capabilities that reinforce one another (Boyer & Lewis, 2002).

Firms can pursue multiple priorities simultaneously (Nakane, 1986; Noble, 1995; Lohmann, et al., 2019). Ferdows and De Meyer (1990) proposed a ‘sand cone model’ which suggests that plants can avoid trade-offs as certain operational capabilities enhance one another, enabling operations excellence to be built in a cumulative fashion. According to the model, there are four competitive priorities: quality, dependability (or delivery), speed and cost.

In their ‘sandcone’ model of operations excellence, they maintain that there is an ideal sequence in which operational capabilities should be developed by following a pre-specified order for developing manufacturing capabilities: first selecting high quality, then dependable delivery, followed by speed and then cost (Ferdows & De Meyer, 1990). The idea is that one must first fully conform to quality requirements

before focusing on dependability, then speed and finally cost. It is thus a cumulative model, where the present competitive priority is dependent on what has been achieved previously.

According to Russel and Millar (2014), several empirical studies have sought to test the trade-off and sandcone approaches. Flynn and Flynn (2004) used data from 167 manufacturing plants from 5 countries. The study provided support for the sandcone approach. In addition, Amoako-Gyampah and Meredith (2007) studied 126 manufacturing firms in Ghana and supported the cumulative capabilities theory as well. They found no trade-offs between the capabilities of quality, cost, delivery and flexibility.

Ping, et al., (2006), in their study, found out that there were differences between developed and developing countries on trade-offs. Developing countries have more trade-offs than developed countries. The economic development level will affect the trade-offs among competitive priorities.

Martin-Pena and Diaz-Garrido (2008) found that manufacturers emphasised quality and delivery most and then cost, thus supporting the notion that compettitive priorities are mutually supportive of each other and not traded off.

2.5 Order Qualifiers, Winners and Delights

A firm's sales performance is premised on its ability to win orders. The ability to win orders depends on its competitiveness (Hörte & Ylinenpää, 1997; Tsai, et al., 2013). Hill (2005) presented the concept of order winners which was later joined by the concept of order qualifiers (Hill, 1995). Slack & Lewis (2011) introduced the concept of order delights.

2.5.1 Order Qualifiers

Order qualifiers are the basic measures a company must fulfil to qualify to become a candidate for purchase (Hörte & Ylinenpää, 1997; Hill, 2005; Lohmann, et al., 2019). Slack and Lewis (2011), highlighted that qualifying factors may not be the major competitive determinants of success and not equal to winning the order. However,

they are important in making it into the order process which is a chance to compete against the competitors that fulfil the same criteria.

Furthermore, these are the aspects of competitiveness where the operation's performance has to be above a particular level just to be considered by the customer (Lohmann, et al., 2019). In other words, order qualifying criteria (dimensions) are those that a firm must meet for the product to even be considered in the market place. Maldaner and Kreling (2019) categorically stated that qualifiers must be in a minimum level required by the market to compete, fulfilling the minimal performance pattern. Holmberg and Moflag (2013) identified order qualifiers as price; quality; delivery reliability; and product range. These are considered further below.

2.5.1.1 Price

According to Al-Mamun, et al., (2014), price and price sensitivity are important inputs to strategic and tactical decisions. They affect companies pricing choices as well as its share of profitability. Each customer will have a certain price acceptability range and different customers have different limits in their perceptions of what price is within their ranges.

Customers do not want to pay less to get less; they demand to get as much output as possible of the money spent (Nesheim, et al., 2015). In their paper, Swink, et al., (2011), highlighted that the impact of price criterion varies depending on the objective and the importance of the purchase.

2.5.1.2 Quality

Since the late 1970s, producing products aligned with the end user specifications has been an important competitive criterion. However, in the recent decades, quality has long surpassed from being an order-winning criterion into an order qualifier (Holmberg & Moflag, 2013).

Customers are demanding higher quality (Purwanto & Sunjoto, 2015; Ling & Mansori, 2018). If a mismatch exists between the supplier's current performance and the customer's requirement, the supplier has to adapt and improve performance in order to meet the requirement (Hill, 2009). If this is not done and the quality requirement remains unfulfilled, the customer may switch suppliers. Since fulfilling

these quality requirements is imperative, quality is considered as a qualifier (Swink, et al., 2011; Csikosova, et al., 2018))

2.5.1.3 Delivery Reliability

According to Hill (2009), delivery reliability constitutes an order-qualifier criterion. Delivery reliability concerns the supplier's capability to deliver the purchased products to the customer on an agreed date and time. Rao, et al., (2011) highlighted that delivery performance provides an indication of how successful the supply chain is at providing products and services to the end user.

Hill (2009) further argued that if the supplier is not able to deliver the product as per agreement, the customer may respond by decreasing the amount of orders from the specific supplier. In the worst case, the supplier is rejected from the supplier list. Due to the high importance and the risk of losing a contract, the supplier's ability to meet the requirement of the criterion is critical.

2.5.1.4 Product Range

According to Hanks (2018), when a company develops a strong core product line, the product range allows the company to focus on those product lines while still offering enough variety in size, colour, taste or functionality to appeal to a wide range of potential customers

In addition, a supplier's capability to offer a broad product range enables the ability to meet specific requirements from the customers and by offering a broad product range the customer can more easily find a product that is suitable for their needs (Hill, 2005). According to Hill, (2015) as well, a broad product range forces the suppliers to develop a process that can manage differences in the product range at a low cost.

2.5.2 Order Winners

According to Hörte & Ylinenpää, (1997) and Lohmann, et al., (2019), order-winning criteria are those measures that make a difference to the customer when he decides between qualified offered products. As defined by Holmberg & Moflag (2013), order winners are the criteria which determine why a certain company wins the order. To

win the order, a company must perform the criteria better than the competitors who also meet the requirements for order qualifying.

Slack & Lewis (2011) argue that order-winning factors are dimensions that significantly contribute to winning business from customers. They further posit that these are regarded by customers as key reasons for purchasing the product or service. These factors are used by companies to define their brands or their competitive stance. Order winning criteria are dimensions that differentiate the manufacturer from its competitors and “win” the order (Hill, 2000; Jaller & Ullstrom, 2008). Furthermore, Maldaner and Kreling (2019) opined that order winners are considered by consumers as key reasons for buying a product or service; therefore, should be offered a better performance than the competitor's to enhance the company's competitiveness and take over the market.
Holmberg and Moflag (2013) identified order winners as brand name; delivery speed; supply flexibility; and marketing and sales. These are considered further below.

2.5.2.1 Brand Name

A brand embodies the sum of people’s perception of a company’s customer service, status and advertising. Good branding increases the value of a company, provides employees with direction and motivation, and makes acquiring new customers easier (Zhang, 2015; Almutlaq, 2016). A company´s brand name serves as an order-winning criterion when the product the company provides is embodied with an image (Hill, 2005)

2.5.2.2 Delivery Speed

According to Holmberg and Moflag (2013) the ability to deliver resources and products faster than competitors makes that an order winning criterion. A firm’s capacity to deliver timely makes for high customer and client satisfaction (Csikosova, et al., 2018).

2.5.2.3 Supply Flexibility

According to Kaschel (2014), flexibility refers to the ability of a manufacturing system in responding, cost effectively and rapidly, to changing production needs and requirements. This capability is becoming increasingly strategic for the design and operation of manufacturing systems, as today’s operating environments are highly

variable and unpredictable (Vedamani, 2018). This ability to quickly respond to demand fluctuations is seen as an order-winning criterion (Hill, 2005).

2.5.2.4 Marketing and Sales

According to Holmberg and Moflag (2013), a competent marketing and sales function is frequently stated as an order-winning criterion. The premise is that the supplier can access insightful details concerning the customer and can tailor the products and services to suit the customer's needs and requirements.

2.5.3 Order Delights

Slack and Lewis (2011) introduced the idea of order delights. These are features of performance that customers are still to be made aware of. The underlying premise is that if an organisation presents a customer with a 'delight' the implication is that, because the customer is unaware of it, no competitor has offered it to them.

Although Maldaner and Kreling (2019) stated that delights are less important criteria as they do not influence directly the consumer, Customer delight is the surprising of a customer by exceeding his or her expectations and thus creating a positive emotional reaction (Lohmann, et al., 2019). According to Lohmann, et al., (2019) as well, customer delight can be created by the product itself, by accompanied standard services and by interaction with people at the front line.

2.6 Manufacturing Strategy

Manufacturing Strategy can be considered as a pattern of choices made in order to achieve the full competitive capability of a business unit (Silva, et al., 2016). These strategies are either explicitly drawn up or implicitly realised as manifested in a stream of real time decisions made at different points of time (Maldaner & Kreling, 2019). It is a functional (plant level) strategy (below corporate and business strategy).

Manufacturing strategy is defined by structural factors and infrastructural factors (Silva, et al., 2016). An operations or manufacturing strategy is viewed as the effective use of these resources to achieve business and corporate goals (Maldaner & Kreling, 2019). The literature generally agrees that organisations with formal and

visible strategies performed better than those without strategies. According to Lofving (2014), formality is the extent to which the manufacturing planning process is structured, through written procedures, schedules and other documents, and the extent of documentation resulting from the planning process. In addition, outlines the monitoring, collection, and dissemination of relevant information leading to appropriate decisions, focused implementation, and the achievement of specific goals (Boateng, et al., 2015)

Slack and Lewis (211) give four perspectives on manufacturing strategy; top-down approach; bottom-up approach; operations resources approach; and market requirements approach. With a top-down strategic approach, the CEO, GM and senior managers establish the plans and goals, and then communicate that strategy to middle managers, who then become tasked with executing that strategy through rank-and-file employees (Heyden, et al., 2016; Brady & Walsh, 2007).

A primary advantage of a top-down approach is that it maintains a chain of command that provides stability and direction in the workplace (Quain, 2018). Another advantage is that when companies have experienced and knowledgeable executives, this approach can streamline the decision-making process and save time and money (Heyden, et al., 2016; Quain, 2018).). The top-down action plans tend to reflect top management's strategic intentions with regard to the organisation's specified priorities (Kim, et al., 2014).

According to Brady & Walsh, (2007), although many companies choose the top-down approach, there are several drawbacks, including the fact that executives can ignore or fail to seek the input of talented and creative middle managers and employees. As a result, effective ideas and initiatives that could improve productivity and efficiency never filter up to those with the power to implement them (Quain, 2018). Another disadvantage is that executives may make decisions that are not practical or easy to implement, which can limit employee buy-in and create a toxic work environment (Kim, et al., 2014).

Slack and Lewis (2011) define a bottom up activity where operations improvement cumulatively build strategy while Rosinski, et al., (2014) define it as a participative

approach involving employees' participation in operations. Rank-and-file workers are in the best position to understand the barriers to increased productivity and efficiency (Rosinski, et al., 2014). The operations resources/capability is discussed in section 2.6.2 while the market requirements strategy is discussion in section 2.6.3.

On strategy visibility or awareness, it was argued that employees' organisational strategy awareness has a positive relationship with employees' commitment for organisational success (Vance, 2010). Gagnon, et al., (2014) argued that operational employees will not commit to organisational success unless they have an appropriate understanding of the manufacturing strategy. Therefore, the leaders in organisations must invest time and resources to communicate organisational strategies to their employees.

In his research in Australia involving 600 entities, Terziovski (2010), found out that Small to Medium Enterprises typically have informal strategies, largely driven by their chief executive officers (CEOs). However, large organisations, have defined strategies as they generally have separate strategic-planning units (Hudson et. al., 2001).

2.6.1 Traditional Manufacturing Strategies

As articulated by Diallo and Mingaine (2013), research on manufacturing strategy has grown considerably in the recent years. Nevertheless, the clarity on the subject has diminished as different approaches and different views have emerged. Some of the views are considered below.

Swamidass and Darlow (2000) identified manufacturing strategies as based on competitive priorities. After studying case studies of American companies, they suggested a quality based strategy, a manufacturing cost based strategy, a flexibility based strategy, and timeliness or delivery based strategy and an innovation based strategy. A summary of the popular strategies over the years is given in table 9. The researcher chose to explain only the strategies that have generated a lot of debate over the years.

Table 9. Manufacturing strategies (summarised by researcher).

Strategy Identified	Authors
quality based strategy	Swamidass and Darlow (2000) (Nair & Boulton, 2018) (Jabbour, et al., 2012) (Swafford, et al., 2006) (Dangayach & Deshmukh, 2006) (Martin-Pena & Diaz-Garrido, 2008) (Wang, 2008) (Camfield & Sellitto, 2018) (Awwad, et al., 2013) (Jitpaiboon, 2014) (Russel & Millar, 2014)
cost based strategy	(Jitpaiboon, 2014) (Russel & Millar, 2014) (Berglund & Stohm, 2015) (Narwal, 2014) (Slack & Lewis, 2011) (Storck, 2009) (Phusavat & Kanchana, 2007) (Russell & Millar, 2014) (Slack & Lewis, 2011) (Garo & Guimarães, 2018) (Kavitha, et al., 2013)Swamidass and Darlow (2000) (Kurt & Zehir, 2016)
flexibility based strategy	Swamidass and Darlow (2000) (Ward & Duray, 2000), (Golec, 2015) (Takala, 2002) (Nair & Boulton, 2018) (Jabbour, et al., 2012) (Swafford, et al., 2006) (Dangayach & Deshmukh, 2006) (Martin-Pena & Diaz-Garrido, 2008) (Wang, 2008) (Camfield & Sellitto, 2018)
delivery based strategy	Swamidass and Darlow (2000)
Resource Based View Strategy	(Barney, 1991) (Terziovski, 2010), (Moran & Meso, 2011), (Burgelman, 1995) (Dekkers, 2000) (Maldaner & Kreling, 2019) (Schroeder, et al., 2002) (Chacha, 2010) (Orr, 2009) (Wang, 2014) (Liu & Liang, 2015) (Bromiley & Rau, 2016) (Soosay, et al., 2016) (Boström & Krol, 2018) (Lindgren & Konopik, 2019)
Market Based View Strategy	(Burgelman, 1995) (Dekkers, 2000) (Wang, 2014) (McGee, 2015) (Soosay, et al., 2016) (Lindgren & Konopik, 2019)
Capacity Based Strategy	(Bagshaw, 2015) (Slack & Lewis, 2011) (Wang, 2014), (Silva, et al., 2016)
Innovation Based Strategy	(Terziovski, 2010) (Slack & Lewis, 2011) Miller and Roth (1994) Cagliano (1998)

2.6.2 Resource Based View

Manufacturing Strategy is a strategic asset (Moran & Meso, 2011). It results from the capability synergies of the manufacturing company and gives a company competitive advantage. As argued by Boström and Krol (2018), operations capabilities provide the fundamental basis of competitive advantage for manufacturing.

Instead of following the (predominant concept of isolating operations capabilities), Barney (1991) introduced the resource based view (RBV) to develop strategy. According to the RBV, a competitive advantage can be achieved when a firm possesses resources or assets that are value-creating and not simultaneously implemented by a large number of firms (Boström & Krol, 2018; Nason & Wiklund, 2018; Ramon-Jeronimo, et al., 2019).

Schroeder & Bates (2002) and Holdford (2018) stated that RBV explores the role of assets, resources and capabilities in manufacturing plants that cannot be easily duplicated, and for which ready substitutes are not available in competition. As defined by the resource-based view, a strategic asset is one that is simultaneously valuable, rare, imperfectly imitable, and non-substitutable (Moran & Meso, 2011; Kamboja, et al., 2015). Furthermore, it is only the strategic assets that differentiate it from competitors. Specifically, the RBV argues that a competitive advantage emerges from unique combinations of resources that are economically valuable, scarce, and difficult to imitate (Holdford, 2018; Mikalef, et al., 2019). The asset should be able to exploit opportunities and neutralise threats within a firm's environment (Schroeder & Bates, 2002; Kraaijenbrink, et al., 2019). Secondly, an imitable asset can be sustained for long periods of time without competitors acquiring it or duplicating it. In addition, they should not be strategically equivalent valuable substitutes (Moran & Meso, 2011; Schroeder & Bates, 2002).

Schroeder and Bates (2002) studied over 164 manufacturing plants and empirically established that competitive advantage in manufacturing (as measured by superior plant performance) resulted from branded processes and equipment which, in turn, was driven by skilled manpower. They demonstrated that assets and resources such as standard equipment and employees with generic skills are not as effective in achieving high levels of plant performance, since they are freely available to

competitors (Diallo & Mingaine, 2013). Liu and Liang (2015) in their exploratory study of several Finnish high-tech manufacturing industries suggested that implementing the resource-based view into the operations strategy can consistently adapt the manufacturing process and build up a sustainable competitive advantage. Mikalef, et al., (2019) confirmed the RBV theory by using survey data from 202 chief information officers and IT managers working in Norwegian firms. They concluded that IT strategic assets can help firms build a competitive advantage.

Orr (2009) applied the RBV manufacturing strategy in the flower industry in Australia. He examined the effect of six variables on competitive advantage (1) the use of resources, (2) the impact of the development process on resources, (3) the impact of management control on the development of resources 4) the impact on capability of management, process, region and scale, (5) the impact of resource development maturity on the approach to resource development and (6) the possibility of evaluating individual resources according to various criteria. He postulated that the first four had a significant effect, thus supporting the RBV approach

Despite the testing of the RBV approach, Liu and Liang (2015) highlighted that the RBV comes along with the drawback of being static and ignoring market dynamics. A competitive advantage can diminish over time (Swamidass, 1987). This implies that resources and capabilities are also in a steady change over time. Hence, firms must not only build up capabilities according to the RBV theory but also need to be able to adapt their capabilities to the changing requirements of the market they are acting in (Boström & Krol, 2018; Kraaijenbrink, et al., 2019).

2.6.3 Market Based View

The market-based view (MBV), underscores the role of market conditions in developing strategy for a firm (Dekkers, 2000; McGee, 2015). The competitive strategy is largely conceived as a positioning of the firm in its markets (Peters, et al., 2011). This contrasts with the resource-based view (RBV) which focuses on the firm's assets and resources and capabilities (Dekkers, 2000).

According to (Wang, 2014), the Market-Based View (MBV) of strategy argues that industry factors and external market orientation are the primary determinants of firm

performance. Makhija (2003), and Lindgren and Konopik (2019) also state that the approach typically stresses privileged end-product market positions as a basis for above-normal future returns and thus higher current firm value. Competitive advantage means the delivery of superior value to customers and economic value to firms in this case. Enhanced end product market position is the foundation for returns (Wang, 2014; McGee, 2015; Soosay, et al., 2016).

As argued by Lohmann, et al., (2019), the objectives of the organisation must be determined by the customers. Therefore, the customers' priorities must be translated by the company's operations strategy into tangibles.

Researchers observed that a firm's performance was significantly dependent on the industry environments (Peters, et al., 2011). In this perspective, a firm's source of market power explains its relative performance. Three sources of market power are frequently highlighted: monopoly, barriers to entry, and bargaining power (Grant 1991). When a firm has a monopoly, it has a strong market position and therefore performs better (Peteraf, 1993; Simpson, 2015; CEA, 2016; Todorova, 2016).

However, critics of the market-based view argue that it is strategy defeating to place the MBV at the centre of strategy and leaving the inside of the firm inactive (McGee, 2015). Some empirical evidence as articulated by Makhija (2003) suggests that when market conditions are in a state of instability then the firm's resources are likely to be the primary determinants of firm value.

2.6.4 Capacity Based Strategy

Slack (2015) defines capacity strategy as a term applied to an interconnected set of decisions, which determine the long-term capacity configuration of an organisation. Previously Hayes and Wheelwright (1984) had opined that a firm's capacity strategy involves the pattern of capacity-related decisions or adjustments made over time. It is different from a firm's capacity position.

Capacity refers to the limitation, which the operating element is able to process: the amount of services executed or tangible products produced (Bagshaw, 2015). The importance of capacity decisions relates to their potential impact on the ability of the

organisation to meet future demand for products and services; capacity essentially limits the rate of the possible output. The premise is that the capacity of a manufacturing entity can be used as a competitive weapon (Silva, et al., 2016). According to Cagle (2011), they can be insufficient capacity to satisfy demand or excess capacity which is indicative of a surplus or cushion.

The economic importance of capacity utilisation is seen in the level of demand (Soliman, 2017). Capacity decisions are generally strategic decisions involving investment commitment in resources, needed in the production of goods and services. If market demand grows, the rate of utilisation of capacity will likewise increase. Also, if demand decreases, capacity utilisation will follow suit (Bagshaw, 2015). If an organization carries too much spare capacity, operations may become inefficient. Too little spare capacity may result in a loss of sales or other constraints on action (Hayes and Wheelwright, 1984; Bradley, et al., 2011).

In their groundbreaking study, Olhager, et al., (2001) classified capacity strategy into three types: lead, lag or track. A lead strategy is based on the idea of a capacity supply surplus in which the objective is to maintain a capacity cushion. For a lead strategy with increasing demand, capacity is increased in anticipation of increased demand and if the demand trend is decreasing, capacity levels are reduced incrementally to demand levels (Hayes and Wheelwright, 1984; Olhager, et al., 2001)

In line with the lead strategy, Bagshaw (2015. p67) defined a comparative “Level Capacity Strategy” which involves maintaining stable workforce level and output rates over the planning horizon. This allows the firm to maintain inventory levels of finished products higher than expected in situations of low demand variability.

A lag strategy, referred to as a capacity demand surplus, is based on the objective of maximizing capacity utilization, namely targeting capacity levels to remain at or below demand levels. Capacity is increased as a result of realized demand increases. If the demand trend is negative, a firm’s capacity position is decreased in anticipation of decreased demand (Olhager et al., 2001).

On the other hand, a tracking strategy combines aspects of both the lead and lag strategies in order to track demand as closely as possible (Hayes and Wheelwright, 1984, Olhager et al., 2001). Bagshaw (2015. p67) defined this as the “Chase Capacity Strategy” which implies matching demand and capacity period by period. In the chase capacity strategy, workforce levels are adjusted through the process of hiring, firing or lay off of production employees to produce output levels to match demand requirements

2.6.5 Other Emerging Strategies

On one hand, Cagliano, et al., (2005), in their classical research involving 115 international companies on manufacturing strategies, practices and performances, came up with a summary of different strategies that are being pursued. The companies were drawn from Italy, Denmark, Spain, Hungary, Argentina, Norway, Germany. The summary is presented in table 10 below.

Table 10. Manufacturing strategy configurations according to different authors Source: Cagliano, et al., (2005)

Manufacturing Strategy	**Competitive Priorities**	**Name of Strategy**	**Researchers**
Market-based strategy: Market-led organisations seek to differentiate themselves by offering high product quality, superior customer service and high flexibility and product variety	Quality Service Flexibility Product variety	Market-driven strategy	Stobaugh and Telesio (1983), Marketer Sweeney (1991) Miller and Roth (1994) Cagliano (1998) De Meyer (1990)
Product-based strategy: Product-led organisations seek to compete through product innovation and improvement, which allows them to market high product quality and variety to affordable sales prices	Product variety Quality (price)	Technology exploiter Innovator High-performance producer	Richardson et al. (1985) Cagliano (1998) Miller and Roth (1994) Sweeney (1991) De Meyer (1990) Cagliano (1998) (Swamidass & Darlow, 2000)
Capability-based strategy: These seek to improve and innovate their capabilities (technologies, knowledge, competencies), which allows them to offer high product quality, including after-sales service, flexibility and affordable sales prices	Quality flexibility service price	Manufacturing innovator Reorganiser Breakthrough Technology-driven strategy Specialist	De Meyer (1990) Cagliano (1998) Sweeney (1991) Sweeney (1991) Stobaugh and Telesio (1983) Frohlich and Dixon (2001)
Price or Cost-based strategy: These companies operate in mature product markets, where the success factors are a good price-quality ratio together with the ability to adapt somewhat to specific customer requirements.	Price quality (flexibility)	Cost-driven strategy Caretaker Quick-fix Cost-minimising customiser	Stobaugh and Telesio (1983) Miller and Roth (1994) Sweeney (1991) Cagliano (1998) Frohlich and Dixon (2001) Sweeney (1991) Richardson et al. (1985) Cagliano (1998) (Swamidass & Darlow, 2000)

2.6.6 Factors leading to the adoption of Manufacturing Strategies

Several authors have attempted to identify factors that lead to the adoption of manufacturing strategies in firms. Researchers agree that successful strategy formulation and implementation is related to the firm factors and the external environment in which they operate (Narkhede, 2014; Charles, et al., 2015)

Specifically, it was stated that firm characteristics are measured by scope of operations in terms of markets served (Darbanhosseiniamirkhiz & Ismail, 2012; Hofmann & Knébel, 2013, Rodrigo, 2015), scale of operations in terms of production or operational capacity (Narkhede, 2014; Charles, et al., 2015, Mills, et al., 2013, Rodrigo, 2015); ownership structure in terms of decision-making system and the size in terms of small number of employees (Mills, et al., 2013; Narkhede, 2014; Charles, et al., 2015). Selection of the most ideal service or manufacturing process design for a company depends on several factors

According to Rodrigo (2015), selection of the ideal process depends on the nature of the marketplace, the business, and the product itself. Mills, et al., (2013), attempted to sum up the factors. He classified them into two categories namely factors that the business should achieve and factors that should enable the business. The factors are indicated in the table 11 below.

Table 11 Factors leading to adoption of manufacturing strategies (Mills, et al., (2013)

Those that the business should achieve	**Those that should enable the business**
▪ Satisfy customer demands	▪ Financial resources and accounts
▪ Production processes	▪ Need to become the best in the class
▪ Product definition/dimensions and technicalities	▪ Continuous process improvement
▪ Plant development (manufacturing capabilities and constraints)	▪ Increased competition
▪ Supply chain	▪ Organisation and development
	▪ Factors beyond control

The authors identified these factors as those that significantly affect the adoption of a manufacturing strategy.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the techniques that were employed to gather, collate, analyse and present the required data for the study. It also gives a summary of the case study protocol, research design and population.

3.2 Research Method

This research used a case study approach. According to Rowley (2002), a case study is an empirical inquiry that explores an existing phenomenon within its real life context. Furthermore, case study as a research strategy often emerges as a viable option for researchers who are seeking to undertake a modest scale research project based on their workplace or the comparison of a limited number of organisations (Harrison, et al., 2017; Rowley, 2002). It usually involves multiple data sources which can be direct detailed observations, interviews and documents in the unit of analysis.

Yin (2017), argued that a case study allows an investigation to retain the holistic and meaningful characteristics of real life events on organisations, individual or managerial processes. As opined by Maimbo and Pervan (2007), case selection must be determined by the research purpose, questions and theoretical context and supported by a case study protocol. This is a set of guidelines that can be used to structure and govern a case research project (Yin, 1994).

3.3 Case Study Design

A mixed-method, single-unit, embedded case study design strategy guided the decisions, planning, and implementation of the research methodology (Coulthard, 2016). This design strategy focused the inquiry on a single entity (niche steel maker). The data were collected from managers involved in strategy making and enforcing within the company context.

As mentioned in chapter 2, manufacturing strategy is considered as a pattern of choices made in order to achieve the full competitive capability of a business unit

(Maldaner & Kreling, 2019). These strategies are either explicitly drawn up or implicitly realised as manifested in a stream of real time decisions made at different points of time.

Therefore, the research design was the logic that aimed to link the data to be collected (status of structural and infrastructural factors) and the conclusions to be drawn to the initial questions of the study (Rowley, 2002). According to Yin (1994), a case study design must have five components study questions; propositions; unit of analysis (population and sample size); research instruments and data collection and the criteria for interpreting findings.

3.3.1 Questions and propositions

The principal aim of the research was to determine the status of structural and infrastructural factors and their effect on operational competitiveness in niche steel producing firm in a South African setting. To attain this, a central research question was asked (section 1.6) with supporting objectives (section 1.7).

3.3.2 Unit of analysis and population

Single cases are often used in longitudinal research because they offer greater opportunity for depth of observation and have consistently been one of the most powerful research methods in operations management (Chris, et al., 2002). However, single cases have limits on generalisability of conclusions and biases such as misjudging the representativeness of a single event, according to Karlsson (2009).

The unit selected for study is a niche producer of steel. It employs over 600 people and has all the managerial functions such as operations, planning, engineering as well as support service departments [quality, human resources etc.].

From the unit, a population was selected. Blumberg et al., (2008), stated that a population is the total collection of elements about which one wishes to make some inferences. For the purpose of this study, the population was defined to include all employees working for this case study firm. The sample was all management

personnel. It is assumed that management personnel formulates and enforces the operations strategy.

The researcher purposefully selected individuals who can provide the necessary information. Purposive sampling means that the researcher intentionally selects participants who have leverage in operations strategy (McNeill & Chapman, 2005). The table 12 below represents the population under study.

Table 12. Summary of the population and sample

Key	Category	Number	Targeted	Actual Participated	Response rate
	Employees working for the unit (excluding managers)	640	No	N/A	N/A
X	Executive/Top management [C and D roles]	8	Yes	5	62.5%
Y	Managers [E, F and G roles]	78	Yes	52	66.7%
X+Y	Total sample	86	Yes	57	66.3%

3.3.3 Research Instruments and data collection

A questionnaire to survey the sampled population and document analysis approaches were used. An online questionnaire was used and was designed to collect the primary data. This was to measure the status of the decision areas and strategy or strategies being pursued. The sections of the questionnaire were as follows:

- Section A:Demographic data

  This section sought to find out the hierarchy or role and the level of experience (number of years of employ) of the respondents. Only these two were asked in order to maintain anonymity and manage ethics issues.

- Section B: Awareness and formality of the manufacturing strategies used

  The second segment of the questionnaire was to find out the level of awareness, the formality among the respondents of the manufacturing strategy inherent within the niche company and to extract the level of participation in the decision

making process among the different management levels as explained in section 2.6 of the literature.

- Section C: Competitive priorities / structural and infrastructural decisions areas and factors leading to adoption of manufacturing strategies

  This section was to assess the degree of emphasis put on the four competitive priorities, namely cost, quality, flexibility and delivery by the organisation. In addition, it was to rate the importance placed on the structural and infrastructural factors when decisions to design and support the manufacturing strategy are taken. These factors were identified as from Hayes & Wheelwright, (1988); Kim & Arnold, (1996); Boyer, et al., (2005); James, (2011); Rodriguez-Espino & Gil-Padilla, (2015); Slack & Lewis, (2011) and Bakare, (2016) as

  i. Facilities (size, location)
  ii. Plant production capacity
  iii. Process technology (selection of appropriate technology)
  iv. Supply network / Chains
  v. Planning and control systems
  vi. Quality assurance and control approaches
  vii. Work organisation
  viii. Sustainable competitive advantage
  ix. Continuous Improvement

Furthermore, the respondents were given factors that lead to adoption of manufacturing strategies and asked to rate their influence on the choice of manufacturing strategy for this case study. The factors were identified from Charles, et al., (2015); Narkhede, (2014); Darbanhosseiniamirkhiz & Ismail, (2012); Rodrigo, (2015); Hofmann & Knébel, (2013) as

i. Need to become the best in the world (World Class)
ii. Continuous process improvement
iii. Manufacturing capabilities and constraints
iv. Financial resources available
v. Satisfy customer demands

vi. Product dimensions, technicalities and

vii. Increased competition

All these were the independent variables or the predictors. An appropriate Likert scale was used for the responses.

- Section D: Relationship between manufacturing strategy or strategies and operational performance

Respondents were given 22 operational performance measures as explained in in table 8, section 2.3 (dependent variables) and asked to rate whether these had improved, worsened or stayed the same over the five years since 2016. It was to measure the impact on them by the inherent manufacturing strategy or strategies in use by the niche steel producer. Table 13 below shows the operational measures against the strategy.

Table 13. Operational performance measures under each strategy

	Operational Strategies			
Operational measures	**Flexibility**	**Cost**	**Quality**	**Delivery**
	Time needed to develop new products or services	Utilization of resources	Number of defects per unit	Order lead time
	Machine change-over time	Labour Productivity	Level or number of customer complaints	% of products on time and in full
	Average capacity or Maximum capacity	Added Value	Customer satisfaction score (index)	Actual versus theoretical throughput time
	Time to change schedules	Efficiency	Warranty claims	Manufacturing cycle time
	Range of products or services	Cost per hour	Prime first time quality yield	Percentage of orders delivered late
			Scrap & Rework	Schedule adherence

Source: Slack & Lewis, (2011)

For purposes of the research, the four strategies selected for study were flexibility, cost, quality and delivery strategies. These measures are placed under the applicable strategy in table 13.

The questionnaire approach was used to gather specific and unique knowledge and behaviours in the field of manufacturing strategy from the targeted sample. Furthermore, questionnaires are helpful in maintaining participants' privacy because participants' responses can be anonymous or confidential (Murdoch, et al., 2014).

The survey within the case study (supported by Yin, 1994) was instrumental in evaluating the status of the independent predictor variables that included tenets of competitive priorities (cost, quality, delivery and flexibility), structural items (process technology, facilities, vertical integration etc.) and infrastructural factors (production planning, organisational structure, quality management etc.) and its relation to operational performance (dependant variables). Data was collected between March 2019 and December 2019.

3.3.4 Criteria for interpreting findings

According to Baruch (2008), the average and also reasonably acceptable response rate is 60% +/-20% meaning that anything below 40% is not reasonably acceptable and would generate validity issues. As articulated by Brtnikova, et al., (2018), the survey response rate is a commonly used indicator of the representativeness of collected data. When response rates are high, the potential for differences between respondents and non-respondents is lower, thus increasing the likelihood of generalising the results to the population sampled as the likelihood of response bias is reduced. Achieving a high response rate is also important for increasing efficiency and reducing cost of surveys implementation.

In addition, surveys suffer from "survey response fatigue". The first one is when people receive more and more requests for their feedback, which makes them less likely to accept any particular request. Secondly, it occurs when surveys are too long or not applicable to them. This is evidenced by high rates of abandonment mid-survey (Baruch, 2008).

The processing of data from the question involved editing, coding, classification, tabulation and use of percentages. Analysis of data was uni-dimensional and mainly interpreted using descriptive statistics involving measures of mean, central tendency, standard deviation and dispersion. The data were analysed using Microsoft XLStat.

Sections A, B and C were analysed using descriptive statistics such as frequency distribution as well as factor analysis to give overall picture about the firm and respondents. Section D was analysed by multiple regression analysis to determine the relationship between manufacturing strategy or strategies and operational performances.

Multiple Regression Analysis refers to a set of techniques for studying the straight-line relationships among two or more variables. Manufacturing strategy measures based on the competitive priorities were the independent variables (predictors), while operational performance measures were the dependent variable (questionnaire responses).

The regression equation that expresses the linear relationships between a single dependent variable and one or more independent variables is:

$$\hat{y} = b_0 + b_1x_1 + b_2x_2 + \ldots + b_{k-1}x_{k-1} + b_kx_k + \varepsilon$$

In this equation, $\hat{y}$ is the *predicted* value of the dependent variable. Values of the *k* independent variables are denoted by x_1, x_2, $x_3 \ldots x_k$. These are the scores of predictors i.e. manufacturing strategy variables where

k:= number of Predictors in model

ε = Residual (Error term)

b's - b_0, b_1, b_2, … , b_k. The b's are constants, called regression coefficients. Values are assigned to the *b*'s based on the principle of least squares.

X1, X2, X3… Xk = scores of predictors i.e. manufacturing strategy variables

3.3.4.2 Secondary Data

Secondary data were collected from the public domain (published financial statements as well as company archives/records) as well as the bi-annual customer feedback (company marketing records/archives) on all the competitive deliverables. The document analysis approach was used to collect secondary data on the firm's financial performance data (on the public domain) as well as the customers' insights and perception about this niche steel producer.

The customer survey is a yearly publication report that summarises customer perspectives on performance areas. Table 14 below shows the specific items covered by the customer survey questionnaire. This was collected from 2016. These records are kept by the company and available upon request.

Table 14. Aspects and elements of secondary data

No.	Aspects	Elements
1	Financial Aspects	▪ Return on Assets ▪ Share price ▪ Return on investments
2	Commercial aspects	▪ Ordering Process ▪ Steel Price Competitiveness ▪ Billing Process ▪ Billing accuracy ▪ Account query resolution ▪ Credit Management
3	Product Aspects	▪ Product quality ▪ Packaging ▪ Dimensional tolerances ▪ Claim ratio ▪ Claim handling response ▪ Resolution of claims ▪ Corrective Actions
4	Delivery Aspects	▪ Production lead time ▪ On time delivery ▪ Handling of backlogs ▪ Delivery tolerances ▪ Flexibility ▪ Availability of volumes
5	Personnel Aspects	▪ Professionalism ▪ Ability to solve problem ▪ Responsiveness ▪ Accessibility ▪ Technical Knowledge ▪ Communication
6	Progressiveness of the niche supplier	▪ Innovative ▪ Technologically advanced ▪ Proposing of new solutions ▪ Reliability ▪ Environmentally responsible
7	Customer Interaction	▪ Customer orientation ▪ Understand my ability ▪ Will adjust product offering to suit my business

Source: Niche Company Customer Survey Items (archives)

According to Bowen (2009), document analysis is an efficient and effective way of gathering data because documents are manageable, accessible and practical resources as well as being reliable. Furthermore, obtaining and analysing documents is often far more cost efficient and time efficient than conducting one's own research or experiments.

In addition, documents are stable, "non-reactive" data sources, meaning that they can be read and reviewed multiple times and remain unchanged by the researcher's influence or research process (Bowen, 2009)

3.3.4.2.1 Secondary Data/Document Analysis

Secondary data were used to support or refute the analysis obtaining from the primary data. The data were already processed and in the public domain.

3.4 Reliability and validity

Reliability and validity concepts are central to the idea of quality in research and its conduct (Mohajan, 2017). Yin (1994) defined reliability as the extent to which a study instrument will produce the same or similar results when applied repeatedly. It is important that research instruments are clear and unequivocal so that respondents interpret them correctly (Maimbo & Pervan, 2007)

According to Neuman (2011), validity represents the 'truthfulness' of a research instrument. Consequently, a research instrument should have both internal and external validity. External validity refers to the extent to which the results of a study can be generalised to other settings while internal validity is the extent to which we can establish a causal relationship between the independent and dependent variable. Addressing these components will result in an instrument that will closely approximate a true measure (Neuman, 2011).

To manage reliability and validity issues, the researcher's background and role was acknowledged (see section 3.4.1); the means by which an unbiased sample was chosen reported; the use of an adapted questionnaire whose validity and reliability has been tested in previous studies; the strategies taken to collect unbiased data

was included; the data analysis method be detailed and that the researcher accounted for the processes used to control and check interpretations.

3.4.1 Role of the researcher

Detailing the researcher's roles, perceptivity, and potential biases is especially important when conducting research involving case studies (Rowley, 2002). As argued by Coulthard (2016), even though the researcher may not directly affect the collection, measurement, or analysis of quantitative data, a researcher's beliefs, values, knowledge, and experience inarguably impact the interpretations of results.

As a result, disclosing the background, expertise, and potential biases of the researcher can enhance the trustworthiness and credibility of the analysis. The researcher is a middle manager employed by this concern in one of the service providing sections. He is not directly involved in strategy formulation.

3.5 Ethics Clearance

Permission to conduct this research on this case was granted by Wits School of Mechanical, Industrial and Aeronautical Ethics Committee. All ethical issues were cleared

CHAPTER FOUR: RESULTS AND ANALYSIS

4.1 Introduction

The data generated were analysed and the results presented in this chapter in the ensuing sections: Section 4.1 is the introduction of the chapter, followed by section 4.2 which provides the descriptive statistics of the variables. The analysis includes demographics and the descriptive statistics including means, standard deviations and frequency distributions.

The factors leading to the adoption of manufacturing strategies were examined by descriptive and factor analysis. Additionally, manufacturing strategies were analysed using descriptive statistics to determine formality, awareness and participation, competitive priorities and decisions relating to design of process and infrastructure. Furthermore, multiple regression analysis was applied to examine the relationship between manufacturing strategy and operational performance, within the case study setting as permissible by Yin (1999).

The primary research data were collected through an online survey. In total, 57 responses were collated from a sample/ population of 86 managers, which translated to 66% response rate. The survey experienced “survey fatigue problems” as the respondents had to be reminded to complete the survey by a general pop up message.

4.2 Demographics

Demographic information was statistical data collected about the characteristics of the population. It provided data regarding research participants and was necessary for the determination of whether the managers in this study were a representative sample of the target population for generalisation purposes, within the unit selected.

The respondents were asked to state their hierarchical level/role of their managerial position on a scale of A (chief executive officer), B (chief operating officer), C (general manager), D (head of departments), E (senior managers), F (middle managers) and G (junior managers) – of which A is the most senior / executive

manager and G is the most junior manager in the case study. Table 15 summarises the responses. Out of the total of 86 managers of all levels, 57 (66%) responded to the survey. The breakdown of responses by level of management is given in table 15.

Table 15. Response rates per level

Managerial level	Total Population	Response	% Response	Greater than 40% response
A	1	0	0	X
B	2	0	0	X
C	4	0	0	X
D	9	5	55.6	√
E	27	21	77.8	√
F	16	11	68.8	√
G	27	20	74.1	√
Total sample	86	57	66.3	√

Source: Research data

Table 15 shows that all levels of management were fairly represented (>40%) except from the general manager' level and upwards. There were no chief executive officers (A), chief operating officers (B) and the general managers (C) that responded to the survey.

Secondly, the respondents were asked to indicate their length of service with the niche company. They were asked to select less than 5 years, 5 to 10 years, 11 to 20 years, or over 20 years. The study sought to know the duration of employ of each respondent with the organisation. The findings are displayed in table 16.

Table 16. Response rate per work experience

Experience in years	**Response Frequency**	**% Response Frequency**
>20 years	28	49.1
>11 years <20	22	38.6
>5 years <11	5	8.8
<5 years	2	3.5
Total	57	100.0

From the responses above, about 49.1% had over 20 years of employ, about 38.6% between 11 years and 20 years. Approximately 12.3% has been with the company for less than 11 years.

4.3 Awareness of the strategy being used

The managers were asked to specify their levels of awareness of the manufacturing strategy or strategies being used in the organisation. They were to select from three options: 1-not aware, 2- aware and 3-fully aware. Table 17 shows the results.

Table 17. Levels of awareness to the manufacturing strategy

Position	Fully Aware	Aware	Not aware	% fully aware
D	5	0	0	100
E	7	10	4	33.3
F	1	9	1	9.1
G	0	15	1	0
Total	17	34	6	29.8
% Frequency	**29.8**	**59.6**	**10.5**	

From the study, close to 30% indicated that they were fully aware of the manufacturing strategy prevailing. About 59.6% highlighted that they were aware while approximately 10.5% were not aware of the strategy, as shown by table 17. However, full awareness decreases as you go lower the hierarchy.

The statistics of the awareness levels were computed and presented in table 18 below.

Table 18. Statistics on the awareness of strategy

	Awareness of the strategy (not aware =1, fully aware =3)
Mean	2.18
STD	0.601272669
Skewness	-0.082017094

A mean score of 2.18 indicated acceptable levels of strategy awareness with the population (1 – being not aware and 3 being fully aware)**.** In summary, 89.4% of the respondents indicated that there were levels of awareness within the organisation.

4.4 Formality of the strategy formulation process

Managers were asked to rank the formality of the strategy process between a scale of 1 and 3; 1 being the informal, and 2 formal and 3 fully formal. The descriptive statistics are summarised in table 19 below.

Table 19. Formality of the manufacturing strategy

Positional Role	Formal	Partially Formal	Informal	% with at least some formality
D	3	2	0	100
E	5	14	1	95
F	3	7	2	83
G	8	11	1	95
Totals	**19**	**34**	**4**	**93**
% Frequency	**33.3**	**59.6**	**7.0**	

The descriptive findings in table 19 show that nineteen (19) of the respondents representing slightly above 30 % of the total agreed that strategy formulation was formal, about 60% agreed that it was partially informal and 7.0% of the total respondents were of the opinion that the process was informal. In summary, 92.9% of the respondents concurred that the strategy formulation process had elements of formality in the organisation. The level of formality and partial formality is high at all management levels.

The statistics of the formality of the strategy formulation process across the management levels were computed and presented in table 20 below.

Table 20. Statistics on the formality of the strategy formulation process

	Formality of strategy (informal = 1, fully formal = 3)
Mean	2.25
STD	0.5757201
Skewness	-0.050565424

From table 20, a mean score of 2.25 indicated a high level of the formality of the strategy within the sample (1 – being informal and 3 being formal).

4.5 Level of involvement in the manufacturing strategy

The participants in the formulation of manufacturing strategies in organisations were identified as Chief Executive officer-A; General Managers-B; Top /Senior Manager-C & Ds; Middle managers-E & F; Line/junior managers-G; and Consultants

The respondents were asked to rate their responses on a scale of 1 to 4 on how they agreed with the extent of involvement of the above groups in the manufacturing strategy formulation process. The scale ranged from 1 (not involved at all) to 4 (highly involved). The results are shown in table 21 below.

Table 21. Level of involvement of the different hierarchies in the manufacturing strategy

	% Frequency of the responses					
Level of involvement	CEO A	GM B	Top (C & D) Management	Middle Managers (E & F)	Line managers G	Consultants
Not involved at all	1.8	1.8	-	-	15.8	39.6
Average involvement	14.0	8.9	12.3	**52.6**	31.6	18.9
Involved to a certain extent	14.0	3.6	3.5	15.8	24.6	35.8
Involved to being highly involved	**70.2**	**85.7**	**84.2**	31.6	28.1	5.7
Total	100.0	100.0	100.0	100.0	100.0	100.0

The results show that the CEO, GM and Top managers are heavily involved in the formulation process as represented by response rates of 70.2%, 85.7% and 84.2% respectively. Several respondents agreed with these results. See appendix A for open ended responses on the involvement of managers.

The respondents indicated that only 31.6% and 28.1% of middle and line/junior managers respectively were highly involved in the strategy formulation process.

Fifty-two percent (52.6%) pointed out that middle managers participate averagely in the process. About 16% of the response showed that line managers are not involved at all in the process.

4.4 Comparison of the Competitive Priorities

Four competitive priorities were selected for the purpose of study. These were cost, quality, flexibility and delivery. Respondents were asked to rank the degree of emphasis placed by the company, on each item, in the last five years in order to remain competitive. Each priority had a series of statements (items) to be ranked. A Likert scale ranked from 1- no emphasis at all to 4 –high emphasis was used.

A summary of the collated descriptive statistics of the four competitive priorities from the 57 respondents is shown in table 22.

Table 22. Comparison table of the four competitive priorities

Competitive Priority	Average Mean (lowest=1, highest = 4)	Std Deviation	No. of questionnaire items	Rank
Cost	3.10	0.745	5	2
Quality	2.68	0.788	6	4
Flexibility	3.31	0.709	8	1
Delivery	3.06	0.679	4	3

The results from descriptive statistics presented in table 22 reveal that the respondent's ranked flexibility as the number one priority the company is pursuing at a mean of 3.31, followed by cost at a mean of 3.10. Delivery ranked third with an average of 3.06 while quality was least with 2.68.

4.4.1 Summary Results of the individual Competitive Priorities

The statistical responses are summarised in figure 4 below. The cost priority had five statements and is shown in blue followed by the quality priority in orange with six statements.

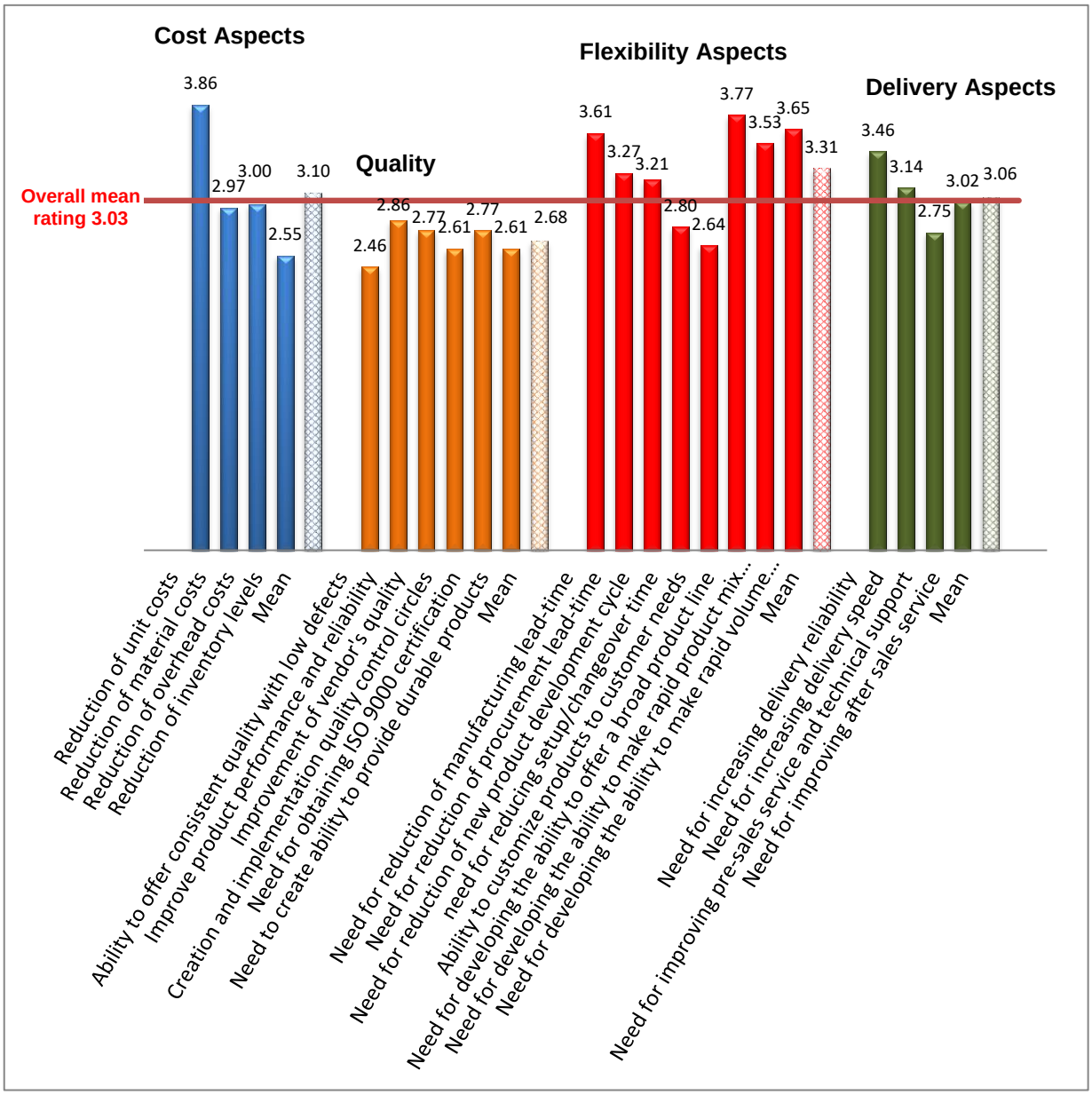


Figure 4. Summary of responses on the competitive priorities

The last two were the flexibility priority in red and the delivery one in green respectively. A Likert scale ranked from 1- no emphasis at all, to 4 –high emphasis was used. An overall mean of 3.03 for all the responses is also shown for comparison sake.

The results from the descriptive statistics presented in figure 5 above reveal that from the questionnaire items, the respondents ranked the need to reduce unit costs, need to reduce the manufacturing lead time, need to develop the ability to offer a

broad product line, need to develop the ability to make rapid volume changes and the need to increase delivery reliability high in priority as evidenced by their high scores of above 3.50. They all agreed that reducing all these would result in competitive advantage.

The quality priority was ranked the lowest in all the questionnaire statements. The respondents agreed that the niched producer is not pursuing a quality approach. Furthermore, the delivery aspects were ranked low. Respondents also agreed that the niche producer is not pursuing the delivery priority as well.

4.5 Structural and infrastructural decisions areas

This section reports on the status of structural and infrastructural decision areas that support manufacturing. The descriptive summary is shown in table 24 below. Table 23 shows each decision items with the corresponding mean scores.

Table 23. Descriptive statistics on the structural and infrastructural factors

Structural/Infrastructural factor	Mean (lowest =1, Highest =3)	Std Deviation
Plant production capacity	2.82	0.431
Facilities [size, location]	2.59	0.596
Process technology [appropriate technology]	2.38	0.648
Quality assurance and control approaches	2.34	0.549
Supply networks/ chains	2.30	0.601
Planning and control systems	2.18	0.431
Sustainable competitive advantage/continuous improvement	2.02	0.618
Work Organization	1.93	0.628
Mean	**2.32**	

A total of eight factors were subjected to ranking and a Likert type of scale was used, with the highest critical decision (highly Important) scoring (3) points, whereas that with least important (not Important) scored (1) point.

The results from the descriptive statistics show that plant production capacity is the overbearing reason that dictates the decisions relating to the design of process and manufacturing strategy being pursued. This had a score of 2.82. Secondly, the

location and size of facilities had a score of 2.59 while the process technology (selection of appropriate technology) was ranked at 2.38.

Figure 5 represents the same data in table 23 graphically to illustrate some finer comparison details.

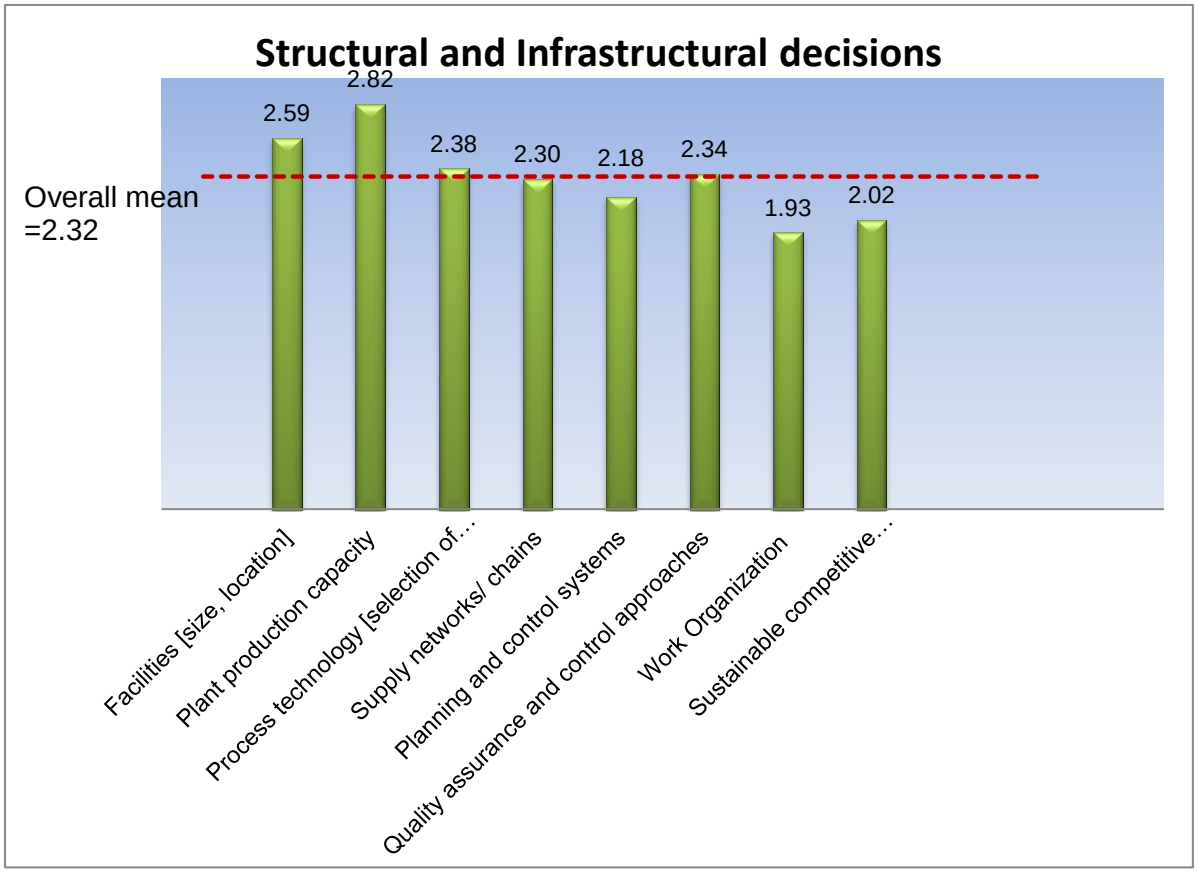


Figure 5. Graphical representation of the decision areas

It shows that facilities and production capacity decisions are above the average while process technology and quality assurance are marginally above the average. The rest are below the mean of 2.32.

4.5.1 Resource Usage – Strategy mix

Figure 6 below shows the summary interaction or resource usage (see section 2.2 on literature) between the competitive priorities (section 4.4) and the decision areas (section 4.5). The statistical summary was computed as a 4 x 8 matrix table (multiplying the priority scores with decision area scores) and results shown in figure 6. Highest possible score is 12 from the highest Likert scale values [competitive priority = 4, decision area = 3].

The computations are summarised in figure 6 below.

	Max =4.0		Resource Usage *[Mean priority score X Decision Area score]*							
Performance objective mean scores	**2.68**	Quality	7.56	6.16	6.38	5.17	5.84	6.27	6.94	5.41
	3.06	Delivery	8.63	7.04	7.28	5.91	6.67	7.16	7.93	6.18
	3.31	Flexibility	9.33	7.61	7.88	6.39	7.22	7.75	8.57	6.69
	3.10	Cost	8.74	7.13	7.38	5.98	6.76	7.25	8.03	6.26
			Plant Production Capacity	Supply Networks / Chains	Process Technology	Development and organisation	Planning and control	Quality Assurance	Facilities (Size Location)	Sustainable competitive advantage
		Max = 3	**2.82**	**2.3**	**2.38**	**1.93**	**2.18**	**2.34**	**2.59**	**2.02**
			Structural and infrastructural decision areas							

Key

>9.00 pivotal

>6.00, < 9.00 - critical

<6.00 secondary

Figure 6. Interaction between performance objective and decision areas in the niche company. Source (computations developed by researcher)

A score above 9.00 is pivotal, a score between 6 and 9: critical and those below 6 classified as secondary (Slack and Lewis, 2011; Charan & Panda, 2018). It can be observed that the pivotal performance objective and operations strategy decision area is the intersection of flexibility and plant production capacity. The score was 9.33. Furthermore, other critical intersection areas with their corresponding values were cost & plant production capacity (8.74); delivery & plant production capacity (8.63); flexibility & facilities (8.57); cost and facilities (8.03). All the other intersection areas were below 8.00 with the lowest being 5.41 (quality and sustainability competitive advantage).

The resource usage values in figure 6 were further presented in figure 7 to indicate which relationship is pivotal, very critical, critical and secondary as per Slack and Lewis (2011). See section 2.2 on literature.

	Max =4.0		Resource Usage *[Mean priority score X Decision Area score]*							
Performance objective mean scores	2.68	Quality	**	*	*	*	*	*	*	*
	3.06	Delivery	***	**	**	*	*	**	***	*
	3.31	Flexibility	***	**	**	*	**	**	***	*
	3.10	Cost	***	**	**	*	*	**	***	*
			Plant Production Capacity	Supply Networks Chains	Process Technology	Development and organisation	Planning and control	Quality Assurance	Facilities (Size Location)	Sustainable competitive advantage
		Max = 3	**2.82**	**2.3**	**2.38**	**1.93**	**2.18**	**2.34**	**2.59**	**2.02**
			Structural and infrastructural decision areas							

Importance key

***	Pivotal,
***	Very critical
**	critical
*	secondary

Figure 7. Interaction between performance objective and decision areas. Source (computations developed by researcher)

From the above figure 7, the interaction between flexibility and plant production capacity is pivotal for the niche producer. The relationship between facilities with delivery, with flexibility and with cost is indicated to be very critical as well that of plant production capacity with cost and with delivery.

The interaction of supply networks, process technology and quality assurance with the competitive priorities is critical while that of development and organisation, sustainable advantage with the priorities is secondary. Of particular note is that the

relationship of quality with the majority of decision areas is indicated to be secondary to the niche producer.

4.5.2 Factor analysis of structural and infrastructural decisions areas

A factor analysis was undertaken in order to test if individual decisions can be grouped around some representative factors. The factor analysis is shown in table 24.

Table 24. Factor analysis of the structural and infrastructural decision areas

Decision Area	F1	F2	Initial communality	Final communality	Specific variance
Facilities [size, location]	0.179	**-0.832**	0.468	0.725	0.275
Plant production capacity	0.495	**-0.645**	0.544	0.660	0.340
Process technology [selection of appropriate technology]	**0.555**	-0.081	0.295	0.315	0.685
Supply networks/ chains	**0.601**	0.002	0.348	0.361	0.639
Planning and control systems	**0.816**	0.135	0.620	0.685	0.315
Quality assurance and control approaches	**0.594**	0.286	0.361	0.434	0.566
Work Organization [human reporting structures, hierarchy]	**0.772**	0.167	0.557	0.624	0.376
Sustainable competitive advantage and continuous improvement	**0.607**	0.171	0.401	0.397	0.603

Two factor groupings were identified (F1 and F2) and these two groupings explained 52.5% of the variance as shown in table 24. Under F1, six decision factors were grouped together that explained 36.6% of the total variance. These were process technology, supply networks / chains, planning and control systems, quality assurance, work organisation and sustainable competitive advantage. F2 was a grouping of structural factors (facilities and plant production capacity) and explained 15.9% of the total variance.

Furthermore, the statistical variability was computed. Table 25 below shows the factors and Eigenvalues. The eigenvalue is a measure of how much of the variance of the observed variables a factor explains.

Table 25. Eigenvalues for factor analysis of the decision areas

	F1	F2	F3	F4
Eigenvalue	2.931	1.271	0.255	0.037
Variability (%)	36.633	15.892	3.185	0.462
Cumulative %	36.633	52.525	55.711	56.172

Factor 1 had a variability of 36.6% while factor 2 explained 15.9%.

4.6 Factors leading to adoption of manufacturing strategy

This section reports on the factors that influence the choice of a manufacturing strategy in the case study as mentioned in section 2.3.6 of the literature survey.

A total of eight factors were subjected to ranking and a Likert type of scale was used, with the highest critical decision (very influential) scoring (3), whereas that with least influence (not influential) scored (1). Respondents were asked to rank how each factor have influenced the choice of strategy currently being pursued. The mean and standard deviation scores were computed as shown in table 26 below.

Table 26. Factors that influence the choice of a manufacturing strategy

Variable	Observations	Obs. without missing data	Minimum	Maximum	Mean	Std. deviation
Need to became the best in class (World Class)	56	56	1.000	3.000	2.143	0.554
Continuous Process Improvement	56	56	1.000	3.000	2.036	0.503
Manufacturing capabilities available and constraints	56	56	1.000	3.000	2.661	0.581
Financial resources available	**56**	**56**	**1.000**	**3.000**	**2.732**	**0.556**
Satisfy customers' demands	56	56	2.000	3.000	2.536	0.503
Product dimensions, technicalities, as-rolled qualities [process routes]	56	56	2.000	3.000	2.643	0.483
Environmental dynamism (factors beyond control)	56	56	2.000	3.000	2.554	0.502
Increased competition	56	56	1.000	3.000	2.107	0.679

From the descriptive statistics, financial resources factor was ranked as number one with a mean score of 2.73. The manufacturing capabilities available and constraints factor was ranked at a mean of 2.65 followed by product dimensions (technicalities, as- rolled qualities process routes) at 2.64. Environmental dynamism representing factors beyond the company's control and the need to satisfy customer demands were ranked high at 2.55 and 2.54 respectively. The least ranked factors that drive the selection of manufacturing strategy were Continuous Process Improvement (2.04), increased competition (2.11) and the need to become the best in class (World Class) (2.14).

The data in table 26 was displayed graphically to indicate finer relationships. Figure 8 shows the graph.

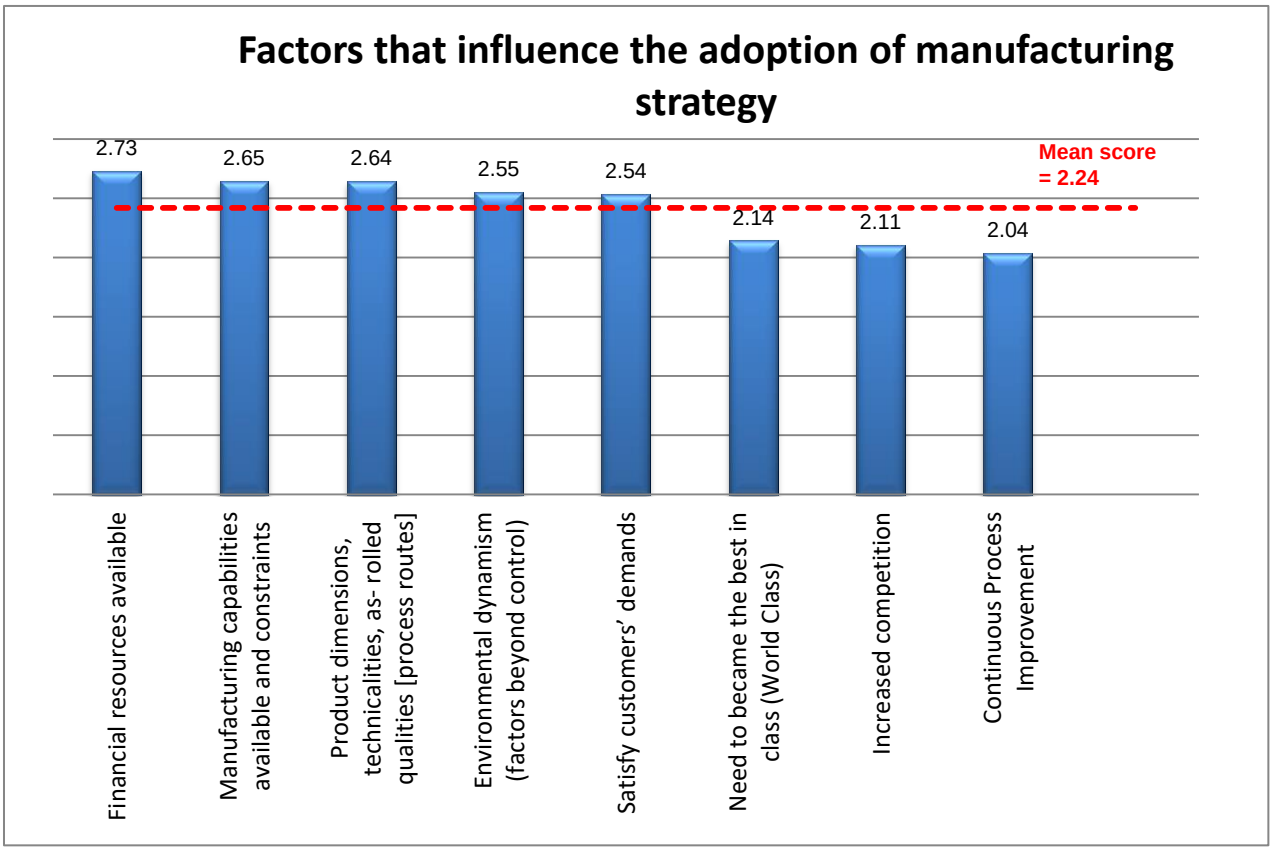


Figure 8. Factors that influence the adoption of manufacturing strategy

Out of a total of eight items, three were below the average score of 2.24. These were the need to become the best in class; increased competition; and continuous process improvement.

4.6.1 Factors Analysis

The eight factors from section 4.6.1 were further analysed using Principal Component Analysis (PCA) in order to extract maximum common variance from all variables and put them into a common scores as well as generate a fewer number of factors. To do this, Microsoft XLStat was used.

These results show the unrotated factor loadings for all the factors using the principal components method of extraction. Table 27 shows the eigenvalues and variability of the factor analysis.

Table 27. Eigenvalues, variability results

	F1	F2	F3	F4	F5	F6
Eigenvalue	2.772	1.560	0.659	0.116	0.036	0.003
Variability (%)	34.647	19.504	8.237	1.452	0.448	0.044
Cumulative %	34.647	54.151	62.388	63.840	64.288	64.332

The six factors have variances (eigenvalues) that are greater than 1. The eigenvalues change less markedly when more than four factors are used. Therefore, the first four factors appear to explain most of the variability in the data. The percentage of variability explained by Factor 1 (F1) is 34.6%, F1 and F2 is 54% and F1, F2 and F3 combined, is 62%. The percentage of variability explained by Factor 4 is 1.5%.

A scree plot to demonstrate the relative variability of the factors was drawn as well. Figure 9 shows the scree plot.

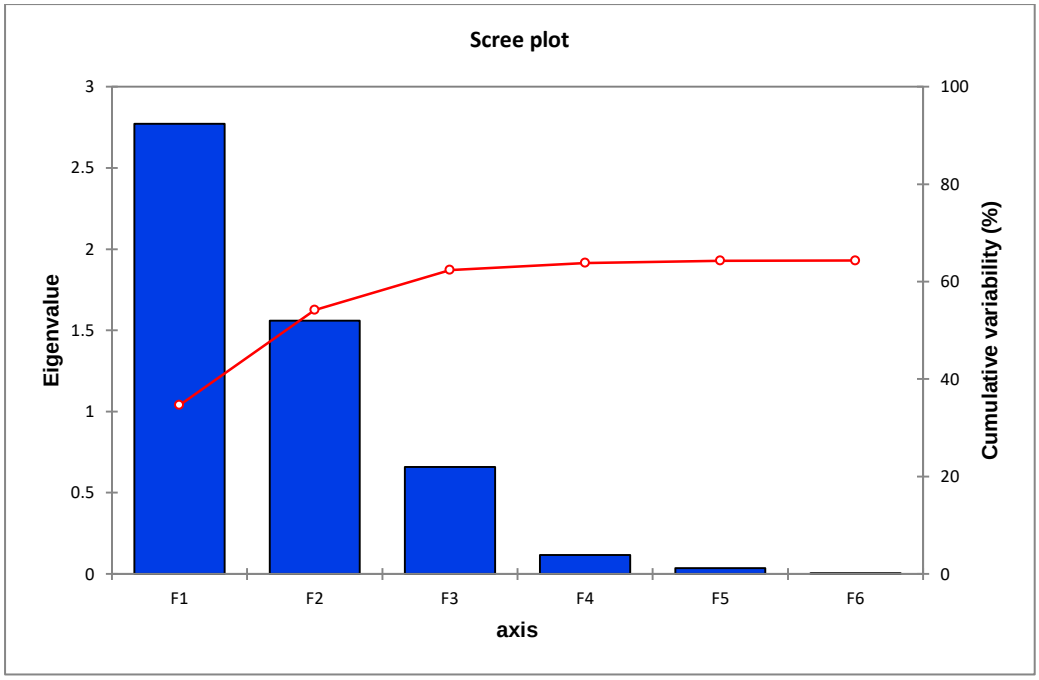


Figure 9 Scree plot after factor analysis

The scree plot shows that the first three factors (F1, F2 and F3) account for most of the total variability in data. The remaining factors accounted for a very small proportion of the variability and are likely unimportant.

The factor loading computations are summarised in the table 28 below. Factor one

Table 28. Factor loading analysis

Individual factors	Factor Loadings			
	F1	F2	F3	F4
Need to became the best in class (World Class)	0.148	0.378	0.015	**0.401**
Continuous Process Improvement	0.039	0.239	**0.490**	0.052
Manufacturing capabilities available and constraints	**0.648**	0.151	0.073	0.005
Financial resources available	**0.410**	0.132	0.104	0.024
Satisfy customers' demands	**0.637**	0.141	0.136	0.020
Product dimensions, technicalities, as- rolled qualities [process routes]	**0.573**	0.131	0.004	0.092
Environmental dynamism (factors beyond control)	**0.483**	0.265	0.182	0.013
Increased competition	0.059	**0.493**	0.069	0.073

(F1) had the highest loading of 2.751. Factors two and three had loadings of 0.493 and 0.490 respectively. Factor one (F1) grouped together the following dimensions together Manufacturing capabilities available and constraints; Financial resources

available; Satisfy customers' demands; Product dimensions, technicalities, as- rolled qualities (process routes); and Environmental dynamism (factors beyond control). Meanwhile, Factors 2 and 3 only had one dimension each as shown in table 28.

4.7 Relationship between manufacturing strategy and operational performance

Respondents were asked to rank each operational performance (dependant variable) item (see sections 2.3 and 3.3.3) as to how it has been impacted by the manufacturing strategy for the past five years: - 1- declined over the years, 2- stayed the same over the years and 3- improved over the years. The descriptive statistics are shown in table 29 below.

Table 29. Descriptive statistics for the dependent variables (performance)

No.	Variable	Observations	Obs. without missing data	Min	Max	Mean	Std. deviation
1	Time needed to develop new products or services	56	56	1.000	3.000	1.643	0.749
2	Range of products or services	56	56	1.000	3.000	2.321	0.811
3	Machine change-over time	56	56	1.000	3.000	1.750	0.745
4	Average capacity or Maximum capacity	56	56	1.000	3.000	1.804	0.724
5	Time to change schedules	56	56	1.000	3.000	1.964	0.571
6	Utilization of resources	56	56	1.000	3.000	1.786	0.653
7	Labour Productivity	56	56	1.000	3.000	1.661	0.668
8	Added Value	56	56	1.000	3.000	1.804	0.773
9	Efficiency	56	56	1.000	3.000	1.446	0.737
10	Cost per hour	56	56	1.000	3.000	1.625	0.799
11	Number of defects per unit	56	56	1.000	3.000	1.732	0.587
12	Level or number of customer complaints	56	56	1.000	3.000	1.589	0.804
13	Customer satisfaction score (index)	56	56	1.000	3.000	1.554	0.737
14	Warranty claims	56	56	1.000	3.000	1.732	0.646
15	Prime first time quality yield	56	56	1.000	3.000	1.661	0.668
16	Scrap & Rework	56	56	1.000	3.000	1.679	0.741
17	Order lead Time	56	56	1.000	3.000	1.607	0.705
18	% of products on time and in full	56	56	1.000	3.000	1.857	0.724
19	Actual versus theoretical throughput time	56	56	1.000	3.000	2.286	0.825
20	Manufacturing cycle time	56	56	1.000	3.000	1.982	0.798
21	Percentage of orders delivered late	56	56	1.000	3.000	1.786	0.653
22	Schedule adherence	56	56	1.000	3.000	1.839	0.708

Of the 22 performance measures, a total of seven items were deemed to be between having stayed the same over the years and improved over the years. These were (displayed in orange in table 29):

1. Actual versus theoretical plant throughput time (2.286),
2. Range of products or services being produced (2.321),
3. Plant manufacturing cycle times (1.982)
4. Time to change schedules (1.964),
5. The ability to adhere to manufacturing schedules (1.839).
6. Average capacity or maximum plant capacity (1.804),
7. Producing added value products (1.804),

The other 15 performance indicator items (in blue and white) had means below 2 indicating that they remained the same to declining over the years.

Multiple linear regression analysis was conducted to investigate the relationship between manufacturing strategy / strategies and operational performance items. Manufacturing strategy predictors were the independent variables, while operational performance measures were the dependent variables. Table 30 shows the goodness of fit statistics from the regression. The R^2 (coefficient of determination) indicates the % of variability of the dependent variable which is explained by the explanatory variables.

Table 30. Goodness of fit statistics

Goodness of fit statistics (Strategy):

Observations	56
Sum of weights	56
DF	42
R^2	0.579
Adjusted R^2	0.448
MSE	0.073
RMSE	0.270
MAPE	6.297
DW	1.983
Cp	6.661
AIC	-134.731
SBC	-106.376
PC	0.702

Source: Research Data **(Microsost XLStat)**

The closer to 1 the R^2 is, the better the fit. It shows that 57.9% of the variability is explanatory.

The table 31 below showed the regression of the 22 independent variables in relation to the manufacturing strategy. This was to find out which performance variables related well to the manufacturing strategy. The regression model loaded a total of 13 factors that are shaded. This means that, the 13 factors allow the study explain 57.9% of the variability of the manufacturing strategy. These 13 factors were most impacted by the manufacturing strategy or strategies being pursued by the niche producer.

Table 31. Summary of variable selection

No. of variables	Combination Variables	MSE	R^2	Adjusted R^2
2	Customer satisfaction score (index) / Schedule adherence	0.094	0.312	0.286
3	Level or number of customer complaints / Customer satisfaction score (index) / Schedule adherence	0.091	0.348	0.311
4	Time needed to develop new products or services / Level or number of customer complaints / Customer satisfaction score (index) / Schedule adherence	0.084	0.409	0.362
5	Time needed to develop new products or services / Average capacity or Maximum capacity / Level or number of customer complaints / Customer satisfaction score (index) / Schedule adherence	0.082	0.438	0.382
6	Time needed to develop new products or services / Level or number of customer complaints / Customer satisfaction score (index) / Manufacturing cycle time / Percentage of orders delivered late / Schedule adherence	0.079	0.469	0.404
7	Time needed to develop new products or services / Efficiency / Level or number of customer complaints / Customer satisfaction score (index) / Manufacturing cycle time / Percentage of orders delivered late / Schedule adherence	0.077	0.494	0.420
8	Time needed to develop new products or services / Average capacity or Maximum capacity / Efficiency / Level or number of customer complaints / Customer satisfaction score (index) / Manufacturing cycle time / Percentage of orders delivered late / Schedule adherence	0.075	0.514	0.431
9	Time needed to develop new products or services / Average capacity or Maximum capacity / Labour Productivity / Efficiency / Level or number of customer complaints / Customer satisfaction score (index) / Manufacturing cycle time / Percentage of orders delivered late / Schedule adherence	0.075	0.526	0.433
10	Time needed to develop new products or services / Labour Productivity / Added Value / Efficiency / Cost per hour / Level or number of customer complaints / Customer satisfaction score (index) / Manufacturing cycle time / Percentage of orders delivered late / Schedule adherence	0.074	0.542	0.440
11	Time needed to develop new products or services / Range of products or services / Labour Productivity / Added Value / Efficiency / Cost per hour / Level or number of customer complaints / Customer satisfaction score (index) / Manufacturing cycle time / Percentage of orders delivered late / Schedule adherence	0.074	0.554	0.442
12	Time needed to develop new products or services / Range of products or services / Labour Productivity / Added Value / Efficiency / Cost per hour / Level or number of customer complaints / Customer satisfaction score (index) / Prime first time quality yield / Manufacturing cycle time / Percentage of orders delivered late / Schedule adherence	0.073	0.567	0.447
13	**Time needed to develop new products or services / Range of products or services / Average capacity or Maximum capacity / Labour Productivity / Added Value / Efficiency / Cost per hour / Level or number of customer complaints / Customer satisfaction score (index) / Prime first time quality yield / Manufacturing cycle time / Percentage of orders delivered late / Schedule adherence**	**0.073**	**0.579**	**0.448**
14	Time needed to develop new products or services / Range of products or services / Average capacity or Maximum capacity / Labour Productivity / Added Value / Efficiency / Cost per hour / Level or number of customer complaints / Customer satisfaction score (index) / Prime first time quality yield / Scrap & Rework / Manufacturing cycle time / Percentage of orders delivered late / Schedule adherence	0.074	0.584	0.442

The best model for the selected selection criterion is displayed in blue

With the research results, the multiple correlation coefficients ranged from indicated strong relationships between the set of independent and dependent variables. The intercept was 2.526.

The 13 items are summarised in the table 32 below together with regression values. The sign (+or -) indicates the direction of the relationship. The value can range from +1 to -1, with +1 indicating a perfect positive relationship, 0 indicating no relationship and -1 indicating a perfect negative or reverse relationship

Table 32. Summary of the 13 variables from the analysis

Source	Value	Standard error	t	Pr > |t|
Intercept	2.526	0.210	12.009	**<0.0001**
Time needed to develop new products or services	0.160	0.087	1.842	0.073
Range of products or services	0.087	0.063	1.380	0.175
Average capacity or Maximum capacity	-0.062	0.059	-1.059	0.296
Labour Productivity	0.126	0.072	1.737	**0.090**
Added Value	-0.069	0.056	-1.221	0.229
Efficiency	-0.175	0.104	-1.688	**0.099**
Cost per hour	0.103	0.079	1.296	0.202
Level or number of customer complaints	-0.247	0.077	-3.204	0.003
Customer satisfaction score (index)	0.233	0.092	2.528	**0.015**
Prime first time quality yield	-0.087	0.078	-1.119	**0.269**
Manufacturing cycle time	-0.190	0.075	-2.551	0.014
Percentage of orders delivered late	0.269	0.093	2.907	**0.006**
Schedule adherence	0.131	0.080	1.640	0.108

The 13 explanatory factors that explain 57.9% of the variability were drawn from the four competitive priorities: flexibility, cost, quality and delivery.

4.8 Document Analysis – Customer perspectives

This section presented the secondary data collated. The company collects data from customers bi-annually through surveys. Customers are asked to rate elements pertaining to Commercial issues; Product aspects; Delivery aspects; Personnel aspects; Progressiveness of the supplier; and Flexibility on a scale of 1 – extremely

poor to 10 – extremely good. The results were incorporated to support or refute the findings from the primary data.

Customer perspectives were collected as well in 2017. This covered two years (2016 and 2017) and presented in figure 10 below. The results of the 2016/2017 customer survey are shown in figure 10 below.

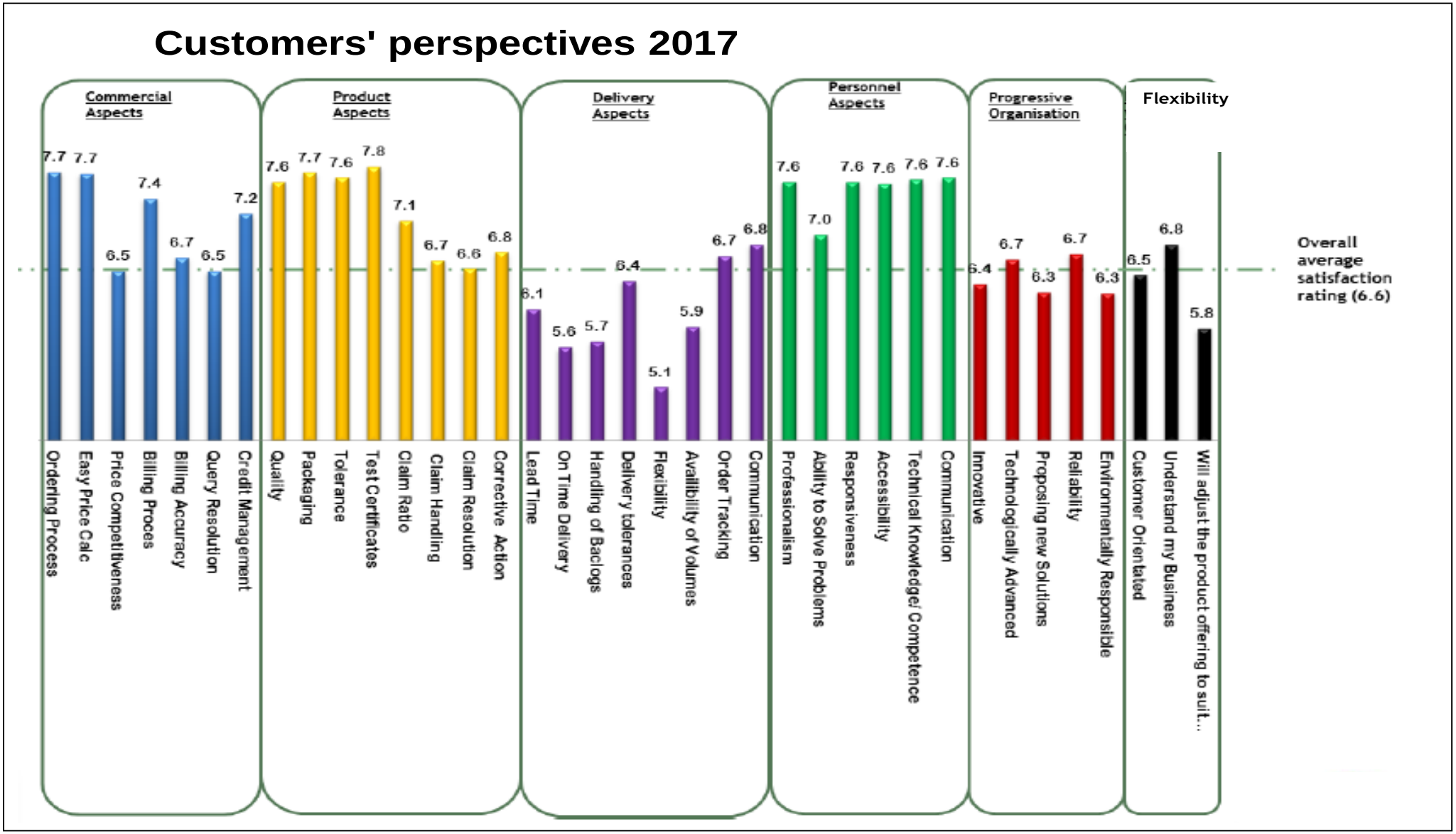


Figure 10. 2016/2017 Customer perspectives. Open sources (available only to company)

From the results presented in figure 10, the overall satisfaction rating was 6.6. The customers ranked commercial aspects and product aspects above 6.6. Commercial aspects include items such as steel price competitiveness, ordering process and billing process. Product aspects include elements such as product quality, product tolerances and packaging as well as claims handling.

The delivery aspects, flexibility and progressiveness were poorly rated; below the 6.6 average. The delivery aspects include production lead time, on time delivery tolerances and availability of volume/stock while the main item in flexibility is whether the supplier will adjust the product offering to suit the customer. Furthermore, the progressiveness (innovation) of the niche company was ranked below 6.6

Customer perspectives were also collected in 2019. This covered two years (2018 and 2019) and presented in figure 11 below. The results of the 2018/2019 customer survey are shown in figure 11 below.

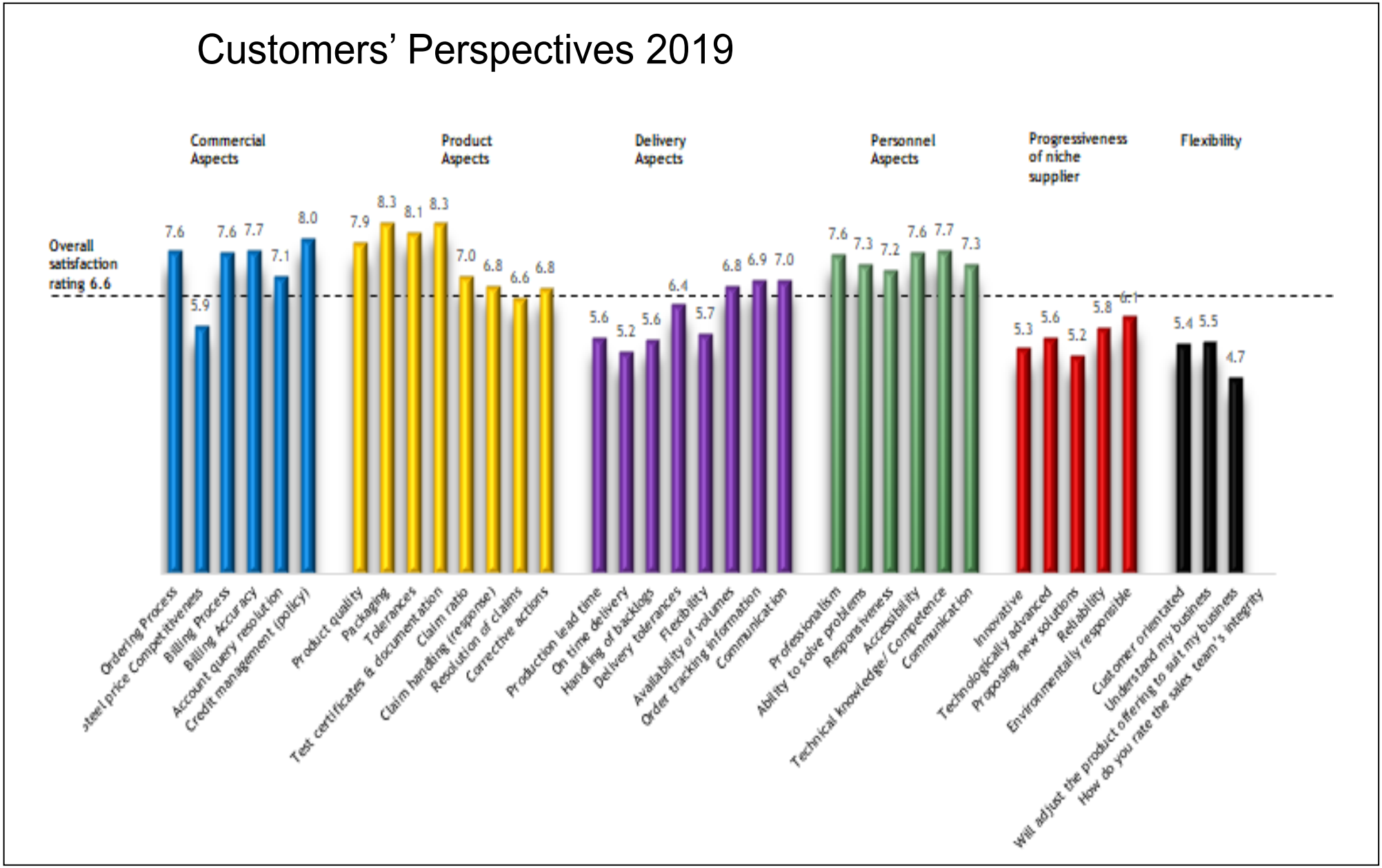


Figure 11. 2018/2019 customer perspectives. Open sources (available only to company)

The results from figure 11 shows that commercial aspects and product aspects were favourably ranked (above 6.6) while delivery, flexibility and innovatiness were poorly ranked. The trend mirrored the 2017 results.

4.9 Financial Ratios

The niche company financial results were extracted from the public domain and shown in figure 12 below.

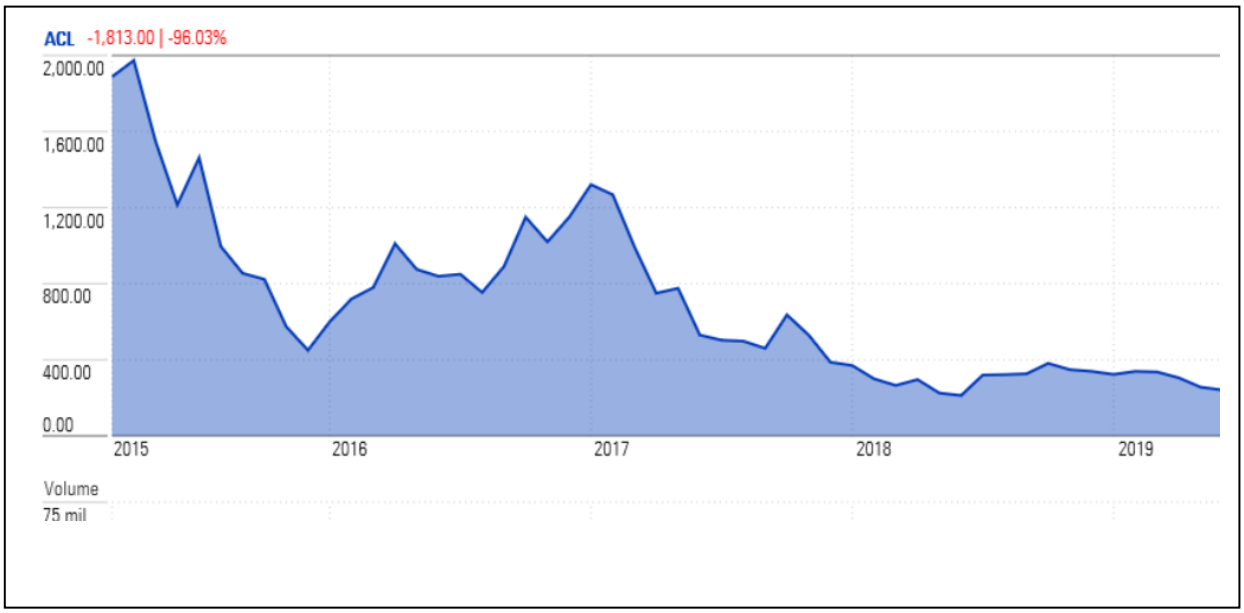


Figure 12. Deteriorating share price since 2010. Source: fin24

The share price was trending at R248 / share in 2015 and at R12 per share in 2020. The most important factor that affects the value of a company is earnings. In this case, these are negative.

Profitability ratios (ROA, ROE and ROIC) were collated from 2014. This is to summarise the performance of the niche company over the years. The results are presented in table 33 below.

Table 33. Financial ratios since 2014. Source: (fin24)

Financial parameter	2014	2015	2016	2017	2018	2019	Industry Index
Return on Assets	-0.48	-26.99	-15.28	-16.58	4.59	-32.4	9.15
Return on Equity	-0.76	-50.52	-34.84	-47.48	17.1	-82.2	17.62
Return on Invested Capital	-0.03	-39.98	-24.7	-28.46	18.7	-52.4	15.79

The profitability ratios shown in table 33 are all negatives from 2014 except for 2018. On one hand, the industry average indices are positive at 9.15, 17.62 and 15.79 for ROA, ROE and ROIC respectively. The positive ratios attained in 2018 were due to the sales of assets and not from operations (Company Report, 2019).

CHAPTER FIVE: DISCUSSION

5.1 Introduction

This chapter provides the discussion and the study findings.

MS is considered as a pattern of choices made in order to achieve the full competitive capability of a business unit. These strategies are either explicitly drawn up or implicitly realised as manifested in a stream of real time decisions made at different points of time. It is a functional (plant level) strategy, below the corporate and business strategy.

These various dimensions of manufacturing performance often conflict according to the literature. For example low cost and high varieties often require different types of equipment and different plant layouts. Moreover, a manufacturing system, like any other engineering design, cannot optimise all dimensions simultaneously. The question of which dimension is most important constantly shifts in firms. For example, as observed by authors, near the end of the month, delivery is most important. After the first of the month, labour cost is the most important. When an important customer complaints, quality becomes important.

Manufacturing strategy was defined by structural factors (capacity strategy, location, process technology, vertical integration / relationships with suppliers and development & organisation] and infrastructural factors [organisational structure; work force management; and the systems for planning, stock control and quality management). An operations or manufacturing strategy is viewed as the effective use of these resources to achieve business and corporate goals.

The principal aim of the research was to determine the status of structural and infrastructural factors and their effect on operational competitiveness in a niche steel producing in a South African setting. A descriptive research approach was adopted where the status of the decisions at play and the operations performance were derived and evaluated so as to determine the relationship between the organisational performance and the decisions at play in a niche environment.

The questionnaire survey and document analysis approaches were used. The questionnaire collected primary data from the managers while secondary data were collected from the public financial levers as well as the customer feedback on the competitive deliverables.

Descriptive statistics was used to evaluate and determine the manufacturing strategies in terms of formality of the strategy formulation process, the awareness and the level of managerial participation in the process. Furthermore, descriptive statistics was used to evaluate the manufacturing competitive priorities, the structural and infrastructural decisions and the factors influencing the adoption of strategies. These were the independent or predictor variables. Descriptive statistics was also used to analyse the manufacturing performance indicators. These were the dependent variables.

A set of manufacturing strategy measures were regressed against operational performance indicators to evaluate the influence of the former on the latter. A multiple regression model was used to evaluate the overall relationship between the manufacturing strategy or strategies and the operational performance.

5.2 Questionnaire, validity and reliability

As reported in the results section, a total of 57 managers out of 86 responded to the online survey to give a 66% response rate. This response rate of 66% is generally acceptable for validity and generalisation purposes to the targeted population. According to Baruch (2008), the average and reasonably acceptable response rate is 60% +/-20%. In this case, the representativeness of the results is to the population is seemingly high. However, when considered in terms of levels (hierarchy) of management, none of the top management participated. Hence the results were biased towards only middle and lower management who were well represented in the study.

5.3 Demographics

Regarding the research participants, 88% of the respondents had over 11 years of employment history with the niche steel producer. This indicates a highly experienced sample that was resourceful in ensuring the accuracy and authenticity

of the information provided for the study. This level of work experience satisfied the assumption that the sample consists of managers who have influence on the manufacturing strategy of the niche company. However, the influence in the study refers to that in the middle and lower management levels as the top management did not participate (table 15).

5.4 Awareness of the strategy being used

A mean score of 2.18 (maximum score – 3.0) from the respondents indicated acceptable levels of strategy awareness with the sample. In total, 89.4% of the respondents indicated that there were high levels of strategy awareness within the organisation.

Strategy awareness level measures the percentage of the workforce that is aware of the strategy or strategies a firm is pursuing. This indicates the rate at which strategy information permeates through an organisation. In this case study, all senior and middle managers who participated were fully aware of the strategy being used. However, as one moves down the managerial level (table 17), the less the managers are fully aware, so much that the lowest level had nobody fully aware among the participants. This suggests that strategy information does not permeate well enough down through the organisation.

As stated by Gagnon, et al., (2014), manufacturing employees will not commit to organisational success unless they have an appropriate understanding and awareness of the manufacturing strategy obtaining in a firm. Therefore, leaders should invest time and resources to communicate organisational strategies to their employees (Hills, 2015). Furthermore, it was argued that employees' organisational strategy awareness has a positive relationship with employees' commitment for organisational success (Gagnon, et al., 2014). Therefore, the high levels of awareness augurs well for the niche steel producer.

5.5 Formality of the strategy being used

From the results, a total of 92.9% of the respondents concurred that the strategy formulation process had elements of formality in the organisation. This is supported by a descriptive statistical mean score of 2.25 (possible 3.0 maximum) indicating a

high level of the formality of the strategy within the sample. From the results therefore the strategy being pursued in this niche company is formal and documented.

As stated by Lofving (2014) and Boateng, et al., (2015), formality is the extent to which the manufacturing planning process is structured, through written procedures, schedules and other documents, and the extent of documentation resulting from the planning process. In addition, it outlines the monitoring, collection, and dissemination of relevant information leading to appropriate decisions, focused implementation, and the achievement of specific goals. This shows these are present in the organisation due to the high mean score from the research results.

5.6 Level of involvement in the manufacturing strategy

The results show that the CEO, GM and Top managers are heavily involved in the formulation process as represented by high response rates of 70.2%, 85.7% and 84.2% respectively (table 21). In support of this, several respondents commented that only plant managers are involved. On the other hand, middle and line/junior managers participate sparingly in the process.

The involvement of mainly senior managers in strategy points to a top-down approach to strategy formulation in this organisation. With a top-down strategic approach, the CEO, GM and senior managers establish the plans and goals, and then communicate that strategy to middle managers, who then become tasked with executing that strategy through rank-and-file employees (Heyden, et al., 2016). The high levels of some form of strategy awareness and formality in this organisation further supports this top-down strategy approach.

A primary advantage of a top-down approach is that it maintains a chain of command that provides stability and direction in the workplace (Quain, 2018) as noted in section 2.6 of the literature survey. Another advantage is that when companies have experienced and knowledgeable executives, this approach can streamline the decision-making process and save time and money (Heyden, et al., 2016). The top-down action plans tend to reflect top management's strategic intentions with regard to the organisation's specified priorities (Kim, et al., 2014).

As stated by Wairimu and Theuri (2014), it is beneficial to engage all employees directly in the strategy making process. This affords them personal participation, and experience how their roles influence the organisational strategy decision making process and results. Otherwise, employees will be removed from organisational reality. Therefore, it is important during strategy formulation and implementation that everyone in the organisation understands the direction and course of action being taken.

Although many companies choose the top-down approach, there are several drawbacks, including the fact that executives can ignore or fail to seek the input of talented and creative middle managers and employees (Quain, 2018). As a result, effective ideas and initiatives that could improve productivity and efficiency never filter up to those with the power to implement them. Another disadvantage is that executives may make decisions that are not practical or easy to implement, which can limit employee buy-in and create an unfortunate work environment (Kim, et al., 2014).

5.7 Comparison of the Competitive Priorities

The results from descriptive statistics presented in table 22 reveal that the respondent's ranked flexibility as the number one priority the company is pursuing, followed by cost, then delivery and quality as the least priority.

The results show that the niche supplier views flexibility as a significant competitive dimension and hence the efforts to control it. The company is making efforts to improve the flexibility performance objectives (dependant variables) especially those listed in table 13 (time needed to develop new products or services, range of products or services and the average capacity or maximum capacity).

This supports literature that niche suppliers should be flexible as they supply small quantities of high valued products that can be ordered infrequently as noted in the literature (Hallgren & Olhager, 2006). Flexibility is critical in reacting to market and competitive changes for a niche producer (Hamlin, et al., 2012). If a business embraces corporate flexibility, it can be possible to weather these challenges. A

flexible business model can help a business shift its core focus to accommodate market shifts (Stringfellow, 2017).

Furthermore, Awwad (2007), argues that flexibility enables firms to respond efficiently to changing circumstances, particularly, when dealing with the turbulent environment that may be characterized by rapid changes such as short and uncertain product life cycles, innovative process technologies, and customized products. From the perspective of these authors, the niche producer appears to be pursuing the appropriate competitive priority.

In addition, the results of this study indicate that trade-offs between the four dimensions were present. The company is pursuing a flexibility priority followed by a cost priority. Other dimensions are receiving a low ranking in the company which suggest that other priorities are being sacrificed. The notion of trade-offs in the manufacturing strategy literature posits that a company cannot excel simultaneously on all competitive priorities. It has to sacrifice another in order to attain the other. Superior performance along one priority can be attained only by sacrificing performance along other priorities. Therefore, the results support the widely held idea of the existence of trade-off in manufacturing as articulated by researchers.

5.8 Structural and infrastructural decisions areas

The descriptive statistics show that structural decision factors (plant production capacity, location and size, and process technology) largely dictate decisions relating to the design of process and manufacturing strategy being pursued for the niche company in the long term as operations or manufacturing strategy is viewed as the effective use of these resources to achieve business goals.

The results strengthen the widely held views about the potential of the productive function as a source of competitive advantage. They provide evidence of the strategic importance of structural decisions in the manufacturing area. If these are deployed effectively, the steel producer can acquire capabilities to support its strategic choices. See comments in Appendix A in support of this.

In this case study, the plant production capacity, facilities and process technology factors are highly considered when decisions to design and support manufacturing are taken. The respondents agreed that the niche company takes advantage of these factors to achieve competitive advantage.

From the structural point of view, the results show that facilities (size and location) and plant production capacity are the most important variables for the niche firm. In addition, those decisions dealing with process technology are relevant too. See comments by respondent 39 in appendix A.

Alternatively, from an infrastructural point of view, the most important manufacturing decisions are those related to quality assurance and control techniques, planning and control systems as well as supply networks / chains. The factor analysis came up with two groups that explained 52.5% of the variance (table 25). The two pivotal structural factors (plant production capacity and facilities) accounted for 15.9% of the variability. This is low when compared to the infrastructural factors that accounted for 36.6%. Structural factors were at 15.9% as they are associated with high capital costs and take a long term view of the investments. This is the widely held view in the literature.

The 36.6% variability shows that the niche producer places greater relevance of short term infrastructural decisions than those related to structural elements. Infrastructural decisions are quick wins. This is also supported by research.

5.8.1 Resource Usage Strategy mix

The study attests the evidence for the existence of relationships between structural production decisions and competitive priorities. See figures 6 and 7 in section 4.5.1. The intersection of flexibility and plant production is pivotal (score was highest at 9.33).

The steel producer places the structural issue of plant production capacity and priority issue of flexibility as pivotal in its quest to deliver results to customers. Plant capacity dictates the level and variety of manufacturing output (Bakare, 2016): in this case the niche producer should be appropriately geared for flexibility. The

intersections / relationships between delivery with plant production, cost with plant production is critical to the survival of the steel producer. Furthermore, the relationship between delivery, flexibility and cost with facilities is very critical in pursuing competitive advantage. It is to be noted that delivery and cost are order qualifiers and hence indispensable. The niche producer is making efforts to improve these critical junctures in their pursuit of manufacturing excellence.

However, the document analysis of section 4.8 indicated that the niche producer was rated poorly on flexibility. This means that the company is struggling to adjust the product offering to suit the customers. Therefore, the niche producer is not meeting this need.

Furthermore, capacity utilisation and facilities relate well to economic performance (Okunade, 2018). When market demand grows, utilisation also grows, when it weakens, capacity utilisation slackens as well. However, the economic performance has been poor for the period under review as evidenced by the negative profitability ratios in table 33 and the poor review from customers. Of particular note is that the delivery aspects that include production lead time, on time delivery tolerances and availability of volume/stock were lowly rated. Therefore, the niche producer is not meeting this need.

Nevertheless, the very critical interaction of cost with plant production capacity and facilities appears to suggest a positive outcome. The steel price competitiveness was ranked well by the customers (see figure 10 and 11 in section 4.8). This indicates the niche producer is meeting this need as far as exploiting these decision areas to produce a price competitive product.

The results in section 4.8 seem to suggest that the customers are satisfied with the quality of the product. Therefore, it is reasonable to infer that the niche producer is a consistent quality producer such it has shifted its focus to managing other priorities like flexibility and delivery. The other relationships quality, development & organisation and sustainable competitive advantage are generally secondary.

The results indicate that the niche produce is using plant capacity and facilities to obtain competitive advantage. These production practices would not be a source of competitive advantage if all the competitors in the industry could obtain the same capabilities from their implementation as opined by Slack & Lewis, (2011); Rodriguez-Espino & Gil-Padilla, (2015) and Urgal-Gonzalez & Garcıa-Vazquez, (2007).

5.9 Factors leading to adoption of manufacturing strategy

The results showed that factor one (F1) loading brought five items together (in their order of rank loading) namely; manufacturing capabilities available and constraints; financial resources available; satisfy customers' demands; product dimensions, technicalities, as- rolled qualities (process routes); and environmental dynamism (factors beyond control). These are shown in table 28.

Manufacturing capabilities are concerned with the physical capability to deliver a strategy while the product dimensions are concerned with producing the actual product the customer desires. The niche producer is also market driven as seen by the need to satisfy customer demands. Respondents indicated that these factors strongly influence the manufacturing strategy to be adopted.

Financial resources are a term covering all financial funds of the organisation and are part of the assets. They concern the ability of the business to "finance" its chosen strategy. On a daily basis, important financial decisions such as scheduling operations, preparing budget, procurement of production inputs, approving a capital investment etc. are made (Smit & Muhamet, 2016). The respondents indicated that the availability of financial resources dictate which manufacturing strategy is being adopted. This is because financial resources are not unlimited.

Environmental dynamism represents the rate of change in an environment. This is the rate at which the preferences of consumers and the products of organisations change over time. See Appendix A for respondent support on this factor.

To conclude this discussion on the factors leading to adoption of strategy, the construct in F1 is mostly the internal capabilities and limitations of the niche

company as the main drivers in adopting a strategy; exploiting the operations resources. Factor 2 (increased competition) and factor 4 (need to be the best in class) may indicate a benchmarking construct where the niche producer tries to along with competition. Factor 3 (continuous process improvement) is a quality construct.

5.10 Relationship between manufacturing strategy and operational measures

The niche company competitiveness should be achieved through the effective configuration and utilisation of firm-specific assets (manufacturing strategy) in order to deliver value that is perceived by customers as significant and superior to that of the firm's competition.

From the regression analysis (table 31 and 32), 13 independent factors (operational measures) that explain 57.9% of variability were drawn up from the four proposed and measured manufacturing strategies.

5.10.1 Possible manufacturing strategies being pursued

From the results, the strategy being pursued can be one of the several possibilities as there was no dominant manufacturing strategy observed. A summary of the inferred strategies is discussed below in section 5.10.1:

5.10.1.1 Mixed Approach

The results showed some elements of the four strategies namely flexibility, cost, quality and delivery blended together. Researchers argue that such organisations that pursue a mixed strategy approach seek to differentiate themselves by offering high product quality, delivery and high flexibility through harnessing internal capabilities (Larsson, 2017). The document analysis (customer feedback) attested that the product quality was good. However quality as a competition priority was given the lowest rating by participants (table 22) and so this strategy is not completely followed.

5.10.1.2 Market Based Strategy

As stated by Stobaugh and Telesio (1983); Marketer Sweeney (1991); Miller and Roth (1994); Cagliano (1998) and De Meyer (1990), market-led organisations seek to differentiate themselves by offering high product quality, superior customer service and high flexibility as well product variety. The niche steel producer shows elements of this approach. A number of these elements are noted in the results (figure 4 in section 4.4.1, figure 10 and 11 in section 4.8) particularly high flexibility and product variety but not much rating was given to quality hence this strategy is at best partially followed.

5.10.1.3 Resource Based Approach

From the results, there are elements of the Resource Based Approach (RBV). The RBV approach to manufacturing strategy argues that a competitive advantage emerges from unique combinations of resources that are economically valuable, scarce, and difficult to imitate. In this case, the niche producer is using its facilities, plant production capacity and process technology to gain and maintain competitive advantage (Barney, 1991). These are their internal resources as their disposal. However, this approach is only partially indicated and not fully supported as not all resources are difficult to imitate.

5.10.1.4 Capacity Based Approach

Respondents ranked plant production capacity the highest. This appears to suggest a capacity strategy is being pursued. Capacity strategy involves the pattern of capacity-related decisions or adjustments made over time that can be used as a competitive weapon. Respondent 49 supported the capacity based approach. See appendix A.

With this approach, workforce levels are adjusted through the process of hiring, firing or lay off of production employees to produce output levels to match demand requirements. However, this approach is only partially indicated since the niche producer is not fulfilling its need of delivery and flexibility.

5.10.1.5 Capability Based Approach

The combination of the operational measures also appears to suggest a capability based strategy may be followed. As articulated by De Meyer (1990); Cagliano (1998); Sweeney (1991); Sweeney (1991); Stobaugh and Telesio (1983); and Frohlich and Dixon (2001), this seek to improve and innovate their capabilities (technologies, knowledge, competencies), which allows them to offer high product quality, including after-sales service, flexibility and affordable sales prices. Nonetheless, this approach is not fully followed as delivery and flexibility remain poor despite the efforts.

From the above discussion, it is not clear which specific manufacturing strategy is being pursued by the niche producer based on the results obtained. One possible reason is that the participants were not top management who are the key strategy formulators in an organisation. The information therefore obtained may not be complete and reflects the knowledge or awareness limitations of the participants who are largely the middle and lower level managers.

5.11 Document Analysis – Customer perspectives

The competitiveness of the niche company is conditioned on its performance in dimensions of cost, quality, flexibility and delivery. Customers rated the niche producer poorly in flexibility, delivery and progressive aspects from 2016 to 2019.

However, from the primary survey results, the company has been focusing on improving the flexibility aspects as the most prominent competitive priority for the five years since 2016. One would expect these efforts to filter positively to the customers.

Despite the efforts to improve flexibility, management is not meeting the needs in these five years. The evidence from the secondary data attests that flexibility and delivery objectives are poor. Based on this result, it is possible to deduce that the flexibility and delivery improvement initiatives being pursued are not effective.

In addition, the financial performance of the organisation is also poor as evidenced by the deteriorating share price, negative ROA, ROE and ROIC (table 33). The average industry indices are positive indicating that other companies within the same

manufacturing sector are doing well. This appears to suggest that, despite the efforts by the niche producer, the manufacturing strategy or strategies being followed are not attaining the anticipated organisational performance.

CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

This chapter concludes the study through exploring and interpreting research findings in light of the objectives, and research question.

6.2 Objective Ones and Research question

The answers to the four objectives and the research are presented below.

6.2.1 Objective One

To determine which structural and infrastructural decisions areas are being pursued by the selected company and what the factors mean for the company.

Two structural decision factors namely plant production capacity and facilities (location & size) largely dictate decisions relating to the design of process and manufacturing strategy being pursued for the niche company in the long term as operations or manufacturing strategy is viewed as the effective use of these resources to achieve business goals. These are the pivotal decision areas supporting the strategy. The two structural factors (plant production capacity and facilities) accounted for 15.9% of the variability as the costs to implement these are high.

About 36.6% of the variance was explained by the infrastructural decisions factors. The relevant infrastructural factors identified were: process technology (selection of appropriate technology); supply networks/ chains; planning and control systems; quality assurance and control approaches; work organization (human reporting structures, hierarchy); and sustainable competitive advantage and continuous improvement. These are easier to implement as the capital outlay is lower than structural ones. This shows the strategic importance of infrastructural decisions in the production area and that the deployment of these, the niche company can acquire capabilities to support and sustain the chosen competitive priorities. This appears to

suggest a greater dependence on short term infrastructural decisions for the niche producer than those related to the structural elements.

6.2.2 Objective Two

To establish the relationships between decision areas and competitive priorities and the operational performance.

The findings provide evidence for the existence of relationships between structural production decisions and competitive priorities. The strongest resource usage relationship matrix was the flexibility priority with plant production capacity decision area at a 9.33 score. The other very critical resource usage relationships were; cost & plant production capacity (8.74); delivery & plant production capacity (8.63); flexibility & facilities (8.57); and cost and facilities (8.03)

Nevertheless, current status is to pursue flexibility, delivery and cost priorities respectively with the use and support of the plant production capacity and facilities to gain competitive edge. This resource usage approach for the five years considered by the study has yielded poor organisational performance as evidenced by the low valued shares, poor financial ratios (ROA, ROE & ROIC) and the largely negative customer feedback. However, the organisation is doing well on product quality aspects as required by the customers.

6.2.3 Objective Three

To determine the dominant manufacturing strategy or strategies being employed by the niche producer.

The study found several manufacturing approaches appear to be being pursued by the niche producer albeit partially articulated. These include the possibility of a mixed approach being practised with elements of cost, flexibility, quality and delivery strategies combined together, other possibilities included a manufacturing strategy that is market based (MBV), resource based (RBV), Capacity based or Capability based. A combination of these

might also be possibility being pursued by the niche producer. No clear dominant manufacturing strategy could be identified.

6.2.4 Objective four

To compare the status to the existing theory on manufacturing strategy

The research contributes to strengthen some widely held views about the potential of the productive function as a source of competitive advantage. The research results support the trade-off theory as originally proposed by Skinner (1969). The niche producer is pursuing a flexibility priority while sacrificing the other objectives.

The literature that manufacturing strategy is a meeting point between competitive priorities and decision areas was supported by the research findings. It provides evidence for the strategic importance of structural and infrastructural decisions in the production area in supporting the competitive advantage. The top three competitive priorities from the niche company were flexibility, cost and delivery while the top two decision areas were plant production capacity and facilities. These interact to shape the manufacturing strategies at hand as articulated by literature.

However, the ‘sandcone’ model was not supported. In this model of operations excellence, there should be an ideal sequence in which operational capabilities should be developed by following a pre-specified order for developing manufacturing capabilities: first selecting high quality, then dependable delivery, followed by low cost and flexibility. The idea is that one must first fully conform to quality requirements before focusing on dependability, then speed and finally cost. It is thus a cumulative model, where the present competitive priority is dependent on what has been achieved previously. This appears not to be the case from the study results.

Some structural and infrastructural decisions were complementary and relevant; the most notable ones found were plant production capacity and facilities (size and location) as well as supply networks/chains, planning and control systems and work

organisation. These elements if properly controlled are expected to influence competitiveness.

6.2.4 Research Question

To what extent do decision areas affect the manufacturing strategy of a niche steel making company in South Africa?

From the study it can be seen that the research objectives were achieved in that the study managed to determine the two dominant structural decision areas at play and the six infrastructural areas at play. The study came up with the resource usage / strategy mix which highlighted the three prominent competitive priorities; flexibility, delivery and cost respectively and proposed possible manufacturing strategies at play. The organisational performance for the five years period since 2016 was analysed and the extent of influence of the decision areas on performance noted.

6.3 Limitations of the study

The limitations experienced in this study were time and access to the respondents. Although the study was well planned with time scales so as to meet the deadlines, the responses were slow. It took the researcher over nine months to register enough statistically acceptable responses.

Another limitation was the issue of confidentiality. Often subjects' views are only possible if total confidentiality is assured. Despite this being an anonymous survey, the respondents were still in the employ of the company. This situation may have prevented the respondents from presenting the actual picture and thus the results may have some element of bias.

The use of a survey instrument to gather information is limited to those who respond. The rate of response places limits on the information collected in the study since the number of responses has a statistical effect.

The niche producer top management did not participate in the survey. Therefore, the views represented are largely the opinions of the middle and lower management levels.

6.4 Recommendations for future Studies

Structural and infrastructural factors are critical in manufacturing strategy. However, it is very difficult to measure the influence of each individual decision area and to analyse its effects in isolation in a manufacturing set up. From this point of view, a suggestion for future research should be oriented to surpass this shortcoming in order to reach a greater understanding the isolated and exact role of decision areas in a firm's success.

Secondly, the small sample size means that the results cannot be generalised to all niche manufacturers in the country. Therefore, a more comprehensive study that focuses on more firms within the niche manufacturing sector is needful in order to formulate sector based manufacturing strategies that can maximise structural and infrastructural capabilities.

Thirdly, future studies can examine the business environment these niche manufacturing firms operate under such as culture, labour structures, economic conditions and political situation. This is to evaluate how structural and infrastructural factors as well as manufacturing strategies are impacted by these factors.

6.5 Recommendations to the organisation

1. Strong and effective manufacturing strategies are only attained if and when firms strike a balance between their structural and infrastructural decisions areas. Failure to do this leads to a company overstating one particular action while neglecting others. This may lead to under-utilisation of potential and can create an imbalance in the allocation of resources leading to long term problems.

   Therefore, it is suggested that the company re-considers the current approach and decide on a specific manufacturing strategy instead of pursuing mixed approaches to manufacturing. The fact that the financials have not improved adds impetus to the need for internal re-organisation.

2. In order to improve flexibility and win orders, the company should improve some specific flexibility performance objectives such as time needed to develop new products or services; range of products or services; machine change-over time average capacity or maximum capacity; and time to change schedules.

   The above performance measures are poor performing. Focusing on these means to complete the modifications of products requested by customers more quickly, secondly introduce new products in the market more speedily, thirdly modify the productive capacity more swiftly, and lastly modify the production mix more quickly, according to the market's demands and dictates. The flexibility improvement initiatives being pursued should be reviewed and improved as they are currently not effective. This may entail allocating more human, technical or financial resources where possible.

3. In order to improve the delivery priority and win orders, the steel producer should be more reliable in meeting order quantities; more reliable in meeting due dates; reduce the promised mean time for deliveries; and improve the performance of the distribution channel.

All these recommendations are short to medium terms.

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APPENDIX A: Comments by respondents

Respondent	**Comments on the extent of involvement in the strategy making process**
5	The challenges that the lower grades are struggling with are not quite understood by higher management. It is survival time and I have to let it work with what is available and given to me, and not usually the best. Labour, spares and minimum cost.
6	Only plant managers are involved, we don't see other managers on the plant.
11	NO.
12	None
19	Strategy not clear
21	The strategy changes with each CEO. One came and closed off some units sighting non profitability. a replacement CEO opened the same units
22	Our strategy is not very clearly communicated. it is reactive
23	Strategy not fully communicated. Not very clear of its formulation
24	I am not clear about the strategy
25	Line managers are just implementers of the what the top managers say. The strategy is very fluid. Today make steel in Vereeniging, tomorrow make steel in Newcastle and then after four years change again
26	Line managers just implement
28	strategy is mainly reactionary
38	Formal strategy outings are held periodically to map out the strategy. Only top management is involved
39	Infrequent sessions are held from time to time.
40	I am not fully aware of what strategy we are pursuing. We sometimes close one unit and after three years we reopen the same unit without proper explanations
41	Strategy making is limited to the top managers. The rest have to enforce it. However, the strategy is not communicated properly down.
42	I am not clear what type of strategy we are pursuing
43	Process not fully understood
44	Process not clearly communicated to lower levels
45	Strategy not fully communicated by top management
46	process largely unknown
48	Strategy is driven by the market. If market is down- we scale down and vice versa.
49	The CEO is the final approval and custodian of the strategy
56	Formal process

APPENDIX B: Comments by respondents on structural factors

Respondents	**Comments on structural factors**
2	None
5	If the support infra structure that provides supplementary support e.g. Civil repairs, outsourcing of manpower due to shortage of labour, HR, service providers, spares, spares suppliers and storage are not backing the fighting group in the front lines, (production and maintenance) delays are expected and deviations from targets impossible to achieve
6	only top managers are involved
19	Very limited range of choices in section 5. There are varying degrees on importance not only 3. Perhaps a rating from 1-5 would be more effective.
22	In some cases delivery priority takes dominance over quality issues such that quality issues are overridden over with the need to delivery and being flexible.
23	Each section tends to push its own agenda. There is lack of coherence across these priorities
25	sometimes delivery priorities override quality
39	Facilities and production capacity seems to take more focus. If the plant is not full- they consider shutting it down
40	Company is not flexible to the customer needs as evidenced by long ordering periods on niche products. Some customers have to order three months in advance. Once a customer misses that window- he misses his delivery. This is due to the long supply chain. Facilities and capacity dictates the manufacturing strategy as to where production will take place.
41	Every unit is given a target $/tonne savings. - Cost driven. Quality is lip service as managers take short cuts in pursuit of production tonnes
42	These resources especially facilities, capacity and supply networks drive the strategy together with factors in section C
43	Quality is mostly reactive
44	Facilities and plant production and supply networks are 2
46	Management prepared to close off units if capacity utilization is low is some of the sections. Cash availability and manufacturing cost dictates all things
47	Capacity is 2 in dictating where to manufacture. Manufacturing Costs dictates where and what to make in the business
48	Facilities, capacity are 2. Cost is a very high priority.
49	Facilities and capacity are critical. Excess capacity is closed off. Our capacity tailors the market demand. if demand increases, we also increase the capacity
50	Facilities and plant capacity are central to strategy. Some capacity was mothballed over the years due to decline in market demand
51	Capacity is taken out if products are not profitable. Capacity is tailored to the market demand Market trends shapes the strategy

APPENDIX C: Research Questionnaire

Introduction

This questionnaire guide is designed to collect information on our company to help answer the research questions and objectives. All information gathered in this research will be treated with utmost objectivity and confidentiality to the subject matter and will not be used for any other purpose other than academic.
Your contribution will be of great assistance to the compilation of this research.
Thank you,

Background and Purpose

I am AMSA employee doing research on manufacturing strategy. The topic of the research is

THE STATUS OF STRUCTURAL AND INFRASTRUCTURAL DECISIONS OF OPERATIONS STRATEGY IN A NICHE STEEL PRODUCING FIRM AND THEIR EFFECT ON OPERATIONS' PERFORMANCE - A CASE STUDY"

Optimizing Manufacturing Capability

Every firm wants to optimize their manufacturing. But, optimization requires some criteria. Many companies just assume that the criteria are cost and, especially, direct labour cost and capital cost. In fact, there are other factors that might be optimized. For example:

- The ability to **deliver quickly**
- The Ability to **deliver reliably**
- The ability to **produce high quality**
- The ability to build **high variety**
- The Ability to introduce **new products** quickly
- The ability to **deliver to certain locations**
- The ability to handle **volume fluctuations** and remain profitable

These various dimensions of manufacturing performance often conflict. For example low cost and high varieties often require different types of equipment and different plant layouts. Moreover, a manufacturing system, like any other engineering design, cannot optimize all dimensions simultaneously. The question of which dimension is most important constantly shifts in many firms. Near the end of the month, delivery is most important. After the first of the month, cost labour cost is most important. When an important customer complaints, quality is most important.

Manufacturing Strategy can be considered as a pattern of choices made in order to achieve the full competitive capability of a business unit. These strategies are either explicitly drawn up or implicitly realised as manifested in a stream of real time decisions made at different points of time. It is a functional [plant level] strategy [below corporate and business strategy].

Manufacturing strategy is defined by **structural factors** [capacity strategy, location, process technology, vertical integration / relationships with suppliers and development & organisation] and **infrastructural factors** [organisational structure; work force management; and the systems for planning, stock control and quality management]. An operations or manufacturing strategy is viewed as the effective use of these resources to achieve business and corporate goals.

The principal aim of the research is to determine the status of structural and infrastructural factors and their effect on operational competitiveness in niche steel producing in a South African setting. And, in the end come up with recommendations on how to maximise them, best utilize the manufacturing benefits for competitive success.

Section A: Demographics

1. **Your Role or Position (to select)**
   A role
   B role
   C role
   D role
   E role
   F role
   G role

2. **How many years have you been with the company?**
   < 5 years
   >5 and < 10
   > 11 and <20
   Over 20

Section B: Manufacturing Strategies Used

1. **Are you personally aware of the manufacturing strategy being used in the organisation**
   Not aware
   Aware
   Fully aware

2. **How would you describe manufacturing strategy making process in your organization in relation to formality?**
   Formal
   Partially formal
   Informal

3. **In your view, who among these participates in the strategy making process are involved and to what extent? Please tick the appropriate indication**

3a. To what extent is the CEO involved in the manufacturing strategy making process

Not involved at all
Involved to a certain extent
Average involvement
Involved to being highly involved

3b. To what extent is the GM involved in the manufacturing strategy making process

Not involved at all
Involved to a certain extent
Average involvement
Involved to being highly involved

3c. To what extent is the TOP MANAGEMENT involved in the manufacturing strategy making process

Not involved at all
Involved to a certain extent
Average involvement
Involved to being highly involved

3d. To what extent are the MIDDLE MANAGERS involved in the manufacturing strategy making process

Not involved at all
Involved to a certain extent
Average involvement
Involved to being highly involved

3e. To what extent are the LINE MANAGERS involved in the manufacturing strategy making process

Not involved at all
Involved to a certain extent
Average involvement
Involved to being highly involved

3f. To what extent are CONSULTANTS involved in the manufacturing strategy making process

Not involved at all
Involved to a certain extent
Average involvement
Involved to being highly involved

Any comments on the involvement of the above

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……
……
……

……
……

4. Competitive Priorities (Determining Manufacturing strategies in use)
In general, the company has competitive priorities which it aims to achieve in order to satisfy customers

- Cost priority
- Quality priority
- Flexibility priority
- Delivery priority

Indicate the degree of emphasis which the company has placed on the following activities over the last five years to remain competitive. (Please tick appropriately)

COST PRIORITY

4.1 Manufacturing strategy adopted is based on need for reduction of unit costs

No emphasis at all
Small/limited emphasis
Average /acceptable emphasis
High emphasis

4.2 Manufacturing strategy adopted is based on need for reduction of material costs

No emphasis at all
Small/limited emphasis
Average /acceptable emphasis
High emphasis

4.3 Manufacturing strategy adopted is based on need for reduction of material costs

No emphasis at all
Small/limited emphasis
Average /acceptable emphasis
High emphasis

4.4 Manufacturing strategy adopted is based on need for reduction of overhead costs

No emphasis at all
Small/limited emphasis
Average /acceptable emphasis
High emphasis

4.5 Manufacturing strategy adopted is based on need for reduction of inventory levels

No emphasis at all
Small/limited emphasis
Average /acceptable emphasis

High emphasis

QUALITY PRIORITY

4.6 Manufacturing strategy adopted is based on need to develop ability to offer consistent quality with low defects

No emphasis at all
Small/limited emphasis
Average /acceptable emphasis
High emphasis

4.7 Manufacturing strategy adopted is based on need to improve product performance and reliability

No emphasis at all
Small/limited emphasis
Average /acceptable emphasis
High emphasis

4.8 Manufacturing strategy adopted is based on need for improvement of vendor's quality

No emphasis at all
Small/limited emphasis
Average /acceptable emphasis
High emphasis

4.9 Manufacturing strategy adopted is based on need for creation and implementation quality control circles

No emphasis at all
Small/limited emphasis
Average /acceptable emphasis
High emphasis

4.10 Manufacturing strategy adopted is based on need for obtaining ISO 9000 certification

No emphasis at all
Small/limited emphasis
Average /acceptable emphasis
High emphasis

4.11 Manufacturing strategy adopted is based on need to create ability to provide durable products

No emphasis at all
Small/limited emphasis
Average /acceptable emphasis
High emphasis

FLEXIBILITY PRIORITY

4.12 Manufacturing strategy adopted is based on need for reduction of manufacturing lead-time

No emphasis at all
Small/limited emphasis
Average /acceptable emphasis
High emphasis

4.13 Manufacturing strategy adopted is based on need for reduction of procurement lead-time

No emphasis at all
Small/limited emphasis
Average /acceptable emphasis
High emphasis

4.14 Manufacturing strategy adopted is based on need for reduction of new product development cycle

No emphasis at all
Small/limited emphasis
Average /acceptable emphasis
High emphasis

4.15 Manufacturing strategy adopted is based on need for reducing setup/changeover time

No emphasis at all
Small/limited emphasis
Average /acceptable emphasis
High emphasis

4.16 Manufacturing strategy adopted is based on need for developing the ability to customize products to customer needs

No emphasis at all
Small/limited emphasis
Average /acceptable emphasis
High emphasis

4.17 Manufacturing strategy adopted is based on need for developing the ability to offer a broad product line

No emphasis at all
Small/limited emphasis
Average /acceptable emphasis
High emphasis

4.18 Manufacturing strategy adopted is based on need for developing the ability to make rapid product mix changes

No emphasis at all
Small/limited emphasis
Average /acceptable emphasis

High emphasis

4.19 Manufacturing strategy adopted is based on need for developing the ability to make rapid volume changes

No emphasis at all
Small/limited emphasis
Average /acceptable emphasis
High emphasis

DELIVERY PRIORITY

4.20 Manufacturing strategy adoption is based on need for increasing delivery reliability

No emphasis at all
Small/limited emphasis
Average /acceptable emphasis
High emphasis

4.21 Manufacturing strategy adoption is based on need for increasing delivery speed

No emphasis at all
Small/limited emphasis
Average /acceptable emphasis
High emphasis

4.22 Manufacturing strategy adoption is based on need for improving pre-sales service and technical support

No emphasis at all
Small/limited emphasis
Average /acceptable emphasis
High emphasis

4.23 Manufacturing strategy adoption is based on need for improving after sales service

No emphasis at all
Small/limited emphasis
Average /acceptable emphasis
High emphasis

5. Manufacturing strategy is defined by **structural factors** [capacity strategy, location, process technology, vertical integration / relationships with suppliers and development & organisation] and **infrastructural factors** [organisational structure; work force management; and the systems for planning, stock control and quality management]. An operations or manufacturing strategy is viewed as the effective use of these resources to achieve business and corporate goals

Please rate the importance / to what extent are these factors considered when decisions to design and support manufacturing are taken

5.1 Facilities [size, location]
Not important
Important
Very important
5.2 Plant production capacity
Not important
Important
Very important

5.3 Process technology [selection of appropriate technology]
Not important
Important
Very important

5.4 Supply networks/ chains
Not important
Important
Very important

5.5 Planning and control systems
Not important
Important
Very important

5.6 Quality assurance and control approaches
Not important
Important
Very important

5.7 Work Organization [human reporting structures, hierarchy]
Not important
Important
Very important

5.8 Sustainable competitive advantage and continuous improvement
Not important
Important
Very important

Any comments
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……
……
……

Section C: Factors leading to adoption of manufacturing strategies
You are given several factors that influence the choice of a manufacturing strategy of a company.
Kindly rate how these factors have influenced the choice of strategy currently being pursued in your company

6.1 Need to become the best in class (World Class)
Not influential
Influential
Very influential

6.2 Continuous Process Improvement
Not influential
Influential
Very influential

6.3 Manufacturing capabilities available and constraints
Not influential
Influential
Very influential

6.4 Financial resources available
Not influential
Influential
Very influential

6.5 Satisfy customers' demands
Not influential
Influential
Very influential

6.6 Product dimensions, technicalities, as- rolled qualities [process routes]
Not influential
Influential
Very influential

6.7 Increased competition
Not influential
Influential
Very influential

Section D: Relationship between manufacturing strategy and operational performance
1. How have the following Operational performance measures been impacted by manufacturing strategy? (Please tick appropriately)

	Operational Performance Measures	**Manufacturing Strategy**	**Declined over the years**	**Stayed the same over the years**	**Improved over the years**
	Scale		1	2	3
7a	Time needed to develop new products or services	**Flexibility**			
7b	Range of products or services				
7c	Machine change-over time				
7d	Average capacity or Maximum capacity				
7e	Time to change schedules				
7f	Utilization of resources	**Cost**			
7g	Labour Productivity				
7h	Added Value				
7i	Efficiency				
7j	Cost per hour				
7k	Number of defects per unit	**Quality**			
7l	Level or number of customer complaints				
7m	Customer satisfaction score (index)				
7n	Warranty claims				
7o	Prime first time quality yield				
7p	Scrap & Rework				
7q	Order lead time	**Delivery**			
7r	% of products on time and in full				
7s	Actual versus theoretical throughput time				
7t	Manufacturing cycle time				
7u	Percentage of orders delivered late				
7v	Schedule adherence				