# Classification of Small to Medium Size Manufacturing Enterprises in Fluctuating Economic Conditions

A thesis submitted for the degree of Doctor of Philosophy

by

**Atefeh Sayad Saravi**

Department of Mechanical, Aerospace and Civil Engineering

Brunel University London

April 2020

# Abstract

Small and Medium Enterprises (SMEs) are at the behest of economic turbulences. Key to sustainability is achieving high-performance standards and being able to effectively measure and monitor performance. This study researches a novel conceptual framework and analysis process to develop a performance measurement system (PMS) for manufacturing SMEs in the UK. The PMS may improve the chances of sustainability of manufacturing SMEs. The PMS was developed underpinned from the literature and tested through an empirical study. The current investigation uncovers the feasibility that a PMS could enable manufacturing SMEs to make their operations more sustainable.

Twenty-five manufacturing SMEs took part in this study over a two period of data acquisition and surveying. About one hundred and thirty interviews and questionnaire were designed to acquire and later validate the information relevant to PMS. Ten SMEs were selected as case studies for the main investigation. Critical factors identified in the literature were used for measurement in the study. Both financial and non-financial factors were considered, resulting in a wide range of measures. Financial factors representing profitability were used to classify SMEs into three groups namely: *Struggling*, *Surviving* and *Successful*. The PMS recognises existing activities as well as their influence on performance measurement (PM) with five measurable indicators: Speed/Time, Effectiveness/Efficiency, Consistency, Waste and, Leadership and Development. The model in this research was tested using regression analysis. The hypothesis is identified to indicate the important role of different factors in waste reduction and SME development. Interviews were held with three directors of each company for validating the tested model.

The results suggest that there is a wide gap between SMEs' sustainability and their business performance in the manufacturing sector of the UK. In general, for the *Successful* businesses, all the studied factors have a significant influence on waste reduction and development. In contrast, the *Struggling* SMEs did not show much sensitivity to the factors, especially for Encouraging Development. A longitudinal study to assess performance measurement practices of manufacturing SMEs

holistically rather than through the perceptions of owner/managers and employees of the SMEs is recommended for future research.

# Acknowledgements

First and foremost, I would like to take this opportunity to express my gratitude to my supervisor, Dr Alireza Mousavi, for his enthusiastic scientific support, insightful guidance, and patience throughout the course of this research.

Secondly, the completion of this research would not have been possible without the endless support of my sincere second supervisor Dr Rebecca DeCoster.

In addition, I would like to thank Brunel University and the UK SMEs, who participated in this study, for their assistance in the surveys of their registered manufacturing firms and for allowing access to their data and resources.

I thank the project consortium for providing me with the opportunity to carry out this work and the many individuals who organised it. In particular, thank you to Professor Kai Cheng, Dr Kim Ping Yang and Saeed Awal.

Despite some difficult moments, I have been fortunate to be surrounded by many individuals who helped in so many different ways in the process and to whom I am greatly indebted. Thank you to Samira Safari in particular.

I would like to thank my dear parents and brother for giving me love, motivation, support and encouragement during my PhD journey. Special thanks go to my sister for her support.

Finally, I thank with love my wonderful husband for his patience, assistance, invaluable encouragement, psychological support and understanding during the years of my research.

*I dedicate this thesis*
*to my daughters, Ayla and Ayda*

# Table of Contents

Table of Contents

# Abbreviation

| | |
|---|---|
| ABC | Activity Based Costing |
| BEM | Business Excellence Model |
| BSC | Balanced Scorecard |
| BSI | British Standards Institution |
| CCR | Capacity Constrained Resource |
| CI | Continuous Improvement |
| CSF | Critical Success Factor |
| CW1 | Product Quality (Performance) |
| CW2 | Product Quality (Conformance) |
| CW3 | Defect Free Products |
| CW4 | Customer Satisfaction Rate |
| CW5 | Waste by Product loss |
| CW6 | Waste by Time loss |
| DIISR | Department of Innovation Industry Science and Research |
| EE1 | Forecasting Production |
| EE2 | Delivery Speed |
| EE3 | Expertise Flexibility |
| EEF | Engineering Employers' Federation |
| EPA | Environmental Protection Agency |
| EPS | Earnings Per Share |
| EVA | Economic Value Added |
| FSB | Federation Of Small Businesses |
| GDP | Gross Domestic Product |
| GICS | Industry Classification Standard |
| GRI | Global Reporting Initiative |
| HACCP | Hazard Analysis and Critical Control Points |
| HR | Human Resource |
| HRM | Human Resource Management |
| IPMS | Integrated Performance Measurement for Small firms |
| ISAT | Improvement System Assessment Tool |

Abbreviation

| | |
|---|---|
| JIT | Just-In-Time |
| KPIs | Key Performance Indicators |
| LD1 | Employee Appraisals |
| LD2 | Competitiveness |
| LD3 | Feedback Activities |
| LD4 | Knowledge Acquisition |
| LD5 | Leadership Supports Development |
| LD6 | Focus of Attention |
| LD7 | Knowledge Transfer |
| LD8 | Employee Training |
| LD9 | Motivation |
| LD10 | Development |
| LD11 | Encourage Development |
| LD12 | Tolerance for Mistakes |
| LD13 | Knowledge Creation |
| LD14 | Knowledge Providers |
| LD15 | Development Changes |
| LD16 | Development Communication |
| MCS | Management Control System |
| MSME | Micro, Small and Medium Enterprise |
| NAICS | North American Industry Classification System |
| NAM | National Association of Manufacturers |
| NMCP | National Manufacturing Competitiveness Programme |
| OPM | Organisational Performance Measurement |
| PM | Performance Measurement |
| PMA | Performance Measurement Association |
| PMM | Performance Measurement Model |
| PMS | Performance Measurement System |
| POS | Point of Service |
| QMS | Quality Management System |
| ROA | Return on Assets |
| ROE | Return on Equity |
| ROI | Return on Investment |

Abbreviation

| | |
|---|---|
| RSR | Resource Stability and Reliability |
| SBA | Small Business Administration |
| SMEs | Small and Medium Enterprises |
| SPSS | Statistical Package for the Social Sciences |
| SR | Sustainability Report |
| SUSB | Statistics of U.S. Businesses |
| TOPSIS | Technique for Order Preference by Similarity to Ideal Solution |
| WCED | World Commission on Environment and Development |

# List of Figures

# List of Tables

List of Tables

# Chapter 1

# Introduction

## 1.1 Overview

This study contributes to the body of knowledge finding and constructing a method of measuring the key performance indicators of economic and operational viability of SMEs in manufacturing sector.

The aim of this introduction is to establish the basis of the study. It provides a perspective for the study through the presentation of the background information, the problem statement, the research question, motivation, the research aims, and the methodology applied.

Sections 1.2 and 1.3 describes the background of the issue, concentrating on the importance of Small and Medium Enterprises (SMEs). Additionally, it focuses on various problems experienced by UK SMEs as well as the value of measuring performance within enterprises. Section 1.4 describes the factors that motivated the research, while Section 1.5 presents the thesis statement followed with created value in manufacturing SMEs in Section 1.6. Section 1.7 includes the research aim and objectives. Section 1.8 explains the structure of the thesis.

## 1.2 Background of the Study

The background of the study emphasises the significant role that SMEs play within the global economic structure in general, with a specific focus on the economy of the UK. The complex problems confronting UK SMEs are also explored. This

section also introduces the notion of PM along with a discussion of its potential to improve the successfulness and survivability (i.e. the viability) of SMEs.

### 1.2.1 Effect of SMEs on Global Economy

There are many studies highlighting the effect of SMEs on poverty alleviation, employment creation and economic development in both developing and developed economies (Gherhes et al., 2016; Jitmaneeroj, 2016; Padachi and Bhiwajee, 2016; Valaei, Rezaei and Ismail, 2017). Table 1.1 details the impact of SMEs on employment creation and the Gross Domestic Product (GDP) in selected countries. The information presented in this table, for both developed and developing countries, suggests that SMEs play a crucial role in the economic development. Consequently, research aiming to enhance the survival, success and sustainability of SMEs may not only benefit SMEs, but also the national economy. This is the main motivation of this thesis.

Table 1.1: Contribution of SMEs in selected countries (GDP: Gross Domestic Product).

| Country | Share of all businesses (%) | GDP (%) | Employment (%) | References |
|---|---|---|---|---|
| UK | 99.9 | 52 | 60 | Department for Business, Energy and Industrial Strategy (2018) |
| Italy | 99.9 | 68.1 | 81 | European Commission (2016) |
| Australia | 96 | 33.1 | 63 | Department of Innovation Industry Science and Research, Australia (2011) |
| Kenya | 90 | 18 | 80 | Katua (2014) |
| USA | 99.7 | 44.5 | 48 | Statistics of U.S. Businesses (2016), Small Business Administration (2012) |
| China | 99.3 | 60 | 80 | Zhao and Wang (2015) |
| South Africa | 90 | 42 | 60 | Abor and Quartey (2010) |

### 1.2.2 Significance of SMEs in UK

SMEs play a significant role in the economic growth of the UK. A survey by the Federation Of Small Businesses (FSB) estimated that there are 5.6 million SMEs in the UK with an estimated turnover of £2.0 trillion in 2018, employing 16.3 million people (Federation Of Small Businesses, 2018). The contribution of SMEs to employment and economic sustainability and growth in the UK is thus substantial. These high numbers are a result of the economic environment and the market change; the timeliness of investigating the means for predicting the viability of SMEs is critical due to the rapid and significant changes in the UK economy likely to be affected by factors such as Brexit (Blackaby, 2018).

One of the major sectors of UK economy is the production sector encompassing manufacturing, service (e.g. tourism), agriculture, and the construction industries (Office for National Statistics, 2013). The manufacturing sector in the UK accounts for 44% of UK exports and directly employs 2.6 million people (The Manufacturer, 2019). Therefore, researching to improve manufacturing SME performance is likely to also support economic growth in the UK.

### 1.2.3 SMEs Failure

Although SMEs form the main part of economies in the UK and other countries, they still have a high failure rate (Jones, 2009; Fatoki, 2014), raising the question of why? The main challenge faced by most SMEs in the turbulent economic environment is the ability to sustain their operations as the dynamics of supply and demand oscillates within the limited resources available to them. The dynamics of supply demand is outside the scope of this thesis, but the utilisation of resources towards sustainable operability is.

The context and subsequently the structure (i.e. alignment of resources) of today's business is changing rapidly. It generates a great deal of uncertainty. This environment forces firms, particularly SMEs, to carefully plan the processes and practices needed to survive in the market. This means that they must keep a close

eye on their performance (Kennerley and Neely, 2003; Raymond, St-Pierre and Marchand, 2009; Cocca and Alberti, 2010) and managers of SMEs need to respond quickly to changing markets.

Researchers posit that SMEs experience extremely high rates of failure, with the majority not being able to survive after their initial period of operation (Asah, Fatoki and Rungani, 2015; Lampadarios, 2016; Maduekwe and Kamala, 2016). Insufficient resources (i.e., lack of finance) is regarded as the primary factor causing SMEs to fail, although other researchers have demonstrated that this assertion is inaccurate (Blumberg and Letterie, 2008; Frazer, Weaven and Grace, 2012). In the experience of the author as an SME owner, strategies and plans of companies can at times be over conservative, and at times marred by high risk taking. Such observed natural behaviour causes miscalculations leading major losses and bankruptcy.

Naimy (2004) suggests using specific measures to define SMEs, including the number of personnel, the value of assets, sales turnover, invested capital and attributes of management. Lyons and Mattare (2011) claim that staff in SMEs are not formally trained and are only provided with non-formal training that allows them to become acquainted with the business, their duties, practical skills required for their role, and other additional guidance if appropriate. In fact, even the founders and managers of UK SMEs may not have been suitably trained in terms of business functionality.

Additional factors that cause SMEs to fail include unsuitable infrastructure, inadequate marketing proficiency and awareness, insufficient information and no market accessibility (Arasti, Zandi and Talebi, 2012; Nyamwanza et al., 2015; Baporikar, Nambira and Gomxos, 2016; Lampadarios, 2016).

Developing a basic framework for PM that can be used by SMEs in the manufacturing industry to improve business performance may help to control and reduce the rate of failure.

## 1.3 Performance Measurement and Sustainability

The primary aim of evaluating the performance of SMEs is to investigate the impact of certain factors on the ability of a company to be successful and survive (Taticchi, Balachandran and Tonelli, 2012; Zeglat et al., 2012; Klovienė and Speziale, 2015; Sorooshian et al., 2016; Gerba and Viswanadham, 2016). There is a continuing debate regarding how effective a PMS is for SMEs. Nevertheless, the majority of researchers has confirmed that it is essential that an appropriate PMS is implemented for firms to employ, in order to increase their successfulness and survivability. It has been determined that PM is a vital business instrument for improving the performance of an enterprise, as it can enable the firm's primary activities to be monitored and evaluated (Hegazy and Hegazy, 2012; Zeglat et al., 2012; Al-Matari, Al-Swidi and Fadzil, 2014; Akpabot and Khan, 2015; Saunila, 2016).

An important question with regard to this subject relates to how measuring the performance of a business is connected with its ability to be sustainable. This could be answered by evaluating the impact of applying a PMS to the belief systems of an enterprise management and to how they operate their business (Srimai, Radford, and Wright, 2011).

Taticchi, Balachandran and Tonelli (2012) assert that measuring the performance of a business can encourage managers to act proactively instead of reactively. This can assist SMEs in becoming suitably prepared for any operational problems they may encounter going forwards (Gallani, Kajiwara and Krishnan, 2015). As a result, owners or managers can improve the potential of a business to survive and continue operating. Furthermore, evaluating enterprise performance could motivate business directors to identify the specific factors, which are essential to the enterprise succeeding and surviving. At the very least, it may enable them to avert failure and develop frameworks for the measurement and management of these crucial factors.

An additional aspect that emphasises the significance of a PMS for sustainability of SMEs is that it allows businesses to assess their activities. The measurement of performance based on specific goals allows management to acquire feedback on

progress, thus enabling them to accomplish their strategic goals (Alfaro, Ortiz and Poler, 2007).

While a large volume of research has been dedicated to PMSs for SMEs, there seems to be less attention been dedicated to the success and survivability of SMEs (Akpabot and Khan, 2015; Saunila, 2016; Zerfass and Winkler, 2016). The development of a suitable PMS is an additional problem that should be resolved (Fisher, Maritz and Lobo, 2014; Wach, Stephan and Gorgievski, 2016). There is no consensus among researchers regarding the nature of measures of performance. While some advocate the traditional classifications like quality, flexibility, time and cost (Bulak et al., 2016), others suggest that different measures should be used such as market share, growth in sales, leadership, survivability, profitability and consumer satisfaction (Amir, Auzair and Ismail, 2014; Wach, Stephan and Gorgievski, 2016). Hence, for this research, it is necessary to design an agile framework of performance measures that can be applied to manufacturing SMEs. Figure 1 demonstrates examples of performance measures for which data can be collected from process variables in an SME.

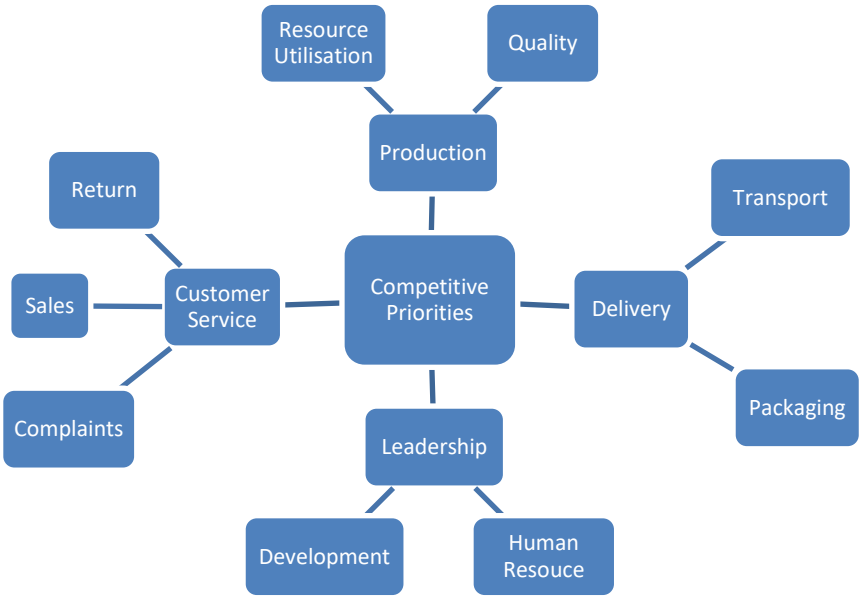



Figure 1.1: Competitive priorities used in this research (Krajewski and Ritzman, 2001; Amir, Auzair and Ismail, 2014; Bulak et al., 2016; Wach, Stephan and Gorgievski, 2016).

## 1.4 Research Motivation

Existing studies have shown the significance of measuring performance in enterprises, through products and procedures. However, the literature in the field is rather inconsistent and lacking in clarity. Particularly, most of the literature on PM does not differentiate between sizes of business (Carpinetti, Galda´mez and Gerolamo, 2008) so even if many PM approaches are proposed, few focus specifically on SMEs (Garengo, Biazzo and Bernardi, 2007).

Several scholars claim that PMSs for large enterprises are often not suitable for SMEs (Gunasekaran, Patel and Tirtiroglu, 2001; Ahmed and Sun, 2012; Einwiller and Boenigk, 2012; Ates et al., 2013; Zerfass and Winkler, 2016). Although studies on PMS in larger enterprises have produced valuable results, the differences between large firms and SMEs, such as their needs, financial resources, and operating requirements, render the findings inapplicable to smaller enterprises (Buonanno et al., 2005; Laukkanen, Sarpola and Hallikainen, 2007). Researchers (Ahmad and Alaskari, 2014; Klovienė and Speziale, 2015) continue to argue the need for flexible, simple and easy to use PMSs among SMEs (Simpson, Padmore, and Newman, 2012; Pekkola, Saunila, and Rantanen, 2016).

Some researchers believe that to be relevant for SMEs, an assessment tool should not be a simple miniature of the tools developed for larger enterprises; whilst remaining simple, comprehensive, not too demanding in terms of resources and it must be able to guide owner/managers towards action and improvement (St-Pierre and Delisle, 2006).

For example, Klovienė and Speziale (2015) discuss the necessity to design a basic framework for measuring performance that can be effectively used by SMEs. The current absence of such a framework has been identified in the initial literature review (Chapter 2). Further, the review shows that there has been limited focus in the literature on manufacturing SMEs. No research studies on SMEs within the UK manufacturing sector were found in the review. Furthermore, although a limited number of researches in both developing and developed nations have studied manufacturing SMEs, the operating environments in developing and developed

contexts could differ. The problems such enterprises encounter could vary as a result of different social, economic and political conditions. It is currently unclear whether the existing frameworks for measuring performance are appropriate for application in SMEs in developed countries, such as the UK. Thus, it is necessary to develop a framework that is specifically tailored to the requirements of SMEs in the UK manufacturing sector.

Additionally, the majority of available studies reviewed appear to have a specific deficiency in that although they provide suggestions regarding the aspects that could be incorporated into a PMS, they do not develop one. Some recommendations are relatively broad and are therefore not beneficial for developing a PM instrument that can be applied in practice. The majority of available frameworks focuses on theory and their suitability for practical use remains undetermined (Ates et al., 2013; Pekkola, Saunila, and Rantanen, 2016). It is also evident that SMEs are often limited to using frameworks that are not applicable to their specific situation (Nudurupati et al., 2011). Hence, the proposed framework should be suitable for practical applications in addition to being scientifically useful in the context of application.

Considering the above discussion, it is evident that the implementation of performance measures from a balanced point of view is recommended, that is incorporating both the financial and the non-financial aspects. Moreover, the concerns from the current literature suggest that there is potential to examine how the performance of SMEs is measured. Consequently, the objective of this research is to develop a model that UK manufacturing SMEs can use to measure their performance practically, effectively and efficiently, and appropriates for the context.

## 1.5 Thesis Statement

It is feasible that a PMS could enable manufacturing SMEs to make their operations more sustainable. For instance, they could proactively identify the main areas in which they are deficient and which impact on their performance. Through identifying these deficiencies, corrective measures can be applied sufficiently early to ensure that performance can be sustained. Preventing failure and supporting long-

term survivability are the greatest challenges confronting the majority of SMEs (Asah, Fatoki and Rungani, 2015; Parnell, Long and Lester, 2015; Zhao and Wang, 2015; Lampadarios, 2016; Maduekwe and Kamala, 2016). In the context of the UK, only 44.1% of enterprises are capable of surviving for at least five years and almost 50% experience failure in the first four years of operation (Office for National Statistics, 2016).

Scholars define numerous notions, except financial resources, as leading to sustainable performance. In fact, Frazer, Weaven and Grace (2012) claim that access to finance may result in the organisation having higher levels of debt, if the source is a loan. Hence, in this investigation, both financial and non-financial factors have been considered to measure SME performance.

To identify a model for successful PM in this study, SMEs were classified based on their performance in terms of financial conditions: Struggling, Surviving and Successful SMEs. Critical factors for sustainability are investigated in the performance of these three categories of SMEs.

While previous research has tended to focus on identifying the reasons for SME failure or on critical success factors, this study attempts to focus on designing an appropriate framework to support sustainable performance of manufacturing SMEs. Comparing the behaviour of struggling, surviving and successful enterprises should highlight the needs of manufacturing SMEs to help develop an appropriate PMS for sustainability.

## 1.6 Creating Value in Manufacturing SMEs

Today's competitive global economy has increased the demand for manufacturing companies to deliver faster with higher quality to meet consumer expectations, while reducing costs. Globalization of the marketplace, especially in developed countries, is creating new markets for small enterprises to enter the manufacturing environment. This creates intense competition between small and large firms, which previously controlled the market. This competitive environment needs SMEs to

design and implement tailored business processes to become more agile to meet changing market demands (Sedehi, 2015).

It is anticipated that the current study will develop a PMS suitable for implementation by manufacturing SMEs within developed nations. This framework could motivate SMEs in the manufacturing industry to evaluate their performance and develop strategies for future operations. Additionally, SME sustainability is crucial for the economy as such enterprises employ more than 50% of the workforce (Katua, 2014; Zhao and Wang, 2015; European Commission, 2016; Valaei, Rezaei and Ismail, 2017).

This research will make theoretical contribution to the implementation of the notion of PM for SMEs. Most published studies have focused on PMSs in large firms, but there appears to be little literature on PM for SMEs in the manufacturing sector. Finally, holistic study of PM in manufacturing SMEs appears not to have been addressed yet in research.

## 1.7 Research Aim, Objectives and Questions

### 1.7.1 Research Aim

This research contributes a framework for PM of manufacturing SMEs. The aim is to examine the changing drivers of SMEs in the UK and to identify the relationships between critical factors and the sustainability of UK manufacturing SMEs.

### 1.7.2 Research Objectives

The specific objectives of the study are to:

- demonstrate that research into SME sustainability can benefit from identifying the changing context and drivers and the required performance of key performance indicators (KPIs) and associated metrics.

- detect the critical factors for the performance of SMEs and classify them based on a literature review.
- investigate and develop a conceptual framework applicable to SMEs in the manufacturing sector of a developed country such as the UK.
- employ holistic PM considering KPIs including delivery, quality, cost and flexibility.
- empirically identify the factors affecting manufacturing SME's performance, and employ analytical tools offered by SPSS software to calculate descriptive statistics with regards to corresponding PM metrics.
- validate the PMS by evaluating it for the degree to which it can be used to increase the sustainability of UK SMEs.
- explore the relationship amongst the classified SMEs based on the degree of their sustainability (*Successful*, *Surviving* and *Struggling*).

### 1.7.3 Research Questions

1. What aspects of manufacturing SMEs have the greatest influence on their performance?
2. What level of influence do the critical factors have on a firm's sustainability?
3. To what extent do waste and development influence SMEs?
4. What are the characteristics of SMEs in the UK, which determine their success?

## 1.8 Structure of Thesis

The rest of this thesis is divided into seven further chapters, which are described below. Figure 1.2 shows the instruction of chapters.

Chapter 1: Introduction

This chapter has introduced the current study, focusing on the concept of PM, sustainability and characteristics of SMEs. It sets the context of the study by

providing the background to the topic of the investigation and includes the research motivation, aims and objectives, and the thesis structure.

Chapter 2: Literature Review

Chapter 2 reviews literature on PMSs and critical factors. The chapter looks at definitions of performance and PM frameworks, theories guiding this research, the weaknesses and strengths of the common PMSs and the success factors influencing these models. An attempt is made to identify the critical success factors (such as waste and development), KPIs, and performance measures for SMEs as well as the existence of relationships between the selected critical indicators and performance.

Chapter 3: Manufacturing SME Characteristics

The PMS, which emerged from this research is justified in Chapter 4. Collected data are used to classify SMEs into three groups (*Struggling*, *Surviving* and *Successful*). The background of ten manufacturing SMEs and their classifications are reported on. Delineation and limitations of the framework and potential improvements are discussed.

Chapter 4: Research Methodology

This chapter looks at the proposed framework and justification for adopting the research design. The target population and data collection methods are presented. The research instruments are discussed including the selection of metrics and indicators along with their definitions. The chosen methods and statistical tools for analysis of the data are justified.

Chapter 5: Data Analysis

Performance is analysed using success factors identified from the literature and data collected from survey questionnaires of SME managers and employees. Reliability tests and analysis of variance (ANOVA) are performed on the data. In this chapter, the data analysis using SPSS version 23 is presented through figures and tables.

Chapter 1. Introduction

Chapter 6: Model Testing

This chapter reports on the empirical findings from the model testing, including reliability- and normality tests and correlation- and regression analyses. The findings are validated by interviews, to explore the accuracy of the PMS.

Chapter 7: Validation and Discussion

This chapter discusses the empirical findings in the context of the existing literature. The concept of the sustainability indicator related to features of the studied SMEs is discussed. In addition, the validation of the proposed model is considered in this section.

Chapter 8: Conclusions

The major findings are summarised and key limitations of the work and its contribution for practitioners are described. Conclusions drawn from the findings and recommendations are proposed based on the results. Future areas for research are identified.

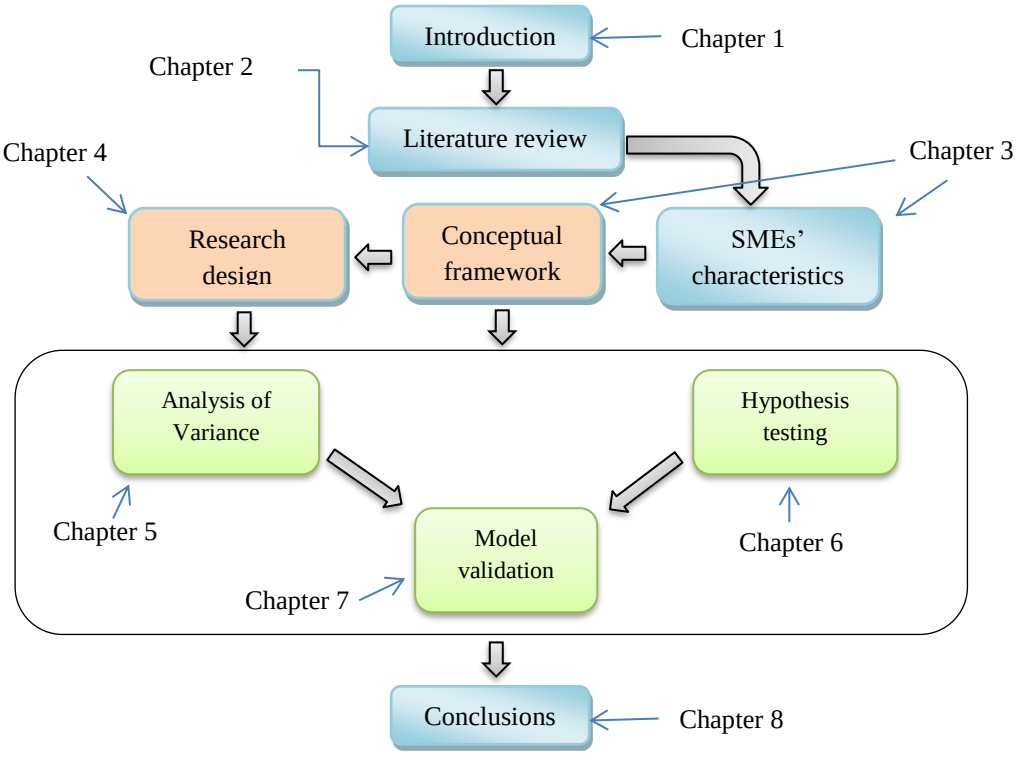



Figure 1.2: Chapter plan of the thesis.

# Chapter 2

# Literature review

## 2.1 Introduction

The previous chapter included a general overview of the study. The chapter described the background to the study, the significance of SMEs for both global and UK economies, as well as the notion of performance measurement (PM). The factors motivating the research along with a brief summary of the research have also been provided.

The literature presented in this chapter develops the foundation upon which the research reported in this thesis was designed. A systematic method was used to guide the literature review for assessing the impact of PM on manufacturing SMEs. First, the definition of concepts is presented which establishes a framework and direction for the research. Then the literature search and collection are reported. For this purpose, the library search engines available at the Brunel university were employed alongside professional databases such as Web of Science, Elsevier (ScienceDirect), Medline, IEEE Explore, Springer, PubMed, etc. After identifying all relevant studies, in the evaluation process, only high-quality references were used for the research. In the first sections, further definitions of business performance, and PM are investigated. The final sections look at critical factors and sustainability.

## 2.2 Business Performance

Business PM is a multi-faceted topic of study from several perspectives, namely (Krajewski and Ritzman, 2001; Amir, Auzair and Ismail, 2014; Bulak et al., 2016; Wach, Stephan and Gorgievski, 2016):

a) Performance of a business could have multiple dimensions, such as human resource, finance, quality, customer satisfaction, etc (Van Looy and Shafagatova, 2016).
b) Different performance dimensions call for different methods of measurement. For instance, customer satisfaction measurement requires customer surveys, whereas cost performance can easily be measured from the existing accounting systems. Additionally, some of the dimensions are quantitative, whereas others are qualitative in nature (Cocca and Alberti, 2010).
c) PM can be context-dependent, especially in the SME category where standards and systems are viewed to play an insignificant role (Melnyk et al., 2014).

This multi-faceted nature of PM of SMEs brings challenges and complexities of the task in hand. Tackling these challenges and complexities generates motivation for further research.

This chapter reviews the existing evidence on PM in general, and particularly with a focus on SMEs. A more in-depth definition of SME as reported in the literature is first presented.

## 2.3 Performance Measurement

Before the 1980s, PM was mostly developed for large industrial organizations, focusing on financial data. However, after the late 1980s, scholars recognised that due to the increasing complexity of firms and markets, financial data alone could not capture comprehensive performance information (Johnson and Kaplan, 1987; Wu, 2009).

PM constitutes the core activity in the performance management process and PM mechanisms are considered to have made significant contributions to different facets of performance, including quality and processes of continuous improvement (Carlucci, Marr and Schiuma, 2004).

### 2.3.1 Main Features of Performance Measurement

A wide range of PM systems (PMS) has been developed over the past few decades, none claiming to be flawless. In fact, it is almost impossible to prescribe the best PMS for every context. It is, however, possible to identify a set of key features that are recommended by the literature for designing an effective PMS. Garengo, Biazzo and Bititci, (2005) present an analysis of the key features that characterise contemporary PMSs, mostly introduced after the mid-1980s, as summarised in Table 2.1. Moreover, Inman and Simmering (2006) added another characteristic to the above list, namely: Match organization's culture.

Table 2.1: Key features of performance measurement systems (Garengo, Biazzo and Bititci, 2005).

| # | Key Features | Description |
|---|---|---|
| 1 | Strategy Alignment | Alignment with a company's business strategy |
| 2 | Strategy Development | Supports strategy development |
| 3 | Focus on Stakeholders | Stakeholder satisfaction as a focus of PMS |
| 4 | Balance | A balance among various perspectives of a company's performance (e.g. internal and external, top and bottom levels) |
| 5 | Dynamic Adaptability | Quick adaptation to the changes in the internal and external contexts |
| 6 | Process Orientation | Performance measurement by business processes |
| 7 | Depth vs. Breadth | Focus on specific objectives vs. measuring a broad range of objectives |
| 8 | Causal Relationships | A quantitative model that formulates a relationship between the results and the metrics |
| 9 | Clarity and Simplicity | Simple metrics and clear procedures |

In a more recent study, Yadav and Sagar (2013) highlighted a more streamlined list including four key features of a PMS, namely being holistic, integrated, dynamic and effective, that can help an enterprise to succeed in a competitive business environment.

A PMS is founded on a theoretical model or framework, which underpins how the performance is measured. The next section is devoted to the literature on PM

models/frameworks across the whole spectrum of businesses, rather than for SMEs alone.

### 2.3.2 Overview of Performance Measurement Frameworks

The Garengo, Biazzo and Bititci (2005) present the eight most widely used PM models, namely:

1) Performance Measurement Matrix (Keegan, Eiler and Jones, 1989);
2) Performance Pyramid System (Lynch and Cross, 1991);
3) PMS for service industries (Fitzgerald et al., 1991);
4) Balanced Scorecard (BSC) (Kaplan and Norton, 1996);
5) Integrated PMS (Bititci, Carrie and McDevitt, 1997);
6) Performance Prism (Neely, Adams and Kennerley, 2002);
7) Organisational Performance Measurement (OPMs) (Chennell et al., 2000);
8) Integrated Performance Measurement for Small firms (IPMS) (Laitinen, 2002).

Garengo, Biazzo and Bititci (2005) also provide a comparative analysis of these eight models across the nine key features of PMS listed in Table 2.1, section 2.3.1. Their comparison shows that the Performance Prism model represents the most complete model in terms of the nine key features listed in Table 2.1.

Most of the above models, however, make no reference to a company's size; models 7 and 8, however, were specifically developed for SMEs. Models and frameworks with a reference to SMEs are reviewed later in section 2.4.4.

In a more recent review study, Yadav and Sagar, (2013) evaluated 25 frameworks. They categorised these frameworks on the basis of five broad themes:

1. Classical and dominant PMS frameworks
2. Holistic and integrated PMS frameworks
3. Frameworks updating BSC approach
4. Context-specific PMS frameworks

5. Recently developed PMS frameworks

Table 2.2 contains information on these five themes and the frameworks for each.

Table 2.2: Categorisation of PMS frameworks (adapted from Yadav and Sagar, 2013).

| # | Category | Description | Frameworks |
|---|---|---|---|
| 1 | Classical and dominant PMS frameworks | Popular frameworks, incorporating non-financial performance measures, quality, self-assessment and inclusion of most of the stakeholders | • BSC (Kaplan and Norton, 1996)<br>• Performance Pyramid (Lynch and Cross, 1991)<br>• European Foundation Quality Model – excellence model (European Foundation, 1991)<br>• Performance Prism (Neely, Adams and Kennerley, 2002) |
| 2 | Holistic and integrated PMS frameworks | Integrating operational, functional and strategic aspects of enterprise performance | • Consistent PMS (Flapper, Fortuin and Stoop 1996)<br>• Integrated dynamic performance measurement system (Ghalayini, Noble and Crowe, 1997)<br>• Dynamic performance measurement system (Bititci, Trevor and Begemann, 2000)<br>• Integrated performance measurement framework (Medori and Steeple, 2000)<br>• Dynamic multi-dimensional performance framework (Maltz, Shenhar and Reilly, 2003)<br>• Holistic performance management framework (Anderson, Henriksen and Aarseth., 2006) |
| 3 | Frameworks updating BSC approach | Incorporating and updating the BSC approach | • Kanji's business scorecard (Kanji and Sa, 2002)<br>• Holistic scorecard (Sureshchandar and Leisten, 2005)<br>• Total performance scorecard (Rampersad, 2005)<br>• System Dynamics based BSC (Barnabe, 2011)<br>• Proactive BSC (Chytas, Glykas and Valiris, 2011) |
| 4 | Context-specific PMS frameworks | Incorporating specific contexts of performance, such as economic value, social values, quantitative factors, performance value chain, etc. | • Measures for time-based competition (Azzone, Masella and BerteleA, 1991)<br>• Economic value added (Stewart, 1991)<br>• Input-process-output-outcome framework (Brown, 1996)<br>• Shareholder value (Rappaport, 1998)<br>• Quantitative models for performance measurement systems (Suwignjo, Bititci and Carrie, 2000)<br>• The action-profit linkage model (Epstein and Westbrook, 2001)<br>• Beyond budgeting (Hope and Fraser, 2003)<br>• The performance planning value chain (Neely and Jarrar, 2004) |
| 5 | Recently developed PMS frameworks | Incorporating major recent issues related to enterprise performance | • Flexible strategy game-card (Sushil, 2010)<br>• Sustainability performance measurement system (Searcy, 2011) |

The need for organizations to align their PMSs with their long-term goals is well established (Kaplan and Norton, 1996; Wheelen and Hunger, 2002). Many PM frameworks have emerged focusing on long-term goals, the most popular being the BSC (Kaplan and Norton, 1992), which emphasises financial and non-financial measures that are aligned with strategic objectives (Bremser and White, 2000; Hudson, Lean and Smart., 2001). As a principle in the BSC, PMs link business strategy to operational performance, thereby identifying critical factors of success in the long run (Kaplan and Norton, 1996). Despite the apparent simplicity of this management principle, it has proven to be an ongoing challenge to translate the theory effectively into practice.

A large volume of studies which have focused on practitioners indicate that the ability of enterprises to survive and grow in markets that are becoming increasingly competitive is highly dependent on their ability to innovate (Kim and Maubourgne, 2005). Rosenbusch, Brinckmann and Bausch, (2011) apply meta-analysis techniques to aggregate prior empirical research on the innovation–performance relationship.

Another method for the evaluation and revision of performance measures has been proposed by Tangen (2004). The method, called 'the Performance measurement progression map', is formed as a flowchart and consists of nine steps separated into three phases. Phase A focuses on finding an appropriate and useful set of measures; Phase B is concerned with how each individual performance measure is designed, while Phase C includes the actual implementation of the results from the previous two phases.

Srimai, Radford and Wright (2011) suggest an evolutionary enhancement of PMSs and present four types of PMS evolutions from 'operations to strategy', 'measurement to management', 'static to dynamic', and 'economic-profit to stakeholder focus'.

PMSs always include a number of dimensions and measures that represent various perspectives of their performance. The next two sections present studies in the literature on these different aspects of PM.

### 2.3.3 Performance Measurement Dimensions

Major areas of performance, or so-called 'dimensions', in an organisation have been identified in various terms in the literature. Time, Cost, Quality and Flexibility are repeatedly cited as the primary operational dimensions (Kaplan, 1983; Lynch and Cross, 1991; Meyer, 1994; Collier, 1995; Laitinen, 1996; White, 1996; Medori, 1998; Slack et al., 1998;), whilst Finance and Customer Satisfaction are also considered to be critical measurement areas (Keegan, Eiler and Jones 1989; Eccles, 1991; Jones et al., 1993; Bititci, 1994; Schmenner and Vollmann, 1994; Ghalayini, Noble and Crowe, 1997).

In addition, Stakeholders, including Employees, Investors and Suppliers, along with wider societal considerations such as the Community and the Environment, and Leadership are increasingly being recognised as important dimensions of performance (Sink and Tuttle, 1989; Kaplan and Norton, 1992; Fitzgerald and Moon, 1996; Waggoner, Neely and Kennerly, 1999; Neely and Adams, 2000; Amir, Auzair, Ismail, 2014). Figure 2.1 demonstrates a tree-type relationship between dimensions, categorised into four groups along with their sub-dimensions of performance.

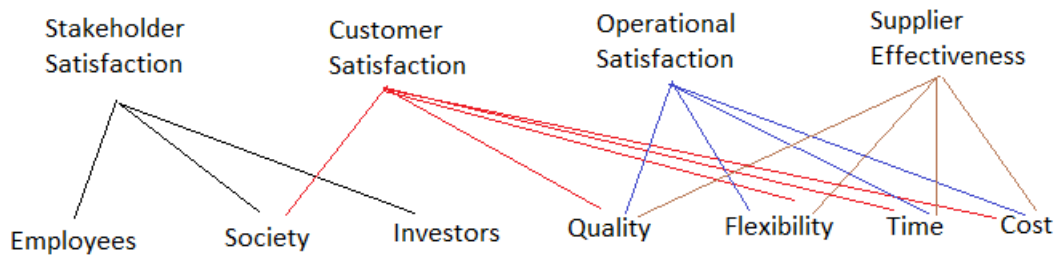



Figure 2.1: Relationships between dimensions and sub-dimensions of performance (Hudson, 2001).

### 2.3.4 Characteristics of Performance Measurement

Performance measures establish the quantitative backbone of a PMS for measuring actual performance. Globerson (1985) and Maskell (1989) are amongst the early researchers who focused on the main characteristics of performance measures, to develop a set of guidelines. Their results have been reiterated or amended through further studies (e.g. Dixon, Nanni and Vollmann, 1990; Lynch and Cross, 1991; Neely et al., 1996). Neely et al., (1997) then undertook another study, drawing together the literature to identify and verify a set of twenty-two performance measure characteristics. Four of these twenty-two characteristics can be merged, resulting in 18 unique characteristics, as presented in Table 2.3.

Table 2.3: Basic characteristics of performance measures (adapted from Neely et al., 1997).

| # | Characteristic should- | References |
|---|---|---|
| 1 | Be derived from goals (targets) and strategy | Dixon, Nanni and Vollmann, 1990; Kaplan and Norton, 1992; Globerson, 1985; Lynch and Cross, 1991; Fortuin, 1988; Maskell, 1991; Azzone, Masella, and BerteleA´, 1991; Goold, 1991; Goold and Quinn, 1990 |
| 2 | be simple to understand | Lea and Parke, 1989; Lynch and Cross, 1991; Fortuin, 1988; Maskell, 1991; Azzone, Masella, and BerteleA´, 1991; Goold, 1991; Goold and Quinn, 1990 |
| 3 | provide timely and accurate feedback | Dixon, Nanni and Vollmann, 1990; Globerson, 1985; Fortuin, 1988 |
| 4 | be based on quantities that can be influenced, or controlled, by the user alone or in co-operation with others | Globerson, 1985; Lynch and Cross, 1991; Fortuin, 1988 |
| 5 | reflect the 'business process' – i.e. both the supplier and customer should be involved in the definition of the measure | Globerson, 1985; Lynch and Cross, 1991; Fortuin, 1988 |
| 6 | be part of a closed management loop | Kaplan and Norton, 1992; Globerson, 1985 |
| 7 | be clearly defined | Globerson, 1985; Fortuin, 1988 |
| 8 | have visual impact | Lea and Parke, 1989; Fortuin, 1988 |
| 9 | focus on improvement | Lea and Parke, 1989; Lynch and Cross, 1991 |
| 10 | be consistent (in that they maintain their significance as time goes by) | Lynch and Cross, 1991; Fortuin, 1988 |

| | | |
|---|---|---|
| 11 | be based on an explicitly defined formula and source of data | Globerson, 1985 |
| 12 | employ ratios rather than absolute numbers | Globerson, 1985 |
| 13 | use data which are automatically collected as part of a process whenever possible | Globerson, 1985 |
| 14 | be reported in a simple consistent format | Lynch and Cross, 1991 |
| 15 | be based on trends rather than snapshots | Lynch and Cross, 1991 |
| 16 | provide information | Fortuin, 1988 |
| 17 | be precise – be exact about what is being measured | Fortuin, 1988 |
| 18 | be objective – not based on opinion | Fortuin, 1988 |

Clearly, the first two, namely a) that characteristics should be derived from goals (targets) and strategy, and b) they should be simple to understand, constitute the most cited ones in the literature, thus could arguably represent the most important ones as well.

These characteristics provide a generic overview of the performance measures that an IPMS should have, in terms of how they should be derived, how they should work and what they should achieve. However, they are insufficient for specifying what should be measured.

Wheelen and Hunger (2002) describe three types of performance measure necessary for effective strategic management, namely: resource input (e.g. employee skills and organisational commitment), behavioural (e.g. operational process and compliance to procedures) and outcome measures (e.g. sales, profit, customer satisfaction, customer loyalty). Researchers have focused on different metrics as a part of a well-designed PM model.

It is widely believed that performance measurement, with its focus on quality and improvement, has helped improve the performance and credibility of public-funded programmes (Ham, 2009). However, some difficulties were encountered, such as how to measure the quality of social services, which level or result would be seen as acceptable and what action should be taken when results were not acceptable, etc. Metrics, which are measurements for compression (Simons, 2000), in fact, has become an important question in performance measurement.

In addition, Kennerley and Neely (2000) added few more characteristics to those already listed in Table 2.3. For instance, they claim that PMS should be multi-dimensional.

The next section will consider performance measurement specifically for SMEs.

## 2.4 SMEs and Performance Measurement

A report prepared by the UK Department for Business, Energy and Industrial Strategy (2018) shows that SMEs make up 99.9% of all businesses and account for 60% of employment (Appendix A), while they contribute to only 52% of total turn-over of all private businesses in the UK (Figure 2.2). Therefore, it is important to discuss the formal definitions of an SME introduced in the literature, as described in the next section.

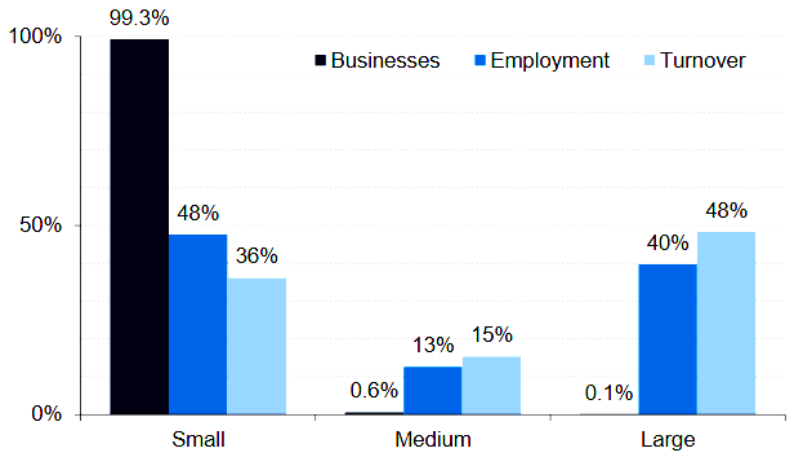



Figure 2.2: Business, employment and turnover distributions across small, medium and large organisations in the UK economy (Department for Business, Energy and Industrial Strategy, 2018).

### 2.4.1 Definition of SMEs

A number of definitions for SMEs have been introduced and these vary across the world. Economic, cultural and social differences between countries can be reflected both in the definition as well as in the classification of SMEs. For instance, The Japanese Ministry of Economy, the European Commission, and the United States define an SME as a company with fewer than 100, 250, and 500 employees, respectively. Apart from the variations in scale, there are other variations in definitions. For example, there are SMEs that have complex hierarchical structures (Rantakyrö, 2004), which is not adjustable with the expectation for SMEs structures. These issues regarding SME definitions raise the need to classify SEMs to support accurate study of them (Husband and Mandal, 1999). The most widely accepted and straight-forward definition of SMEs, however, uses 'staff headcount' as the sole criterion, and is put forward as follows:

'Any business with fewer than 250 employees is marked as SME.' (European Commission, 2016)

It can, however, sometimes encompass more criteria. The European Union (EU) has imposed the implementation of a universal definition for SMEs. In 1996, the European Commission established the first definition of SMEs, applicable to the whole territory of the European Union (EU), further amended in 2003 through the 361/2003/EC Recommendation, according to which SMEs are characterised by:

- Less than 250 employees, and
- Turnover of less than 50,000,000 EUR or annual balance of less than 43,000,000 EUR.

The 361/2003/EC recommendation by the EU, also applied in the UK (Ward and Rhodes, 2014), introduces three sub-categories of SMEs based on the number of employees, as described in Table 2.4.

Table 2.4: Sub-categories of SMEs introduced by the EU (Ward and Rhodes, 2014).

| **Sub-category of SME** | **Criteria** |
|---|---|
| Micro | 0-9 employees |
| Small | 10-49 employees |
| Medium | 50-249 employees |
| Sub-category of SME | Criteria |

Although the above definition is useful especially for national policymakers deciding on qualification for SME support programmes, there is a need for different definitions for different purposes, such as production or customer services. For instance, there are companies which are heavily dependent on other companies, while still operating independently (Carter and Jones-Evans, 2006). Consequently, besides the number of employees, the nature of business as a characteristic (Hollander, 1967) will be used to provide analytical definitions for this study.

### 2.4.2 Main Features of SMEs

According to Hudson, Smart and Bourne, (2001) the typical SME is characterised by the following features:

a) limited resources,
b) limited cash flows,
c) few customers,
d) often engaged in management ‘fire-fighting’,
e) concentrates on current performance (however that is defined, but usually concentrates on turnover) rather than taking a strategic focus,
f) often has a flat organisational structure and possibly high staff turnover.

These features mean that many SMEs do not have the capabilities or resources to create a proper and carefully designed strategy based on a rational assessment of the external business environment in which they operate (Simpson, Padmore and

Newman, 2012). Many SMEs' owners/managers do not run their businesses to maximise financial performance, but instead run their businesses for other reasons such as lifestyle (Jarvis et al., 2000; Jennings and Beaver, 1997; Walker, Loughton and Brown, 1999; Walker and Brown, 2004) and satisficing behaviour is often encountered in SMEs owners/managers (Greenbank, 2001).

The role played by the owner/manager may have an effect, since many SMEs are owned and managed by a single individual (Aldrich and Cliff, 2003); without other senior executives within the SME, sources of influence on the owner may therefore be family members. Critical success factors (CSFs) and performance may be defined according to the needs of the owners/managers rather than aiming at maximising financial performance of the business. In addition, the approach that a manager/owner adopts when interacting with his/her staff impacts on the manner in which decisions are made, along with the time required for the process, and also determines the extent to which they delegate responsibilities or assert control (Garengo and Bitici, 2007). Accurate SME research must attempt to reflect all the above features.

### 2.4.3 Performance Measurement for SMEs

Many authors have underlined the importance for businesses to evaluate and modify performance measures to adapt to the rapidly changing and highly competitive business environment (Eccles, 1991; Kennerley and Neely, 2002). However, there is a significant immaturity of studies in the literature on PM in SMEs (Brem, Kreusel and Neusser, 2008; Taticchi, Tonelli and Cagnazzo, 2010).

In review studies, several researchers (Garengo, Biazzo and Bititci, 2005; Wu, 2009; Ates et al., 2013) have identified five common issues in existing PM projects for SMEs, namely:

a) A significant gap between theory and practice of PM in SMEs
b) Lack of SMEs' involvement in PM projects
c) Incorrect use of PM models (i.e. use of simplified managerial structures)

d) Rare attention to a 'holistic approach' (i.e. only dealing with day-to-day operational concerns)
e) Informal, unplanned and unstructured effort.

Then, they identified the most significant factors that cause the above five observations and diminish the realisation of PM in SMEs, as presented in Table 2.5.

Table 2.5: Barriers to PM realisation in SMEs.

| **Barriers** | **References** |
|---|---|
| Lack of human resources | Barnes et al., 1998; Noci, 1995; Hudson, 2001; Hvolby and Thorstenson, 2000; McAdam, 2000; Tenhunen, Rantanen and Ukko, 2001. |
| Limited capital resources | Ghobadian and Gallear, 1997; Barnes et al., 1998; Burns and Dewhurst, 1996; Hudson et al., 2000; Noci, 1995; Hvolby and Thorstenson, 2000; Neely and Mills, 1993; Bititci et al., 2002. |
| Reactive mentality | Brouthers, Andriessen and Nicolaes, 1998. |
| Tacit knowledge and little attention to the formalization of processes | Garengo, Biazzo and Bititci, 2005. |
| Wrong perception of performance measurement | Bourne, 2001; Hvolby and Thorstenson, 2000; Hussein, Gunasekaran and Laitinen, 1998; McAdam, 2000. |
| Technical and operational orientation | Barnes et al., 1998; Hudson et al., 2000; Hudson and Smith, 2000; Hudson, Smart and Bourne, 2001. |

They also recommend a hybrid approach based on a combination of management control systems (MCS) and PMSs, where MCSs take an accounting management approach while PMS adopts an operational management approach. In addition, Bhimani (1994) claims that the successful implementation of a PMS in SMEs can assist decision-making processes and improve management processes and strategic control. Unfortunately, however, in spite of these potential benefits, the evidence shows that SMEs are less likely than large organizations to successfully implement PMSs in their enterprises (Taylor and Taylor, 2013).

The next two sections present studies in the literature on performance measurement models and metrics specifically in SMEs.

### 2.4.4 Performance Measurement Models/Frameworks in SMEs

Taticchi, Tonelli and Cagnazzo, (2010) claim that since the advent of the 2000s, research on performance measurement in SMEs has taken two directions: the first and main direction is the application/adaptation to SMEs of the models, which have been developed for large companies, and the second is the development of specific models for SMEs. Within the first direction, it is possible to find cases of implementation of the well-known BSC, application of quality models such as the Business Excellence Model (BEM) and application of the Activity Based Costing (ABC).

Hudson, Smart and Bourne, (2001) argue that existing measurement systems such as the BSC have been designed for medium to large corporations, whereas the c SME context requires a different approach.

Most previous studies addressed medium and large companies and ignored differences between SMEs and large companies. For instance, Bititci, Carrie and McDevitt, (1997) suggested 'Integrity' and 'Deployment' as key characteristics of PMS. Their method is based on an 'IPMS Reference Model' to enable organisations to evaluate their existing measurement systems, and whether they display these two characteristics. Similarly, Caplice and Sheffi (1995) identified a set of six criteria for the evaluation of a PMS as a whole and applied their framework successfully in two large enterprises. Cocca and Alberti (2010) reviewed recommendations provided in the literature regarding PM in companies, and defined a list of general characteristics of a 'good' PMS. The identified PMS features are tailored to SME needs through an analysis of SME characteristics and a survey of PM current practice.

There are, however, a few studies, that have particularly discussed and developed PMSs for SMEs. Each frameworks focuses on different aspects.

**Environment**

Researchers, such as Kennerley and Neely (2002), suggest that a PM model should be adaptable to the rapidly changing and highly competitive business environment. For Instance, Bahri, St-Pierre and Sakka, (2011) found that economic value added

(EVA) as a global financial factor can be a useful tool for performance management in SMEs, when used in conjunction with a list of business practices that affect the firm's results. Their findings indicate that some business practices have a direct impact on EVA within one year, while others have a deferred influence. The impacts of other practices on EVA were found to be weak or insignificant, an aspect that requires further investigation. There are many studies that focus on the effect of SMEs on the Macro or Micro economies, and vice versa. These investigations can be considered as environmental aspects in this field of research.

Moreover, customer diversity is another environmental effect on SMEs' performance. Some frameworks ignore the fact that large customer bases are not homogenous, and that often, SMEs have close relationships with their customers (McAdam, 2000; Hutchinson et al., 2015). Consequently, there is a necessity for a framework that sustains this relationship for the benefit of the SMEs.

**Improvement**

Dixon, Nanni and Vollmann, (1990) provide a collection of questions to help managers identify the improvement needs of their organisations. They focused on the existing performance measures and tried to establish an agenda for performance measure improvements.

Garengo (2009) proposes a framework to classify PMSs from SMEs, which take part in Quality Award Programmes, and to study their evolution. PMSs are classified according to two dimensions: a) PMS characteristics (i.e. how companies are using measures to manage performance) and b) PMS scope (i.e. what companies are measuring). However, the framework does not represent a tool that SMEs can use to assess the effectiveness of their PMS; rather it is a model intended for theoretical reasoning and company classifications by external academics.

Ahmad and Alaskari (2014) developed an assessment methodology that can be used to evaluate performance of SMEs in the manufacturing sector. They claim that this assessment model enables manufacturing SMEs to identify opportunities for improvement and determine gaps in their current performance.

Ates et al., (2013) found that SMEs engage with a four-stage performance management process, although there are gaps between their practice and the

complete process as recommended in literature. SMEs seem to be more focussed on internal and short-term planning and pay less attention to long-term planning.

Medori and Steeple (2000) developed a model that includes a performance measurement grid and a checklist for auditing existing performance measures. Their framework assists organisations in identifying the measures no longer relevant or useful for them ('false alarms') and the measures that are not currently being measured but are important for the company's success ('gaps').

The Improvement System Assessment Tool (ISAT) was developed by Van Aken et al., (2005). Their tool is not an assessment for PMSs, but it is part of an overall system for organisational improvement.

**Measures Effectiveness**

Researchers such as Wettstein and Kueng (2002) describe a PMS as much more than a collection of measures, having five basic elements: people, procedures, data, software, and hardware. In order to develop an effective PMS, it is necessary to identify the relevant and irrelevant factors and their relationships in the system as a whole. The literature provides some examples of this type of modelling, which are described in this section.

Tangen (2004) proposes a method, called 'the Performance Measurement Progression Map', for the evaluation and revision of performance measures. His model consists of a flow chart and nine steps separated into three phases. The method focuses on a useful set of measures, design of individual performance measures and actual implementation of the results in each phase.

Najmi, Rigas and Fan, (2005) identified a structured framework for reviewing business performance and the PMS simultaneously, considering strategic relevance of the measures as well as efficiency and effectiveness of the PMS. The framework examines organizational performance in three review stages, ongoing, periodic and overall.

## Critical Factors

Wettstein and Kueng (2002) propose the evolution of PM systems along four stages (Ad-hoc, Adolescent, Grown-up, Mature). Their model is based on six dimensions: scope of measurement, data collection, storage of data, communication of performance results, use of performance measures, and quality of performance measurement processes.

In addition, while some advocate clearly defined frameworks, others prefer to provide criteria for PMS design. Only a few researchers such as Simpson, Padmore and Newman (2012) have developed an academic theoretical framework relating success and performance in small and medium-sized enterprises (SMEs) in order to find the CSFs. They focused on SMEs in the UK and used a literature review and in-depth interviews with owner-managers of SMEs. In addition, a knowledge elicitation exercise was carried out based on the experience of the researchers and on the interviews with owner-managers. Figure 2.3 demonstrates their theoretical model.

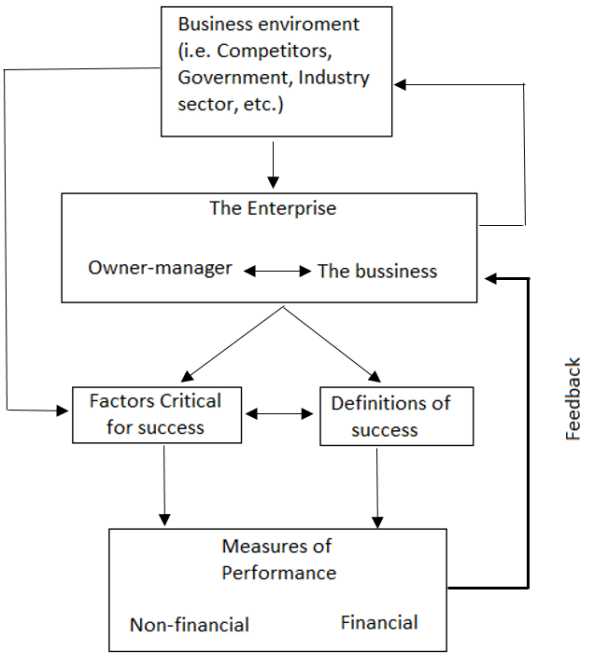



Figure 2.3: Defining theoretical success relationships (Simpson, Padmore and Newman, 2012).

Considering the above model and similar investigations by other researchers such as Cocca and Alberti (2010), it can be concluded that the framework should reflect both success and failure factors and study both financial and non-financial factors.

With reference to performance measurement, SMEs are still relying mainly on accountancy information and financial measurements (Carpinetti, Galda´mez and Gerolamo, 2008). A focus on technical aspects and production has usually led SMEs to a misconception about performance measurement, which is often considered a time-wasting activity (Garengo, Biazzo and Bititci, 2005).

In addition, one of the challenges for SMEs is keeping the PMS updated. They need to be extremely flexible and reactive to market changes; this would be even more challenging for SMEs with lack of resources and managerial expertise (Garengo, Biazzo and Bernardi, 2007; Hudson, Smart and Bourne, 2001).

The above review demonstrates that there appears to be a gap regarding a practical method to support SMEs in the process of identifying main weaknesses of performance measurements. There is a need for a model, which includes all the above factors from the literature: Environment, Improvement, Measures Effectiveness and Critical Factors. Consequently, the objective of this research is to develop a method that is able to evaluate the effectiveness of PMS factors and identify directions for improvement. The next section tends to categorise the existing studies based on their selection of the performance measurement factors for SMEs.

**Data Availability**

Because of the nature of SMEs, there are specific challenges to measuring their performance:

- Data Collection, due to the lack of historical information (Wang and Ang, 2004; Anderson, Henriksen and Aarseth., 2006).
- Interpretation of financial data can be difficult due to a small starting base, enormous and erratic growth rate and uneven record-keeping (Barnes et al., 1998, Sapienza and Grimm, 1997; Simpson, Padmore and Newman, 2012).
- Inappropriate use of longitudinal sample design; due to the group's typically short operation-history (Chandler and Hanks, 1993; Wang and Ang, 2004).

- Lack of resources to execute a comprehensive PM due to the focus only being on day-to-day operations (Stephen Town, 2000; Cocca and Alberti, 2010).

In addition, it was concluded in the section 2.3.3 that design and implementation of an effective PMS requires a wide range of inputs from several dimensions. The dynamic nature of key parameters for the success of SMEs allows for a PMS to leave space for flexible formulation of the key performance indicators (KPIs) as well as setting the key inputs to be measured. The scope and novelty of such collective approach to create a performance model is uncertain. Therefore, it is important to however support achievement of a model by employment of a method that can identify and report the key requirements of the model and includes the holistic view.

The following section discusses the KPIs and metrics that have been used to model SME performance.

## 2.5 Performance Measures and Key Performance Indicators for SMEs

The use of performance metrics and indicators varies widely. The following sections classify indicators into two groups: financial and non-financial. However, some scholars employ both to create a PMS. In this section, the KPIs have been investigated in detail.

### 2.5.1 Financial Measures of Performance

A significant volume of research in the field of accountancy on the subject of PMS has specifically focused on financial performance (Blackburn, Hart and Wainwright, 2013; Maduekwe and Kamala, 2016; Gerba and Viswanadham, 2016). There are three main aspects of financial PMSs (Otley, 2001):

- They are instruments for financial management;
- They provide a reporting tool for external stakeholders;

- They can be used for motivating and controlling the activities of both management and personnel.

Financial ratios including the debt to equity ratio, current ratio, inventory to cost of sales ratio, quick ratio, creditors to purchases ratio and debtors to sales ratio are used to evaluate the cash flow, liquidity situation and financial risk of an enterprise (Otley, 2001; Hegazy and Hegazy, 2012).

For instance, Maseko and Manyani (2011) investigated accounting record-keeping practices for performance measurement employed by SMEs in Zimbabwe. Their research involved 100 SMEs including operating retail shops, manufacturing firms and suppliers of various services. They found that the majority of SMEs do not keep complete accounting records due to lack of accounting knowledge and as a result there is inefficient use of accounting information in financial performance measurement. Some scholars have proposed a performance measurement and management system for SMEs, based on an analysis of the connections between these firms' business practices and performance as measured by economic value added (EVA) in Canada. They used a sample of 108 Canadian manufacturing SMEs over two consecutive years. Regression analysis was used to investigate the influence of diverse business practices on EVA (Bahri, St-Pierre and Sakka, 2011). They only considered cost as a metric and they claim that some business practices have a direct impact on EVA within one year, while others have a deferred influence.

Each of these studies has some limitations. In one investigation by Henri (2004), some of the recognised limitations of financial performance measures are summarised as follows:

- being too historical and focusing on the past
- being unable to explain and predict future performance
- emphasizing short-term performance
- leading to inappropriate behaviour (e.g. competitive with target setting)
- being impractical
- not being timely
- being too aggregated.

The above shortcomings indicate that financial measures alone are not suitable to predict the future performance. Researchers have therefore adopted the measurement of non-financial measures (Otley, 2001; Gallani, Kajiwara and Krishnan, 2015).

### 2.5.2 Non-financial Measures of Performance

The identified shortcomings of financial measures resulted in a fundamental change in the process of investigating performance (Otley, 2001; Wach, Stephan and Gorgievski, 2016; Gerba and Viswanadham, 2016). Several researchers claim that while financial measures have importance for the measurement of SME performance, measures that are non financial such as consumer satisfaction, service delivery, staff performance, leadership, operating efficiency as well as community and environmental aspects should be incorporated into the PMS (Bulak and Turkyilmaz, 2014; McCann and Barlow, 2015; Wach, Stephan and Gorgievski, 2016).

For instance, Lee and Wong (2015) have developed a survey instrument to be applied in SMEs to evaluate their knowledge management performance. A reliability and validity analysis was performed to ensure the quality of the instrument. These researchers claim that the model can provide managers and practitioners in SMEs with detailed guidance for establishing their own knowledge management performance indicators. The results have been compared with large companies' results. In another study, McCann and Barlow (2015) investigated why SMEs are using social media and how they should measure its return on investment (ROI). The measurement of economic value associated with the use of social media by a business was researched to construct a model for analysing the ROI of social media for SMEs. The importance of a planned entry into the social media arena, formulation of measurable goals and objectives and understanding the business process are presented as vital pre-cursors to measuring, and indeed attaining ROI. The researchers found that some social media applications are more valuable than others, but 65 percent of the companies surveyed did not measure ROI. An overarching framework, aimed at SMEs is presented, which advocates that SMEs

should take a strategic focus, plan their use of social media and draw insight from both quantitative and qualitative data when measuring ROI. Other scholars have investigated the extent to which SMEs recognise the significance of non-financial performance measures in their supply chain management to increase profitability in the manufacturing sector. They found that most enterprises paid attention to customer satisfaction measures and product quality; the majority reported that their businesses were evaluated by customers on a quarterly basis, according to quality of products, on-time delivery, defect-free delivery and flexibility (Matsoso and Benedict, 2014).

A few of the studies, which were related to non-financial measures, focused on innovation and development as an influential factor for improved performance. For example, Rosenbusch, Brinckmann and Bausch, (2011) identified a number of factors that impact on the innovation –performance relationship (Figure 2.4). First, fostering an innovation orientation has more positive effects on business performance than creating innovation process outcomes such as patents for innovative products or services. This result highlights that entrepreneurs and SME managers focusing only on creating innovative offerings miss important dimensions, which are essential for realizing the value that innovation can provide to their firms. Second, increasing resources for innovation process outcomes lead to a greater increase in SME performance than increasing resources for innovation process inputs (e.g., R&D spending).

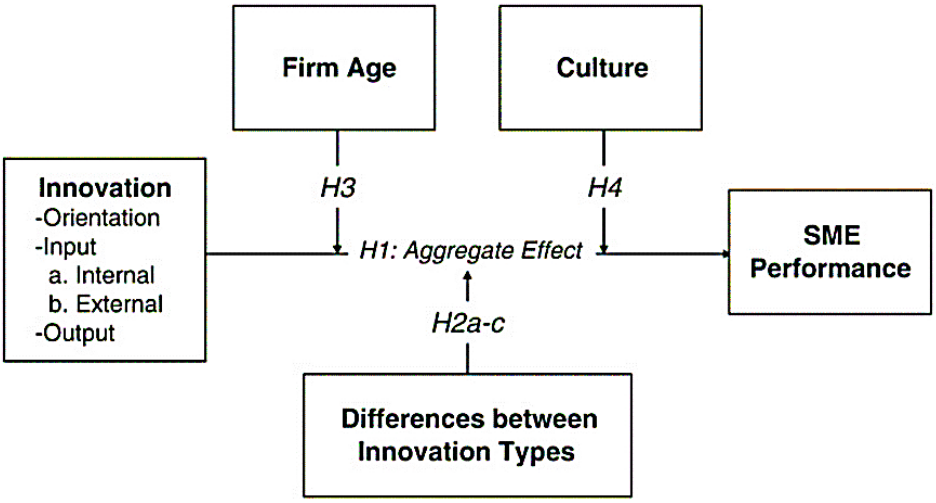



Figure 2.4: Model of studied relationships focused on innovation (H: Hypothesis) (Rosenbusch, Brinckmann and Bausch, 2011).

Additionally, Zeng, Xie and Tam, (2010) examined the relations among distinct cooperation networks and SMEs' innovation performance by applying the structural equation modelling (SEM) technique. The researchers determined that the connection and collaboration with governmental agencies did not assert any significant effect on the SMEs' capacity to innovate. In a different study on innovation measures, Antony and Bhattacharyya (2010) created a model to measure organisational performance and excellence and investigate the relationship between the two. In addition to innovation, researchers have also taken non-financial factors into consideration, like customer service and human resources (Chen and Lee, 2010; Roach, 2011).

Generally, research into PMS has revealed that non-financial measures also have shortcomings. For example, they could be misused by personnel to the detriment of the performance of the firm (Henri, 2004). Additionally, they are unable to provide a convincing explanation regarding the connection between the measures and profitability. In the light of the shortcomings of both types of measure, a balance should be achieved between financial and non-financial measures (Gerba and Viswanadham, 2016; Wach, Stephan and Gorgievski, 2016).

### 2.5.3 Financial and Non-Financial Measurements

In an early study of the literature, researchers developed a model that considered non-financial measures from four different perspectives, namely financial, consumer, business processes, and innovation and learning (Biggart et al., 2010; Cocca and Alberti, 2010).

Further popular studies on performance measurement that have included a combination of financial and non-financial measures are shown in Table 2.6.

Table 2.6: PMSs incorporating both financial and non-financial measures.

| Study | Indicators | Concept of Performance used |
|---|---|---|
| Mabhungu (2017) | • Innovation<br>• Flexibility<br>• Customer service<br>• Cost<br>• Leadership | • Critical success factors for SMEs<br>• Information management systems<br>• Relationship between the level of profit and the number of years of operation. |
| Chi (2015) | • Cost<br>• Flexibility<br>• Quality | • Strategies for higher quality<br>• Delivery performance<br>• Greater flexibility than cost reduction. |
| Sedehi (2015) | • Quality<br>• Customer satisfaction<br>• Cost<br>• Waste<br>• Flexibility<br>• Efficiency/effectiveness | • Providing facility decision-makers<br>• Enterprise Resource Planning adoption<br>• Waste reduction. |
| Ahmad and Alaskari (2014) | • Cost<br>• Quality | • Manufacturing added value per employee<br>• OTIF<br>• Absenteeism<br>• Customer complaints<br>• Adherence to production plan<br>• Quality rate<br>• Product rate<br>• Stock turn<br>• Maintenance cost<br>• Process capabilities. |
| Bulak and Turkyilmaz (2014) | • Human Resource<br>• Cost<br>• Quality<br>• Customer Service | • Proximity to Market<br>• Ability to Control Costs<br>• Potential Labour Force<br>• Product Quality<br>• Prompt Advantage Certification<br>• Product Assortment<br>• Distribution Channel<br>• Pricing Policy<br>• Service;<br>• Capital<br>• Machinery-Equipment Track<br>• Profit Margin and Market Share. |

| | | |
|---|---|---|
| Antony and Bhattacharyya (2010) | • Innovation<br>• Productivity<br>• Cost<br>• Efficiency | • Competitiveness<br>• Creativeness<br>• Effectiveness<br>• Profitability. |
| Atuahene-Gima et al., (2005) | • Innovation<br>• Cost | • New product program performance<br>• Current market need<br>• Revenues from new products<br>• Profitability of new products<br>• Growth in profitability and sales of new products. |

In Chi's (2015) study, enterprises facing a turbulent environment performed better when considering different strategies for higher quality, greater flexibility, and better delivery performance than when considering cost reduction. In contrast, low performers prioritised low cost while quality and flexibility were given certain weights (Chi, 2015). The effects of non-financial and financial measures on performance have been confirmed by Ahmad and Alaskari (2014). They demonstrated that SMEs find assessment of performance a difficult and costly procedure; therefore, the real challenge is to change their viewpoints.

As discussed earlier, the study of PMS reveals that using both financial and non-financial measures is essential to improve performance in SMEs. The appropriate selection of metrics should enhance the success and survival of small firms. To build on this concept, the next section will review the factors influencing the sustainability of SMEs.

## 2.6 Sustainability of SMEs

The concept of sustainability can be considered as survival or success of an enterprise. If the business performance of an SME is not sustainable, this means it is failing. This section reviews the reason why SMEs fail.

According to Hart and Milstein (2003) sustainability of enterprises is an essential factor within the modern business environment, which should be planned for within 21st century's business strategies.

Fiksel (2006) states that sustainable enterprise resilience is the 'capacity for an enterprise to survive, adapt, and grow in the face of turbulent change,' and simultaneously, 'to increase shareholder value without increasing material throughput'. Integrating sustainable enterprise resilience within the industrial ecology framework allows the creation of various business opportunities within green technologies. Introducing the principle of going green allows a business to implement strategies to reduce the amount of raw materials used alongside decreasing their energy use, which reduces expenditure over a prolonged period of time. Going green also allows the invention of innovative concepts to aid in the recovery and reuse of waste streams in places with virgin resources (Fiksel, 2006). The use of sustainable enterprise resilience within a business model allows redefinition of growth in a more suitable, ecological and sustainable context for the SME. SME's have been in operation successfully for centuries within the framework of limited local markets, whilst continuously adapting to evolving conditions effectively (Blackford, 2003). In 1987, the World Commission on Environment and Development (WCED) defined the strategy of a sustainable enterprise as 'the process of aligning an enterprise with the business environment to maintain a dynamic balance' (WCED, 1987).

The interest in sustainability has seen a steep increase in the last few years. This increase was seen in both the managerial concept of corporate sustainability and in the societal notion of sustainable development. Recently, a new upcoming organisation has been encouraging the private and public sector to reach beyond the traditional economic profit levels and enhance their efficacy. This encouragement drives through the objective to include environmental and social aspects (Waddock, 2008). The encouragement created by this new organisation can also be defined as positive pressures; these pressures have motivated managers to introduce the use of sustainability criteria within their organisational strategies and reporting methods to develop sustainable programmes (Klynveld Peat Marwick Goerdeler (KPMG), 2013). Although this pressure has introduced motivation, the challenge of sustainable implementation and management still remains. Sharma and Starik (2009) state that the demands imposed by sustainability behaviour exceed those required to meet the organisation's other objectives. To develop sustainability reports, the main focus has shifted to the Global Reporting Initiative (GRI) guidelines. The term

'sustainable reporting' describes a detailed procedure that enables the organisation to alter its assessment and viewpoint, which leads to improved organisational changes through a learning process (Schein, 1996).

The reporting procedure has proven to be a useful method for organisational actors, who aim to embed the sustainability criteria within their strategies in an effective manner. However, implementation has mainly concentrated on large corporations (Bansal and Roth, 2000; Adams and McNicholas, 2007; de Klerk and de Villiers, 2012). As a consequence, there is a lack in both the conceptual and empirical literature on the issues and opportunities associated with managing and reporting aspects related to sustainability within SMEs (Bansal, 2005). For instance, Williamson, Lynch-Wood and Ramsay (2006), analysed environmental practices of 31 manufacturing SMEs and their results indicated that business regulations and performance drive behaviours. This suggests that environmental practice may be considered as a non-compulsory strategy, which imposes extra monetary cost on the business, which could then affect the business' core activities. There is great uncertainty with regards to adopting sustainability reporting in SMEs due to the lack of knowledge on how SMEs will be impacted or how they would adopt the process itself.

Managers can foresee and comprehend that 'sustainability related issues are having or will have material impacts on their business' (Berns et al., 2009, p.7) and 'sustainability represents new sources of competitive advantage and a proxy for management quality' (Berns et al., 2009, p.11). Managers create a new way of operating effectively by considering the positive and negative impacts produced by their business. This technique allows them to investigate their weaknesses; this then enables them to exploit their business' future potential to gain an advantage over their competitors.

Companies have adopted the use of sustainability reporting as it has become a very common and effective tool within the industry to respond to criticism and justify expectations from stakeholders, as the stakeholders have a profound interest in the social and environmental impacts of business activities of the company (Boiral, 2013). The traditional management protocol and measurement system are not specifically created to portray a balanced view of the social, environmental and

financial metrics. This introduces a new challenge for the PMS, which is a system in place to supplement operational and strategic levels with useful tools; sustainability plays the role of a 'trigger' for change in the PMS (Leite, Brazdil and Vanschoren, 2012). SMEs play a crucial role in maintaining a robust economic growth. For SMEs to maintain a robust economic growth, they must sustain performance over a prolonged period of time; this can be a challenging task (Ates et al., 2013). To lower the risk of this challenge, SMEs must adopt advanced managerial practices available for successful improvement to business performance, which will give them an advantage above their competitors. Enderle (2004) opposes this guidance and claims that the integration of sustainability reporting standards or management systems might be unsuitable for small organisations, because such standards were created and developed to aid large businesses and corporations. Furthermore, from the SME's viewpoint, informal tools may be ineffective and more effective tools may require larger investments in terms of time, energy and funds. Kloviene and Speziale (201) stress that the literature available contains gaps in several areas; the main gap outlined was regarding the relationship between PM and sustainability reports (SR) in SMEs. This gap was found by unveiling the relationship between PM and SR.

Adopting the sustainability reporting method has shown positive outcomes with potential to support a company's essential goals; this indicates that the use of sustainability reporting is not restrictive to just the disclosure of sustainability activities. Some positive findings include the fact that sustainability reporting has improved strategy-making decisions, which in turn enhanced the managerial awareness on matters related to sustainable development. Improving manager's awareness has resulted in a change in the managerial thinking procedure, supporting a more long-term perspective. These long-term perspectives include aligning the company to a more sustainable culture, which support social and environmental values, creation and disclosure procedures. The development of sustainability denotes a pattern of expansion that is insightful to the future, aiming to incorporate economic prosperity for future generations without damaging the environment or society. Post publication of the Brundtland Report by the WCED in the late 1980s, this concept took a rise in interest and popularity amongst institutes (WCED, 1987).

Prior to this report's release, the concept existed but did not gain a large interest group; this was unexpected as research related to reporting of non-financial protocols has been a matter of importance with a long history for many years (Guthrie and Parker, 1989).

Sustainability reporting, often denoted as corporate responsibility reporting (de Klerk and de Villiers, 2012), is a process that allows the indication of an institute's organisational and disclosure methods that relate to the company's sustainability practices and its performances, along with the 'triple bottom line' (Elkington, 1997). Using a reporting method within a company's infrastructure has many advantages; the main advantage is that it gives managers the opportunity to take into account and organise their sustainability footprint (Adams and Frost, 2008). As the practice of sustainability reporting and disclosure has gained popularity, the objective of sustainability has become clearer (Global Reporting Initiative, 2008), with evidence of successful integration of (Gray, Adams and Owen, 2014, p.112). In a recent study on South African companies, Samkin (2012) provides evidence of a progressive institutionalisation of sustainability reporting.

This section reviewed the literature to explore the fundamentals of sustainability in SMEs, to contribute towards mapping and consolidating a research agenda for the integration of factors that make a business successful. In the following sections, the reasons for failure or success of SMEs are discussed.

### 2.6.1 The Failure of SMEs

Watson et al., (1998) claim that an organisation's failure depends on viability problems that result in the termination of trading. For example, the lack of operational cash flow within an SME is a major issue that can lead to the failure of an SME. Unfortunately, however, there is a lack of research from the last two decades on essential factors or methods that could be used to stop an enterprise from experiencing failure (Wild, 2010; Collett, Pandit and Saarikko, 2014).

When comparing SMEs to larger businesses, it is evident that their operational strategies differ; some methods may work for larger businesses, but when applied to SMEs, may lead to failure. 'Cash is King', (Otley, 2001) for instance has proven to be more appropriate to SMEs than larger businesses; the concept acts as a life line for SMEs. Bhandari and Iyer (2013) debate whether cash flow is more important than accounting income; this debate arises from the fact that cash allows the company to purchase goods, clear debts, pay wages and bills alongside any other expenditure needs. Without cash flow, a company will fail to meet the demands of the basic principles of survival, resulting in bankruptcy (Bhandari and Iyer, 2013). A company's success is determined by the net operating cash flow. When a company has a positive cash flow, it is assumed that the business is operating at a profitable rate, which thus serves as an indication that the business is successful. The main contributing factor to the failure of an SME is a negative cash flow for a prolonged period of time (Olawale and Garwe, 2010; Ramukumba, 2014). When a company is in a negative financial situation, they usually try to seek help from a financial institution; however, obtaining financial support is difficult for SMEs. Therefore, it is a crucial matter of survival for SMEs to build trustworthy relationships with their suppliers, in order to purchase goods on credit (Ramukumba, 2014). Thus, it is reasonable that a performance measurement framework should be put into place to identify the motivation for the relationship with suppliers and measure the extent of the relationship. The extent of the relationship will be a good indicator for SMEs to monitor from time to time for the benefit of the growth of the business.

Some researchers oppose the argument that negative cash flow is the main reason behind most SME failures (Robb and Fairlie, 2009). If a company is operating in a positive cash flow and not utilising the cash flow in an effective and efficient manner to maximise their profit, they may still experience failure. This viewpoint is based on detailed research into reasons for SME failure. Some SMEs misuse their financial resources, resulting in failure of the business (Stokes and Wilson, 2006; Ramukumba, 2014). Another aspect identified in previous studies is a connection between the lack of planning and business failure (Jayawarna, Macpherson and Wilson, 2007). Planning is a crucial element of any business as it allows the enterprise to develop further, communicate internally and externally in an efficient manner, implement new rules and strategies, alongside improving the company's

strategy to achieve performance objectives (Talib, Ali and Idris, 2014). When creating a business plan, it is crucial to consider the needs of the company's/enterprise's stakeholders, which includes: the suppliers, the customers, government rules and regulations, the employees and the shareholders (Talib, Ali and Idris, 2014).

The performance of any enterprise relies heavily on the planning process of the business (Richbell, Watts and Wardle, 2006; Blackburn, Hart and Wainwright, 2013). However, some researchers query the contribution of business planning on the performance of an enterprise (Bridge, O'Neill and Cromie, 1998).

Other research looks at the aspects of failure from another angle. These studies state that failure to keep employees satisfied and motivated can lead to the downfall of a business. This derives from the idea that if an employee is not motivated or satisfied by a job, they will not commit to the job. The lack of satisfaction of an employee can invoke low morale at work resulting in undesirable outcomes such as absenteeism, reporting for work late, unwillingness to go the 'extra mile', not being prepared to work overtime to meet deadlines, high staff turnover and low productivity in the work place (McKenna, 2005; Hutchinson et al., 2015).

Considering the above discussion, a performance measurement framework, which does not incorporate elements related to the risks of failure for SMEs seems incomplete. Simultaneously, it is important to identify the elements that lead SMEs to succeed rather than only preventing failure. Consequently, it is important to understand the concept of success for SMEs. The following section therefore addresses details of different aspects of success and CSFs.

### 2.6.2 The Success of SMEs

Various scholars have defined the meaning of success differently and claim that defining the term of 'success' is not easy (Simpson, Padmore and Newman, 2012; Sarasvathy, Menon and Kuechle, 2013; Gerba and Viswanadham, 2016; Wach, Stephan and Gorgievski, 2016). Some argue that the business's success is defined by

its growth and profitability (Simpson, Tuck and Bellamy, 2004; Simpson, Padmore, J. and Newman, 2012). These researchers found that sustainability of a business may be influenced by other factors besides the profitability and viability of the business. Others define success as a sense of achievement, job satisfaction, recognition, flexibility and control (Parker, 2009; Jayawarna, Rouse and Kitching, 2011; Wach, Stephan and Gorgievski, 2016). Medori and Steeple (2000) created a framework of performance measurements and check list for observing existing performance measures, in order to distinguish the measures no longer relevant or beneficial for the company ('false alarms') and the measures that are not being measured by the firm, but are important for its success ('gaps').

Variations in the definitions of success in the literature create challenges for studying sustainability of SMEs. For example, another scholar suggests that only the SME owners can determine if their businesses are successful or not. In this case, the PMS should satisfy the owners. In addition, data on profitability of SMEs is often not available, which makes it difficult for an outsider to study the success of the enterprise (Fatoki, 2014). This study assumes that the owners of the SMEs are motivated to create and maximise their wealth.

### 2.6.3 Critical Success Factors of SMEs

The invention of the CSF concept was introduced in 1961 by Daniel; however, it only gained popularity when mentioned by Rockart in 1979 (Quesada and Gazo, 2007). Rockart (1979) defined CSFs as the limited number of areas, which result in success of an enterprise through competitive performance. Oakland (2003), defines CSFs as those elements, which should be examined to ensure effective management and to maintain the goals of the organisation. In addition, Masocha and Charamba (2014) emphasise that key factors of success can be identified as anything that results in gaining business for the enterprise. Tracy (2007) states that each industry has its own unique success factors that depend on the demand of the business.

Within research and industry lies a confusion regarding the factors and actions that are most likely to facilitate the accomplishments of an enterprise (Laitinen, 2011; Parnell, Long and Lester, 2015). Currently, it is evident that no research studies have been conducted to conclude on the meaning of success to SME entrepreneurs. This can be a slight issue as previous research studies conducted highlight that it is crucial to have valid measures of success (Ahmad, Wilson and Kummerow, 2011). Ahmad, Wilson and Kummerow (2011) debate over the issue and conclude that there is no universal agreement that allows one to constitute the best measure of success. Their study focusses on some of the CSFs, which have an influence on SMEs' business performance in general, alongside factors which are critical for the success of the performance measurement framework.

In this study, it is assumed that CSFs for the SMEs refer to those conditions, which need to be in place to design and implement a successful performance measurement framework. The review of existing literature reveals that the success factors for the performance of SMEs are leadership, the commitment of employees, business planning, competitors, innovation, and management of information, customer services, suppliers, costs, resources, regulators, sources of finance etc. The following section details the critical factors and their relationships, and the related performance metrics.

#### 2.6.3.1 Leadership and Development

In an investigation that concentrates on the manufacturing sector, it was found that strong leadership and the enterprise culture itself are considered as CSFs (Timans et al., 2012).

Managers are often the owners of SMEs and when this is the case, the SME's control is in the hands of one person or a small group of people with a high level of autonomy (Pansiri and Temtime, 2008). The managerial competencies therefore play a large role in the organisation's failure or success, specifically in SMEs. In the scenario where the manager is an owner-manager, issues can arise because decisions are mainly based on the director's personal skills and intuition, rather than on the analysis of information gathered and obtained. The owner-manager usually adopts a highly personalised management style, tending to follow a 'react and adapt' philosophy and 'fire-fighting' strategies, focusing on short term goals and not

engaging in strategic planning for the future of the enterprise (Hudson Smart and Bourne, 2001).

An owner of a business is motivated to make decisions that result in long-term success and survival of the business; however, this can depend on the motivation for starting the business (Asah, Fatoki and Rungani, 2015). Some scholars (Asah, Fatoki and Rungani, 2015; Bager et al., 2015) claim that the success, growth and survival of an enterprise relies heavily on managerial skills rather than technical skills. However, the core motivation of the founder also plays a crucial role in the success, growth and survival of an enterprise; hence, the founder contributes heavily to the performance of SMEs (Halabi, Barrett and Dyt, 2010; Isaga, Masurel and Van Montfort, 2015; Gherhes et al., 2016). In addition to the involvement of the founders, a sturdy management structure is also essential to achieve optimal performance in SMEs (Guest, 2009). In order for a PMS to be successful and show a positive effect on the business, all the managerial staff must be willing to abide and commit to it (Amir, 2011).

The commitment and quality of the management is of vital importance to SME performance, given the need to operate under conditions of limited resources. Managers in SMEs must be able to accomplish both strategic and operational roles; they are likely to achieve this by having transferable skills and competencies across such roles (Lubatkin et al., 2006). The adoption of leadership development practices should result in significant direct and indirect performance payoffs (Teo, Le Clerc and Galang, 2011) and also improve employee management (Schlosser, 2013).

Furthermore, leadership development can assist SMEs in improving manager human capital (Subramony, 2009) and in developing unique managerial resources, which conform to the SME strategy (Polyhart, 2006). A resource-based view recommends that SMEs develop internal abilities and unique resources in order to respond to external contingencies (Oliver, 1991); SMEs need to aim, therefore, for managerial development (Mabey and Ramirez, 2005). This implies that SMEs need to employ leadership development practices, which conform to a strategy drawing on formal and informal practices. Informal practices include developing leaders, both experientially and practically (Leitch, McMullan and Harrison, 2013; Shaw and Conway, 2000). According to complex resource-based theory, such practices are a

vital resource with synchronicity to the operating context of the SME (Colbert, 2004).

Only a small number of studies have been conducted on leadership development practices in SMEs; consequently, their implementation is vague. As this is the case, we attempted to discover the leadership impact and other elements of success in SMEs. The principal effect of the leadership style of the owner/manager relevant to achieving success, is on business development, associated with such elements as planning, innovation and employee commitment (Ling, Qing and Shen, 2014; Ntalianis, Dyer and Vandenberghe, 2015; Mumford et al., 2002; Bulak et al., 2016).

**Employee**

The SME owner/manager is the change agent, who can have an impact on the behaviour of those who work on a project, with their activities concentrating on the main shareholders (Bassioni, Price and Hassan, 2005). Employee behaviour can be affected by communicating the strategy of the project, by means of suitable performance assessments, and by training the employees responsible for initiating the project structure (Berko, Ashie and Kodjo, 2016; Padachi and Bhiwajee, 2016) and by implementing motives for the purpose of averting employee resistance (Watts and McNair-Connolly, 2012; Valaei and Rezaei, 2017). It may be necessary to determine impressive performance measures so that senior managers have no difficulty in accepting the performance assessment structure. Senior managers are not permitted to employ any performance measures in order to make decisions if they consider them to be of poor quality (Biggart et al., 2010).

Studies are inconclusive over whether other SME human resource (HR) practices may be appropriate to leadership development (Behrends, 2007; Marchington and Suter, 2013; Sheehan, 2014). However, these studies imply helpful investigative approaches. Firstly, only a few studies investigate human resource management (HRM) strategy fit–adoption relationship within the context of a leadership development. Contingency and resource-based aspects imply that SMEs will involve different strategic choices concerning leadership development practices (Messersmith and Guthrie, 2010). Secondly, SMEs are deficient in HR proficiency and leadership, regarding the adoption of formal leadership development practices. Large companies can accomplish leadership development by initiating specialist

units or functions, which concentrate on leadership development exclusively (Wu, Bacon and Hoque 2013). Consequently, gaps in HR expertise in SMEs may influence the implementation of leadership development practices. Thirdly, there are leadership competency gaps in SMEs (McBain et al., 2012), which influence performance to a greater extent than in larger companies. Consistent with the resource-based perspective, SMEs who address these gaps will be advantageously competitive; subsequently, this indicates the need for implementation of leadership development practices in SMEs (Cantner, Meder and Ter Wal, 2010).

If any enterprise is to be successful and to survive, employee commitment is essential (Krüger and Rootman, 2010; Valaei and Rezaei, 2017). SME owner/managers can encourage employee commitment by listening to employees and supporting them, thereby establishing an inspiring environment, enabling employees to work diligently. They can also show an interest in each employee, remain positive and always value each employee's work (Krüger and Rootman, 2010). Employee commitment is an essential feature for successful SMEs.

The characteristics of employee commitment recognised in existent literature are: autonomy, employment motivation level, job satisfaction, employee participation in decision-making, employee feedback, recognition and loyalty, professional development and employee learning (Krüger and Rootman, 2010; Berko, Ashie and Kodjo, 2016; Valaei and Rezaei, 2017). Failure to encourage employees causes employee dissatisfaction and low commitment leading to the unwelcome outcomes already mentioned such as: high staff turnover, lack of willingness to work overtime or travel the 'extra mile', reporting for work late, absenteeism and generally low productivity (McKenna, 2005; Bartunek and Spreitzer, 2006; Hutchinson et al., 2015).

The literature also implies that employee commitment is associated with that of the owner/managers. Signs of owner/manager commitment include participation in running the business, resource supply, employee empowerment, entrepreneurial orientation (risk-taking behaviour), owner/manager involvement of employees and support of continuous learning for manager/owner and employees (Ling, Qing and Shen, 2014; Ntalianis, Dyer and Vandenberghe, 2015). Signs of employee commitment are autonomy, employee involvement in decision-making, employee

loyalty, job satisfaction, professional growth and employee learning (Krüger and Rootman, 2010; Ntalianis, Dyer and Vandenberghe, 2015). Owner/manager motivation positively affects employee motivation (Carneiro, 2008). Low commitment levels are caused by dissatisfied and unmotivated workers (Krüger and Rootman, 2010). This causes numerous difficulties such as poor attendance, high staff turnover, unwillingness to work overtime, sub-optimal productivity and failure to report for work on time (Macleod, 1999). Employee satisfaction and commitment are vital if any business is to succeed and survive; therefore, managers need to ensure that their employees remain satisfied (Krüger and Rootman, 2010; Ntalianis, Dyer and Vandenberghe, 2015). Owner/managers can achieve this by committing themselves to providing employees with good working conditions, autonomy and flexibility, involvement in decision-making, providing feedback for employees and recognising their endeavours (Ireland, Hoskisson and Hitt, 2009; Krüger and Rootman, 2010; Ntalianis, Dyer and Vandenberghe, 2015).

Owners/managers can encourage employee commitment by committing themselves to empowering employees through respecting their autonomy, providing training, flexible work practices and supporting participation in decision-making (Carless, 2004; Walker and Brown, 2004; Schjoedt, 2009). Training involves considerable expense for a company; however, its impact in terms of encouraging employee commitment is invaluable (Meyer and Smith, 2000; Ling, Qing and Shen, 2014). Owner/managers can thus empower employees in many ways, leading to high employee commitment levels. Furthermore, owner/managers can avoid being critical of employees who make mistakes while pursuing innovation, but support them instead (Ndubisi and Iftikhar, 2012), for the reasons explained in the following section.

**Innovation**

Innovation is necessary to sustain long-term business performance (Saunila, 2016); furthermore, the success and survival of a business is dependent on its innovation capacity (Al-Ansari, Pervan and Xu, 2013; Bulak et al., 2016). Innovation can be the lifeline of company growth and survival, since it is crucial in generating value and competitive benefit for the business (Baregheh, Rowley and Sambrook, 2009).

Some studies have demonstrated a positive connection between SMEs' business performance and the innovation level (Forsman and Temel, 2011; Kotey, 2014). However, other researchers have discovered either no, or a negative relationship, between innovation level and business performance (Freel, 2000).

An innovative business is described as one, which constantly searches for new concepts leading to new products and new methods of conducting business (Shirokova, Vega and Sokolova, 2013). This can be crucial for SMEs, which often lack resources. Shirokova, Vega and Sokolova, (2013) contend that SMEs should encourage new abilities, entrepreneurial culture and orientation as well as an entrepreneurial mindset to survive and grow, particularly when resources are limited. Masocha and Charamba (2014) also emphasise that constant innovation is a critical element for SMEs to compete with large companies successfully. They advocate that this innovation ought to concentrate on marketing strategies, internal procedures and on maximising the delivery of consumer satisfaction and advantages. Furthermore, Loewe and Chen (2007) assert that innovation does not emanate from fortune or a visionary leader's ability, but from efficient planning. Planning is essential for innovation (Panayides, 2006); if SMEs are to be successful and to survive, planned innovation is vital (Mumford, Hunter and Bedell-Avers, 2008).

**Planning**

Although business planning has a positive impact on a company's performance (Mazzarol, Reboud and Soutar, 2009; Blackburn, Hart and Wainwright, 2013), some researchers question the business planning contribution to a project's performance (Bridge, O'Neill and Cromie, 1998). Furthermore, some literature implies that owner/managers have an impact on the preparation of viable project business plans (Mumford et al., 2002). Frequently, such plans indicate (and may be restricted by) the owner/manager's expectations, personality, experience, inherent and acquired skills, values and know-how (Hambrick, 2007; Guo, Zhao, J. and Tang, 2013).

#### 2.6.3.2 Delivery

Subsequent to the supply chain becoming a critical factor in operations, product delivery is now regarded as a competitive priority around the world. Delivery effectiveness is dependent on both time and volume of delivery. Delivery was perceived to be a competitive priority by firms subsequent to the adoption of ideas like lean manufacturing, zero inventor, and JIT (Just-In-Time) among others (Kaur, Kumar and Kumar, 2017). In the context of the present study, delivery as a competitive priority is evaluated on the basis of the firm's ability to deliver orders on time, the flexibility to accommodate orders of different volumes with no impact on delivery effectiveness, the adaptability of the delivery schedule to individual customer needs, and success in reducing the frequency of client back orders (Kaur, Kumar and Kumar, 2016b). Factors recognised as having an effect on delivery, especially in the manufacturing sector, include resources and quality. Shah and Ward (2003) demonstrated the utilisation of lean production in the manufacturing industry for fabricating products with high quality efficiently and economically with reduced waste.

**Quality**

Product quality is recognised around the world as a competitive priority. The quality of a product is considered to be its fitness of use; this incorporates factors such as the performance, reliability and durability of the product. Product quality is dependent on the design requirements in addition to the manufacturing ability and capacity of the company (Kaur, Kumar and Kumar, 2016a). Product quality is assessed in this study using the following variables: level to which the companies are fabricating products that meet the design specifications; decline in frequency of customer guarantee or warranty claims (thus implying ongoing product enhancement); the competitive ability of the firm is founded on quality and it provides products with reliability and durability.

It is suggested by Karim, Tarazi and Reille, (2008) that a firm's long-term competitiveness is dependent on its ability to form strategies targeted at improving the quality and reliability of products. Avella, Vazquez-Bustelo and Fernandez, (2001) investigated whether a firm's manufacturing strategy explains its level of competitiveness or impacts on its business effectiveness. In their study, competitive

manufacturing capabilities were assessed on the basis of cost, flexibility, delivery and quality. Their findings suggest that companies do not have specific manufacturing competitive priorities and companies remain at an 'externally neutral stage', as stated by Hayes and Wheelwright (1984) and Hayes, Wheelwright and Clarke (1998).

In a study conducted by Karim, Tarazi and Reille, (2008), a comparison was made between different competitive priorities, which were ranked in terms of their level of importance in distinct regions around the world. For example, within the United States, conformance quality was ranked the highest, followed by the reliability of products, timely deliveries, reduced pricing and speed of delivery. In Europe, conformance quality was also found to be the most important priority, again followed by reliability of products, timely delivery, and the speed of new products. Conversely, the most important priority in Japan was found to be reduced prices, which was followed by reliability of products, timely delivery, and speed of new products. In Australia, the credibility of firms was considered to be the most significant factor, followed by the quality and reliability of products, the firm's design and manufacturing capabilities, timely delivery, and pricing. Lastly, in Malaysia, the most important factor was found to be the quality and reliability of products, followed by firm credibility, marketing strategy, pricing, and the design and manufacturing capabilities. The specific competitive priority variables assessed in the present work are quality, cost, adaptability, delivery, the relationship between buyers and suppliers, technology, environmental aspects and consumer satisfaction (Karim, Tarazi and Reille, 2008).

A critical assessment of performance measurement frameworks appears to indicate that there is minimal focus on the management of suppliers as a critical factor that impacts on the effectiveness of SME business performance. For instance, the most widely used performance measurement frameworks, namely the BSC proposed by Kaplan and Norton (1992) and the Results Determinant Framework developed by Fitzgerald et al., (1991) do not include suppliers in their assessments. However, the management of suppliers is a significant determinant of financial performance (Rajagopal, 2010; Shi and Yu, 2013). It is important that firms establish effective relationships with their suppliers in order to gain a competitive advantage and

sustainable organisational performance (Talib, Ali and Idris, 2014; Bulak et al., 2016).

A particular sector's degree of competitiveness can be evaluated on the basis of the performance of that sector according to the price being offered, the reaction to changes (Slack, 1998), quality, product variants, and problems with delivery, among other factors (Tracey et al., 1999; Kaur, Kumar and Kumar., 2016a). In their research, Nauhria, Pandey and Kulkarni (2011) found that the eight competitive priorities relevant to performance in the manufacturing sector, and specifically the automotive sector, are quality, cost, delivery, adaptability, customer focus, capability to innovate, sustainability, and manufacturing technologies.

Quality is thus a further significant aspect, which needs to be taken into account for an effective PMS.

#### 2.6.3.3 Flexibility

The concept of flexibility has been broadly employed in different fields in distinct contexts. 'The ability to change or react with little penalty in time, effort, cost or performance' can be considered as a comprehensive definition of flexibility (Upton, 1994).

Numerous researchers have suggested different dimensions associated with manufacturing flexibility and the majority have focused on flexibility at higher levels and connected it with the strategies and competitiveness of firms. Researchers (Koste and Malhotra, 1999) have suggested that the three fundamental dimensions of flexibility, namely machine, labour and machine handling, are not dependent on different dimensions. They are regarded as the basic flexibility dimensions that largely act as the foundation for higher-level dimensions. There is no hierarchical structure that connects these flexibilities and they are regarded as being on the same level and are completely separate. Other scholars (Koste and Malhotra, 1990) emphasise the range number and heterogenous nature of these dimensions, while Zhang, Vonderembse and Lim (2003) include uniformity in their research; the latter researchers analysed and defined the association between manufacturing effectiveness, capability and client satisfaction.

According to Groover (2005), a standard manufacturing system involves the integration of human resources and equipment, tasked with the assembly or processing of raw materials or a collection of components. Examples of integrated equipment include tools and machines for production, devices for handling materials and positioning work and computer systems. The manufacturing system is regarded as the critical component of the production process as this is where the value of the work is increased at each step to achieve the planned product. The current study focuses on the flexibility of elements of the manufacturing system. Investigation of these elements facilitates the examination of the aforementioned lower-level flexibilities (machine, labour and machine handling) that are separate from each other and act as the foundation for higher-level flexibilities. Research into the flexibility of the elements of manufacturing systems can facilitate the comprehension of the general flexibility of such systems. Moreover, part of flexibility is related to the capacity for the innovation.

Innovation can be regarded as being non-linear, fuzzy or poorly defined rather than being based on cause-and-effect logic (McAdam, Reid and Mitchell, 2010). This can present problems for SMEs, as it is important to maintain a balance between the necessity to innovate and the problems that can hamper it, including limited availability of resources, insufficient skills, scepticism regarding official training, the necessity to be adaptable, and the lack of a process to systematically measure innovation performance (McAdam, Reid and Mitchell, 2010).

Although small size of an organization is considered a deficiency with regard to available resources, it is more conducive to a flat organisational framework with limited bureaucracy, which enables a firm to be more flexible, adaptable and efficient in terms of reacting to dynamic conditions (Garengo Biazzo, S. and Bititci, 2005). Consequently, SMEs generally have significant potential to innovate and are capable of satisfying the developing and changing needs of consumers. Additionally, an organisational structure with limited layers of management is conducive to more personal relationships and simplified communication processes, which offers management increased visibility on the processes, and the potential to have a direct influence on personnel and the PMS (Singh, Garg and Deshmukh, 2008).

It is also necessary for firms to manage their competitors to ensure they remain successful and can survive in the long term (Miles, 2012). Therefore, firms should not only concentrate on their clients, but should assign the same level of significance to their rivals, if they want to achieve a competitive advantage in the market (Matanda and Ndubisi, 2009). A firm's ability to manage its rivals requires an understanding of who they are as well as an understanding of their business operations (Masocha and Charamba, 2014). The firm's objective should be to provide products that are unique and offer higher quality than their rivals to ensure survival in the market (Nieman and Nieuwenhuizen, 2009). Additionally, Masocha and Charamba (2014) recommend that firms should determine the areas in which their competitors are deficient and exploit them accordingly. Hence, it may be necessary to incorporate aspects of rivals' performance when developing a performance measurement framework for MSMEs (Micro, Small and Medium Enterprises). Rivals' performance could be incorporated into the performance measurement framework for MSMEs via benchmarking (Taschner, 2016). Tucker and Pitt (2009) perceived benchmarking as a process in which the best practices of the industry are compared with the performance of the firm (Tucker and Pitt, 2009; Taschner, 2016). In other words, benchmarking allows the firm to conduct a comparison of its performance with that of its rivals (Amir, 2011). Benchmarking has critical importance since it is essential for a firm to perform more effectively than its rivals in order for the business to grow (Laukkanen et al., 2013).

Benchmarking can be conducted internally or externally (Hegazy and Hegazy, 2012). External benchmarking involves a comparison of the enterprise's performance with outside standards that are determined based on industry best practices, while internal benchmarking involves management assessing the firm's performance on the basis of its own predetermined standards. According to Tucker and Pitt (2009), it is only possible to achieve a long-term competitive advantage and superior performance through external benchmarking. As well as benchmarking, MSMEs can additionally maintain communication with their rivals for the purpose of sharing knowledge, data and different resources (Bayraktar, 2015; Gunawan, Jacob and Duysters, 2016). As internal benchmarking is reliant on the perceptions of actors within the firm, it can fail to generate satisfied customers or high-level business performance. Competitor management can therefore be beneficial and

requires the creation of advantageous long-term relationships with rivals instead of regarding them as opponents.

Moreover, in a study by Krægpøth, Stentoft, and Jensen (2017) change in demand for agility, cost reduction and delivery reliability were recognised as the key drivers. In their study, forecasting being too weak, supply chain complexity and product portfolio complexity were acknowledged as the main barriers.

#### 2.6.3.4 Cost

If costs are managed effectively, the efficiency of the operation will increase. For instance, measures implemented to reduce costs by a firm experiencing problems as part of an overhaul of the business can enhance its performance, thus allowing the business to recover (Alfaro, Ortiz and Poler, 2007; Laitinen, 2011). Additionally, the ability to control costs is perceived to be a crucial success factor by Feindt, Jeffcoate and Chappell, (2002). Biggart et al., (2010) claim that one of the main methods of enhancing a firm's profit is controlling costs, largely in terms of inventory and store expenses. Managing inventory avoids shrinkage via in-store audits (Ng Harrison and Akroyd, 2013), and is particularly relevant to MSMEs operating in the retail industry. Another factor which may impact on costs is management of revenue.

Revenue management is a management accounting discipline aiming to improve revenues and a firm's limited capacity to improve its potential to survive in the long-term (Ng, Harrison and Akroyd, 2013). This is achieved by providing a reasonably-priced product or service at the appropriate time that satisfies customer requirements. Revenue management can improve the ability of an MSME to generate profit. However, according to Otley (2001) MSMEs consider accounting functions of coordination, control and accountability to be less significant because of their smaller magnitude and the more personal control of the owner/manager.

A firm's cash flow position is improved, however, by the generation of revenue (Ng, Harrison and Akroyd, 2013), which is critical for its long-term existence (Bhandari and Iyer, 2013). Revenue management involves the collection and analysis of data to acquire knowledge on the patterns, routines and demand trends of consumers for the purpose of assessing the firm's profitability (Ng, Harrison and Akroyd, 2013). Additionally, scholars point out that revenue information can be gathered from Point

of Service (POS) systems, barcodes and internet sites. Analysis is then conducted on this data by utilising management accounting methods like demand forecasting, linear programming, BSC, cost-volume analysis and predictive budgets (Otley, 2001; Ng, Harrison and Akroyd, 2013).

The lack of access to financing has consistently been perceived to be one of the factors that contributes to the decline of MSEMEs (Masocha and Charamba, 2014; Ramukumba, 2014). As MSMEs do not have easy access to finance from financial institutions (Ramukumba, 2014), it is important that they maintain effective communication with suppliers, to obtain goods on credit. The PMS should therefore be able to determine the drivers of these relations with suppliers and assess the degree of the relationship. Such a measurement allows MSMEs to regularly monitor their relationships with suppliers to ensure it is benefitting the firm. Various authors (e.g. Robb and Fairlie, 2009) claim that insufficient finance is not a primary driver of SME failure, or in other words, having access to financial resources does not ensure that a firm is successful. Using such resources in an effective and efficient manner to generate success is more important. For example, certain MSMEs that have sufficient resources are observed to misuse them, causing the firms to fail (Ramukumba, 2014). Research (Masocha and Charamba, 2014) into South African MSMEs, has shown that companies with foreign owners exhibit better performance than locally-owned companies, even though the local firms have better access to financial resources. Ramukumba (2014) argues that the focus should be shifted from problems caused by insufficient financial resources to the viability of the business, the entrepreneurial proficiency of the owners/management and the application of contemporary management methods to boost performance and survival of MSMEs.

Traditionally, the majority of SMEs have evaluated their performance on the basis of their profit levels (Atkinson, Waterhouse and Wells, 1997; Henri, 2004; Halabi, Barrett and Dyt, 2010). Profit measures are used as instruments to motivate and control the performance of units, managers and staff with the aim of ensuring that all employees are suitably focused on accomplishing the goals of the organisation (Drury, 2004; Otley, 2001). Performance evaluations can be conducted on separate managers and units based on the profit or output of separate responsibility centres within an organisation (Drury, 2004). However, there appears to be no agreement in the literature regarding how effective profit measures are for motivating and

controlling the actions of managers and personnel within a firm. For instance, Otley (2001) provides conflicting arguments, claiming that measures of financial performance like the profitability indicated within a firm's financial statements are capable of capturing controllable dimensions of business performance, but also that profitably purely measures outcome and is unable to determine performance. He suggests that the actions that specifically enhance performance should be measured instead of performance outcomes. Various scholars have additionally argued that measures of profitability cannot always indicate the level of success as they evaluate previous performance instead of forecasting future prospects (Kaplan and Norton, 1992; Otley, 2001). Therefore, a PMS designed to boost effectiveness and survivability of a firm could concentrate on different measures as opposed to profit.

#### 2.6.3.5 Customer Services

As SMEs are dependent on a restricted customer base, they are generally closer to their clients and can potentially establish more intimate relations with them (Hong and Jeong, 2006). Nevertheless, this often requires them to maintain deferential relations with clients and SMEs are frequently subordinate to larger-sized firms (Hudson, 2001). The reality is that an SME's demand is generated by stronger customers in all parts of the supply chain, which can lead to challenges in terms of leveraging debt payments and therefore managing variations in cash flow and this can restrict the ability of the firm to control future events.

For a firm to increase its competitiveness and thus be successful, the level of customer service it provides must be improved (Alfaro, Ortiz and Poler, 2007). The majority of research (if not all) into measuring performance has focused on the customer viewpoint. One of the critical factors that should be included in any PMS therefore is the customer (Talib, Ali and Idris, 2014). The present study adopts the perspective that the management of customers is a critical driver of firms' business performance.

Firms that grow successfully generally maintain close relations with their clients and are dedicated to providing high-quality products and services (Bulak et al., 2016). It is important for firms to establish intimate and trusting relations with their clients in order to enhance performance (Azmat and Samaratunge, 2013; Shi and Yu, 2013), and this can be achieved via networking (Taipale-Erävala, Heilmann and Lampela,

2014). The significance of developing relationships with clients, therefore, cannot be over-emphasised.

The management of customers should be targeted at the development of trust and loyalty among consumers (Hutchinson et al., 2015). When customers are loyal, it is easier for the firm to retain them, which is crucial for the firm to remain successful (Azmat and Samaratunge, 2013). Loyal customers consistently purchase from the firm even when the goods or services provided by the firm's rivals are considered better (Hutchinson et al., 2015). Hence, SMEs should focus on their customers and their primary concern should be to ensure customer satisfaction in order to retain them and acquire new ones, thus boosting the firm's performance in the market.

Owners or managers of SMEs may be required to have an extensive understanding of the market and industry that their firm serves. Positive relationships with clients can enable the SME to deliver the specific goods or services requested by the customer (Taipale-Erävala, Heilmann and Lampela, 2014). For instance, firms that intend to initiate the development of new products must rely on information from customers and market research to understand the future needs of their customers.

In addition, some researchers propose a bi-objective optimisation model that simultaneously considers the satisfaction of customers and environmental effects on production configuration in the manufacturing industry (Tang, Wang, and Ullah, 2107).

## 2.7 Chapter Summary

This chapter has explored definitions of the terms SMEs, sustainability, success and failure, and reviewed available literature on performance measurement in SMEs and sustainability of SMEs. Business performance measurement is a multi-faceted topic of study that brings in challenges and complexities to research. It is almost impossible to prescribe the best PMS for every context. It has, however, become possible to identify a set of key generic features, such as strategy connection, stakeholder orientation, dynamism, simplicity, and cultural fitness, - that are

recommended to design an effective PMS. Two features namely a) strategy connection, and b) simplicity were found the most cited ones in the literature with respect to the design of performance measures and may thus represent the most important ones. Despite much research published on performance measurement in large companies, there is a clear lag and immaturity in the literature with respect to SMEs.

From review of PMS studies in SMEs during the 2010s, research appears to have focused more on non-financial performance measurement, rather than financial performance or a combined approach. The research rarely reports on the implementation results or model validation through implementation. The sustainability, failure and success of SMEs have been reviewed. The CSFs recognised from the review are leadership, cost, flexibility, customer service and delivery. Therefore, these CSFs will be considered in the current study.

In addition, the review of the literature has revealed that there is no agreement among scholars on the most ideal PMS for SMEs. None of the PMSs evaluated seems to advance of the practice for SMEs in the manufacturing sector from the viewpoint of their sustainability. No literature proposing an appropriate PMS for SMEs in the manufacturing sector in general or more specifically in a developed country such as the UK was found. However, research also suggests relationships between success factors and SMEs' performance. The next chapter presents the research methodology for this research.

# Chapter 3

# Manufacturing SME Characteristics

## 3.1 Introduction

In this chapter the reader will be introduced to the philosophy, framework and the context of the current investigation. The research challenge approaches the research question from two perspective. Firstly, the study intends to define manufacturing system and specify the boundaries of the system within the small to medium size enterprise (SME). Second, within the context of Manufacturing system definition propose the performance modelling (PM) framework. In the first instance, the key elements of manufacturing systems will be introduced, with respect to existing literature as well as the results of the interviews and surveys by the author. Subsequently, a set of rules and measurement techniques will be extrapolated from the outcome of systems definition to measure performance and predict viability. The main concepts of the research are shown in Figure 3.1.

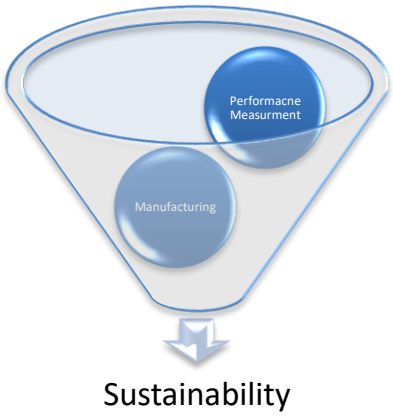



Figure 3.1: Positioning the research.

## 3.2 The Manufacturing Systems Classified as SME

The contribution of manufacturing to the worldwide economy amounts to approximately £6.7 trillion. As opposed to the common perception, the manufacturing sector within the UK is booming and the UK is presently the eighth-largest industrial country in the world. If the existing pattern of growth persists, it is likely that the UK will achieve a top-five ranking by 2022 (The Manufacturer, 2019).

As stated by MAKE UK (previously EEF: Engineering Employers' Federation), there are presently 2.7 million employees in the UK manufacturing sector, which contributes 45% of the overall exports, totalling approximately £275bn (The Manufacturer, 2019).

A vast proportion of manufacturing firms within the UK are SMEs. For example, the UK electronics sector contributes £78bn to the overall economy on an annual basis, and more than 95% of firms in this sector (approximately 6,000 firms) are micro or medium sized. Likewise, the food and drink industry have annual turnover of £21.9bn, where approximately 96% of the approximate number of 6,360 firms are SMEs. Figure 3.2 illustrates the median profit of all SMES with a turnover lower than £25M in each industry. According to the figure, the manufacturing sector is ranked third out of all sectors (Merchant Savvy, 2018).

It was reported in a recent study conducted by the specialist challenger bank, Hampshire Trust Bank, that the manufacturing industry in the UK has witnessed a 6%increase in SMEs since 2010 (Global Manufacturing, 2017). SMEs in the manufacturing sector have the largest presence in the South East (13.7%) and North West (11.9%) (British Standards Institution, 2014).


Figure 3.2: Median profit of SMEs with a turnover of less than £25M, by sector (Merchant Savvy, 2018).

Manufacturing can be defined as a group of interconnected actions and operations that involve the processes of designing, selecting materials, planning, production, quality control, management and the marketing of products (Blackstone and Cox, 2005). Manufacturing incorporates the production of tangible goods, whereby raw materials are processed, frequently into intermediate materials, which are subsequently converted into parts, sub-assemblies and completed products. (Although various researchers have attempted to differentiate between the definitions for the terms ‘production’ and ‘manufacturing’, for the purposes of the current study, they are used interchangeably).

The business departments that perform manufacturing tasks are labelled as manufacturing firms, or alternatively, manufacturing organisations. Such firms can be categorised in various different ways, largely on the basis of the product manufactured. For instance, different standards have been established for classifying industries on the basis of the type of product made. Two systems of classification that are widely used in contemporary business are the Global Industry Classification

Standard (GICS) and the North American Industry Classification System (NAICS). The different types of classifications covered by the NAICS include the manufacturing of food, clothing, plastics and rubber products, and computers and electronic devices. Manufacturing firms are also frequently categorised on the basis of two factors: variety and volume. Normally, if a firm manufactures an increased volume of products, the variety of products will be more limited. Conversely, if a manufacturing firm produces a wide variety of different goods, it will typically only make them in smaller volumes. Hayes and Wheelwright (1984) employed this classification system for developing what they defined as the product-process matrix. The approach takes into account both the type of process and product attributes mentioned before.

Different types of process include job shop, batch, assembly, and continuous flow production (Slack, Chambers and Johnston, 2007). It should be noted that Hayes and Wheelwright (1984) suggest that unique products manufactured in low volumes are more conducive to continuous flow production processes. This implies that flexibility is frequently sacrificed to achieve automated and more efficient processes as production is shifted from being project or shop orientated for unique products towards the continuous flow type of production preferred by the chemical and food sectors.

Larsson (2017) posits communicating performance measures facilitated ongoing improvements. He attempted to determine the primary issues related to communicating measures of performance to promote improvement.

Manufacturing firms are primary drivers of economic expansion (Eurostat, 2016). Approximately two million manufacturing firms are operating in Europe. As they employ over 30 million workers, such firms are considered to be key drivers of growth in the economy (Eurostat, 2016). This large number of manufacturing firms brings strong competition. A frequently adopted approach to enhance competitiveness is to implement or enhance the implementation of CI (Hyland, Mellor and Sloan, 2007). Although continuous improvement (CI) is frequently implemented to enhance competitiveness (Hyland, Mellor and Sloan, 2007), numerous manufacturing firms do not implement CI successfully, even though its

underpinning theory is widely recognised (Nordin et al., 2012; Bhasin, 2012; Tiwari, Buse and Herstatt, 2007).

Factors that have been identified as critical for the effective implementation of CI are performance assessment, incorporating a system for evaluating performance, the interconnection among objectives at different levels of the firm, and ongoing assessment of performance (Ukko et al., 2009; Bakås, Govaert and Van Landeghem, 2011). Another factor considered to be critical for successful implementation of CI is the ability to communicate measures of performance (Ukko et al., 2009; Bakås, Govaert and Van Landeghem, 2011). Different aspects of CI include enhancing productivity, quality assurance, and improving the reliability of deliveries (Hyland, Mellor and Sloan, 2007). While manufacturing enterprises adopt a variety of different improvement techniques, regardless of the technique selected, the success factors are virtually identical (Kumar, Antony and Douglas, 2009).

In the current study, CI is employed as a universal term to cover all improvement techniques. The outcomes of research into management approaches such as Lean Production, Six Sigma and Lean Six Sigma are additionally included in this study, as these alongside CI are all widely-adopted techniques for improving manufacturing processes. Although the definition of Lean Production is still the subject of debate (Petterson, 2009), according to one definition, it is ‘a philosophy that when implemented reduces the time from customer order to delivery by eliminating sources of waste in the production flow’ (Liker, 1997, p. 481). Various scholars have claimed that there is a close association between Lean Production and CI (e.g., Liker, 2004; Womack and Jones, 2003), as they have common foundations and utilise the same instruments. The concept of Six Sigma was originally established by Schroder et al. (2008) on the basis of quality management, the promotion of control and efforts to improve processes. Lean Six Sigma combines Lean Production and Six Sigma, developed as a framework for continual process enhancement (Malayeff, Venkateswaran and Arnheiter, 2012). The concept of CI originates from the Japanese term kaizen, which is a compound of the words kai (change) and zen (good), thus assigning the meaning of ‘change for the better’ (Kaizen Institute, 1985). Hence, CI defines a process of gradual enhancements made to the conventional working methods (Chen, Gully and Eden, 2001).

Timans et al. (2012) researched the application of lean Six Sigma in manufacturing SMEs and determined that communication is one of the four leading critical success factors (CSFs).

Greatbanks (2017) points out that while manufacturing SMEs can translate strategies into actual manufacturing practices, they still need to design processes with operational measurements.

Manufacturing firms are confronted by a number of complexities that impact their efforts on achieving business goals such as operational effectiveness and strategic positioning. A study conducted in 2011 by the National Association of Manufacturers (NAM, 2011) emphasised the obvious necessity for available specialised workers, as almost 5% of manufacturing positions remain unfilled and 82% of all manufacturing firms have a deficiency in terms of skilled production personnel. The complicated and evolving essence of project and process management also emphasises the need for solutions to the problem of inadequate visibility of company-wide business functions. Furthermore, the uncertain and variable situation caused by internal and external sources in terms of operations management leads to complexities in managing, coordinating and ensuring business processes are effective (Klassen and Menor, 2007).

Studies have revealed that process management approaches like Six Sigma and lean manufacturing have positive effects on business outcomes and improve company profits (Das et al., 2000; Hendricks and Singhal, 1996; Kaynak, 2003; Powel, 1995).

The following topics emerge from the literature on manufacturing SMEs since 1974: supply chain management, organisational learning, Six Sigma, Quality Management System (QMS), ISO 9001, general facility management, lean manufacturing, process management, and PM (Sedehi, 2015). No research to date appears to have considered sustainability through PMS in manufacturing SMEs. The following sections review metrics from the literature.

## 3.3 Competitive Priorities and KPIs in Manufacturing SMEs

Numerous literature have been dedicated to the competitive priorities as an important factor for setting and measuring the performance indicators of SMEs. According to Hayes and Pisano (1994), manufacturing operations embracing competitive advantage achieve successful activities through advanced abilities better than those in the market. An automated manufacturing system can be advantage for competitive priorities by influencing the factors such as labour costs, productivity, lead-times, quality and safety (Mathur et al., 2001). To meet the needs of a competitive advantage, Harrison and Hoek (2002) claim that consumer requirements must be achieved by meeting budgets within the supply chain management's competitive landscape. Bhagwat and Sharma (2007) argue that to make SMEs more competitive, a strong information system must be established, incorporating integrated supply chain trading partners, essential information and internal business operations. Other researchers (Leong, Snyder and Ward, 1990) point out that competitive advantage is also represented as competitive priorities for a wide range of SMEs. This research focuses upon the important elements, which play an integral role within effective PM functions for SMEs.

Competitive priority is described in operations management literature as a key strategic benchmark of manufacturing, which gains a global competitive advantage and improves commercial achievements (Díaz-Garrido, Martín-Peña and Sánchez-López, 2011). Competitive capabilities and competitive priorities have a symbolic connection, which must be recognised and appreciated by organisations (Kathuria et al., 2010). According to Kim (2013), there is also a close connection between target markets and competitive priorities. With an objective of improving business performance, Oliver Wight International Inc. developed a framework of standards, the Oliver Wight ABCD Checklist for Operational Excellence (1993), for managing strategic plans within an organisation. The strategic aspects cover people, teams and product development with specific emphasis on planning and control (Argyropoulou et al., 2010). As a combination of operational tasks, good business support is created through the existence of competitive priorities (Fine and Hax, 1985). According to Awwad, Al-Khattab and Anchor (2013), through the competitive priorities of

operational development and manufacturing tactics, competitive advantage of manufacturing organisations can be strengthened. SMEs are able to adapt their business agendas and become more competitive in international markets as a result of effective management of information systems in a competitive marketplace (Sharma and Bhagwat, 2006).

With regard to strategic decisions, a manufacturer's competitive priorities are defined within the literature as low costs, quality delivery and flexibility (Slack and Lewis, 2008; Ward et al., 1998; Peng, Schroeder and Shah, 2008). New areas of competitiveness identified by Dangayach and Deshmukh (2000) include improved quality, better performing products, limited costs, diversity of product and enhanced service quality. The pursuit of the competitive priorities of cost, quality, delivery and flexibility has thus recently evolved. It is no longer possible to restrict the development of smaller organisations specifically to these traditional priorities. Innovation is regarded as an emerging new competitive priority, irrespective of the limited proof of security and sustainability for organisations (Matthias et al., 2013). Greater emphasis is placed on quality and delivery in Indian manufacturing management (Kathuria et al., 2010) and competitive priorities such as quality, delivery, innovation, low cost and flexibility are considered to have the potential for greater profit from assets (Rusjan, 2006).

Many variables, such as innovation, have been employed for PM by different academics. Innovation may mean a new product range and operational procedures (Corbett, Wassenhove and Constance, 1993; Leong, Snyder and Ward, 1990). In addition, Cleveland, Schroeder and Anderson (1989) highlight the importance of batch sizes and stock levels of new products, whilst Davis et al., (2001) and Tan (2007) prioritised customer service. Between each of the four competitive priorities, there are connections, for example between innovation and human resources, creating multi-dimensional connections (Wood, Ritzman and Sharma, 1990). However, not all authors embrace the four key competitive priorities in their writings (Slack and Lewis, 2008) and various sub-variables have been used in different studies to measure different dimensions. For example, according to Garvin (1984), dimensions include perceived quality, reliability, performance, conformance, features, aesthetics, durability and serviceability. As noted by Gerwin (1993),

flexibility also has many types of sub-variables, including volume, material, routing, change-over, modification and flexible responsiveness.

In this study, all the four main competitive priorities (delivery, quality, cost, and flexibility) have been considered; however, these dimensions are measured in the form of various sub-variables. The sub-variables used as KPIs in this study are explained here.

According to Kaur et al., (2018), SME manufacturing processes involving machinery and human resources, recognises flexibility in many areas.

The current research uses the word 'machine' in reference to machinery, fixtures and tools, all of which are introduced in a manufacturing site for the sole purpose of product development. Each plant has a different type of manufacturing machinery, which varies according to the product size and shape, as well as the system's automation capabilities. A collection of academics, namely Zhang, Vonderembse and Lim (2003), Mishra, Mishra and Boynton (2014), and Asadi, Alsubaey and Makatsoris (2015), refer to machine flexibility as the capacity of equipment to perform tasks in an efficient and cost-effective manner. Browne (1984) defines it as the ability to implement adaptations to create a specific set of parts, whilst Koste and Malhotra (1999) define it as operational range and heterogeneity. These varied definitions prompted review of the concept in order to develop instruments for the purpose of measuring machine flexibility in this study.

A model created by Koste, Malhotra and Sharma (2004) provides guidance for management to establish which specific areas to focus on for financing, product quality or process performance investment. These researchers identified that by growing machine flexibility, the impact of the review period delay could be reduced. Kaur, Kumar and Kumar (2016b) identified a number of variables related to machine flexibility, which are adopted in this study: automation levels, changeover times, new product production, availability of machines, capacity of machines and ability to incorporate new fittings.

A physical on-site manufacturing process, which involves all employees forms an efficient and productive manufacturing process (Ramasesh and Jayakumar 1991; Hyun and Ahn 1992). The skills required from each manual worker depends on the

needs and expectations of each site and each department. This is solely dependent upon the exact skill and level of qualification or experience required to effectively complete particular operational activities. The capability of an employee to fulfil manufacturing responsibilities economically and effectively is defined as worker/labour flexibility (Upton, 1994; Zhang, Vonderembse and Lim, 2003). Improvement in organisational performance can be related directly to the essential role of worker/labour flexibility (Koste and Malhotra, 1999). It is based on the perspective that inter-department training or knowledge adopted by an employee can lead to growth in heterogeneity experienced by the worker which, in turn, increases the level of flexibility. According to Zhang, Vonderembse and Lim (2003), workers who are flexible are better equipped to manage uncertainties internal or external to their production environment. This includes issues such as absenteeism, fluctuations in demand volumes and changes in customer demands in terms of design. Research by Francas et al., (2011) supports this idea; these researchers identified that labour flexibility can be achieved as a result of the ease of labour transfer. The more tasks can be transferred between employees, the more workers acquire labour flexibility. Some researchers use specific variables to assess worker flexibility: the ability to multi-task across different machines; multi-tasking on one single machine; multi-operational knowledge across different machines; adaptability in working techniques; availability of staff in response to demand and product design changes; ability to move from different internal business units with ease (Kaur et al., 2016b).

Another aspect of flexibility in manufacturing is being able to create changes regarding the need of competitive market. Tomas and Hult (2012) recognises competitiveness as a subject of controversy, incorporating diverse concepts and disciplines. However, analysing competitiveness establishes a solid foundation for a developing business strategy (Li et al., 2009). This has, therefore, become a significant approach for management theorists and practitioners. In order to offer consumers with better value for money, competitiveness between organisations should focus on operational efficiency, cost effectiveness, fulfilment of customer satisfaction and a high quality of customer service (Ambastha and Momaya, 2005). Deniz, Seçkin and Cüreoğlu (2013) point out that open market businesses face a greater level of pressure to adapt product pricing policies to meet customer expectations and gain a competitive advantage. According to other researchers

competitive advantage is achieved when products offer unique features and benefits or the price point is the lowest in the market, without compromising quality. Efficient operations are essential if an organisation is to have market longevity. Failure to offer this will lead to a departure from the market (Schuller and Lidbom, 2009). In the words of ElMaraghy and ElMaraghy (2006), the role of the individual is significant in operational success and manufacturing system efficiency and, thus, the competitive position of the organisation overall.

According to Porter (1996), competitive advantage can be established if a cost or differential competitive strategy is implemented. A model, developed by Kwasi and Moses (2008), presents competitive and manufacturing strategies as directly impacted by business performance; competitive strategies are translated through manufacturing strategies. According to Kwasi and Moses (2008), cited in Kaur et al., 2016a), delivery, flexibility, quality and costs impact on performance. Competitiveness over the long-term is dependent on the way a business engages in strategy development to enhance product quality and reliability.

The role of an organisation's manufacturing strategy has been studied by Avella, Vazquez-Bustelo and Fernandez (2001); these researchers reviewed whether manufacturing strategy defines business competitiveness or impacts on business performance. Manufacturing competitiveness was identified as recognising cost, quality, flexibility and delivery. Other researchers however, conclude that manufacturing competitive priorities are unconfirmed and, as defined by Hayes and Wheelwright (1984) and Hayes, Wheelwright and Clarke (1988), organisations remain 'externally neutral'. Kapoor (2011) defines competitiveness as productivity that dictates the use of resources (Kapoor, 2011). Kapoor argues that national success can be achieved irrespective of the industry within which a nation competes, but may be influenced by competitors within the industry. This forms the analytical foundation for the study identifying organisational behaviour within an Indian context.

Rather than being a performance measure, one concept, resource utilization, has established itself in specific studies as an explanatory variable. The impact of CCR (Capacity Constrained Resource) utilisation and its distribution in operational performance measures has been assessed by Kadipasaoglu et al. (2000). The direct

result of the Managerial focus on substituting or growing machine scale to prevent a lack of capacity can be observed in a lack of interest in expanding other continuous improvement initiatives. The 5S is an example of a programme, which failed to generate advantages from growing machine scale because of limited commitment from senior management towards initiatives. This programme consists of five concepts including: Sort, Set in Order, Shine, Standardize, Sustain and it is a visual system. Similar to 5S, other programmes such as Statistical Process Control or Total Productive Maintenance suffered from same failure. Lack of commitment is attributed to poor awareness and education regarding the benefits related to continuous improvement initiatives. In addition, Benavides and Landeghem (2015) identified in their research a belief that improvements in non-constrained workplaces result in resources being wasted.

Another crucial factor that can have a positive effect on the performance of SMEs is reduction of waste. Only a few studies have been conducted highlighting the effect of this on the manufacturing sector. According to Sedehi (2015), there are various types of waste within the manufacturing sector, including inventory, transportation, motion, etc. as shown in Figure 3.3. Furthermore, Hon (2004) reports the correlation between waste and various factors such as productivity, budget and timeline. Consequently, some researchers have used lean practices in studying management of employees, total preventative maintenance and continuous improvement strategies (Shah and Ward, 2003).

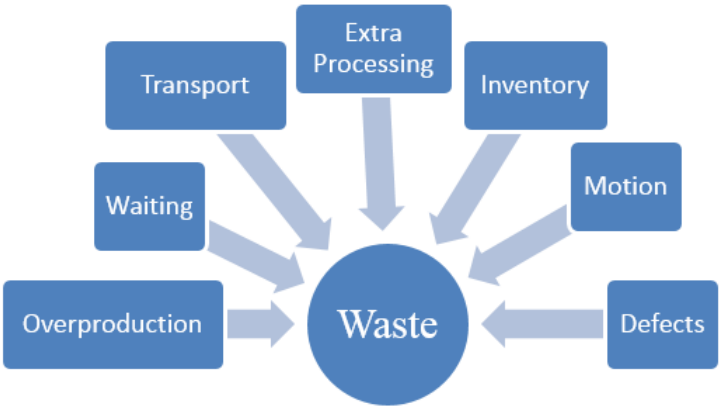



Figure 3.3: Types of Waste (Toyota Production System cited in Sedehi, 2015).

The extremely competitive era of manufacturing along with the industrial globalisation has provided SMEs with great opportunities for growth, improvement

and expansion, achieving quality and cost-effective processes. However, this has also impelled SMEs to acknowledge the regulatory restrictions related to environmental impact, and to implement sustainable manufacturing paradigms, which results in zero waste manufacturing (Tan et al., 2014b).

Lean manufacturing has been widely recognised and integrated as one of the strategies to tackle issues associated with waste minimization through non-value adding activity identification and removal. These strategies aim to enhance and increase the performance of organisations in three dimensions such as profitability, flexibility and efficiency. Lean manufacturing enables the organisation to develop and expand its business performance by reducing manufacturing lead-time and cost, improving product quality and delivery time, and thus also improving customer satisfaction and making the organisation more competitive. Panizzolo et al. (2012) discuss the effects on operational performance of implementing lean manufacturing in Indian SMEs. The lean manufacturing implementations were classified as upstream, down-stream, and value stream performance. Their study showed that Indian SMEs are reluctant to implement lean manufacturing practices, because of the high investment cost and consultancy related expenses.

The primary challenge in the modern globalised and competitive markets revolves around how growth can be sustained, which can be achieved through the application of different strategies such as green manufacturing. This type of manufacturing is a methodical, economically motivated integrated strategy, which targets all waste streams linked to design, manufacturing and functioning, in addition to the disposal of goods and materials (Sezen and Cankaya, 2013). In the context of India, the Indian authorities have implemented several different programmes within the scope of the National Manufacturing Competitiveness Programme (NMCP), with the primary goal of enhancing SMEs in India in order to improve their global competitiveness. These programmes include the Lean Manufacturing Competitive Scheme, Technology and Quality Upgrade Support, and the ISO 9000/ISO 14001/HACCP (Hazard Analysis and Critical Control Points) certification reimbursement scheme, among others. Although numerous scholars have conducted research on the subject of ‘lean performance’ or ‘leanness’ (Vinodh and Balaji, 2011; Almomani et al., 2014; Wong, Ignatius and Soh, 2014; Pakdil and Leonard, 2014) and ‘green/environmental performance’ or ‘greenness’ (Salem and Deif, 2014; Tan,

Smyrnios and Xiong, 2014a; Rehman and Shrivastava, 2013), only a limited number have investigated both at the same time (such as, Duarte and Cruz-Machado, 2013; Galeazzo, Furlan and Vinelli, 2014; Verrier et al., 2014). For instance, various researchers have explored the correlation between lean activities and environmental performance (Vinodh et al., 2011), whereas others have concentrated on the connection between lean and green applications (Dües, Tan and Lim, 2013; Hajmohammad et al., 2013). A number of researchers have examined the relation between lean and green manufacturing activities and the performance of the supply chain (Cabral, Grilo and Cruz-Machado, 2012; Govindan et al., 2015), whereas others have concentrated on lean and green indicators of performance (Cabral, Grilo and Cruz-Machado, 2012). When lean and environmental (green) practices are coordinated effectively, this allows the enterprise to exploit the associated advantages, including a reduction in costs and lead times, enhanced process flow and environmental quality, and increased staff morale and dedication (Environmental Protection Agency, 2007). From the findings of their case studies, Wu et al. (2015) indicate that lean, green and social practices can impact on the triple bottom line performance (which is considered as three performance indicators including: economic, environmental, and social) of an enterprise when implemented separately, but additionally emphasised the necessity for a synergy of such practices to optimise performance. Continually evolving market conditions, the competitive environment, demands from governmental agencies to diminish effects on the environment, and the growing cognisance of customers regarding green products has forced SMEs to implement lean and green manufacturing approaches to sustain their competitiveness (Kumar et al., 2006; Sangwan, 2011).

One way of reducing waste in the manufacturing process is green manufacturing, which includes supply chain design and operations decision support, and green production (Chan et al., 2017; Sarkis and Zhu, 2017). Studies on this topic have considered three aspects of manufacturing, namely: testing and inspection, packaging and transportation (Emmet and Sood, 2010; Kaur et al., 2018).

Several scholars believe that green management reduces waste and the cost related to the waste. For instance, Wang and Chan (2013) propose a hierarchical fuzzy TOPSIS (technique for order preference by similarity to ideal solution) approach (this approach looks at a problem as a geometric system with *m* points in the *n*-

dimensional space) to assess improvement areas, when implementing green supply chain initiatives.

Considering the above review and definitions along with the discussion in section 2.6.3, related to CSF, a full range of financial and non-financial factors has been considered for this study. Table 3.1 lists of these factors and their definitions.

Table 3.1: Performance KPI Justifications in this Study (Kaur, Kumar and Kumar, 2016a and 2016b; Laukkanen et al., 2013; Hon, 2005; Bulak et al., 2016; Benavides and Landeghem, 2015).

| **KPIs** | **Justifications** |
|---|---|
| Speed/Time | Reveals the resource utilisation management and affects waste reduction. |
| Effectiveness/ Efficiency | Demonstrates the capability of providing on-time order delivery and is related to frequency of customer orders. |
| Consistency | Shows the fitness in SMEs and includes aspects of product performance, durability product and reliability of the product. Consistency results in customer satisfaction. |
| Waste | Waste is related to factors such as time and productivity. Waste reduction should result in cost reduction. |
| Leadership and development | Manager/owner leadership influences employee commitment, innovation and planning. |

## 3.4 Conceptual Framework

Manufacturing organisations are seeking improvement through increased production flexibility, improved process control development speeds, efficient resource utilisation and waste elimination to gain an advantage over competitors. These firms are adopting different methods to achieve better performance (Womack, Jones, and Ross, 1990). Considering the review presented in section 2.6.3, on CSFs and the discussion in the above section, quality, delivery, cost and flexibility have been selected as the manufacturing competitive capabilities affecting manufacturing SMEs' sustainability (Table 3.2).

The conceptual framework presented in Figure 3.4 is postulated on the argument that sustainable SMEs perform differently to non-sustainable SMEs. First, financial performance metrics have been used to classify SMEs' sustainability. Second, non-financial performance metrics (Table 3.2) are studied to understand the behaviour of categorised enterprises in the presented framework (Figure 3.4). In this way, it will be possible to reveal if there are any direct or indirect effects of CSFs (such as waste management or development) on the financial factors that have been used to define the sustainability of the manufacturing SMEs.

This study also argues that measures of non-financial performance such as speed/time, effectiveness/ efficiency, consistency, waste, cost, leadership and development are outcome measures of the SME's operation. Measuring performance of sustainable SMEs may provide evidence to justify non-sustainable enterprises placing more emphasis on the measurement of non-financial performance.

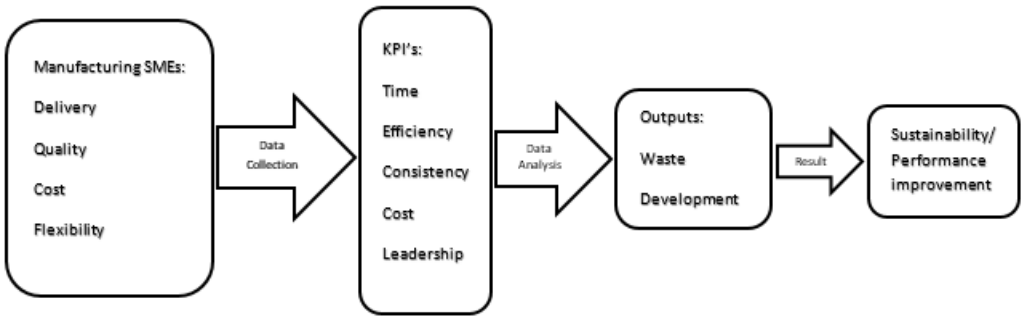



Figure 3.4: Conceptual framework for the study.

Table 3.2 details the competitive priorities and metrics selected for this study. The definition of each metric and the source references are available in Appendix B (Questionnaire Map).

Table 3.2: Competitive priorities and metrics used in this study.

| **Competitive Priorities** | **KPIs** | **Metrics** |
|---|---|---|
| Delivery | Speed/Time | Average Resource utilization |
| | | Total down Time Hours (Scheduled/Unscheduled) |
| | Effectiveness/ Efficiency | Forecasting |
| | | Production Capacity |
| | | Delivery Speed |
| | | On-time Delivery |
| | | Expertise Flexibility |
| Quality | Consistency and Waste | Product Quality (Performance) |
| | | Product Quality (Conformance) |
| | | Defect Free Products |
| | | Customer Satisfaction Rate |
| | | Waste by Product loss |
| | | Waste by Time loss |
| Cost | Cost | Monthly Sales |
| | | Operation Cost (fixed) |
| | | Operation Cost (Variable) |
| Flexibility | Leadership and Development | Employee appraisals |
| | | Competitiveness |
| | | Feedback Activities |
| | | Knowledge acquisition |
| | | Leadership Supports development |
| | | Focus of attention |
| | | Knowledge Transfer |
| | | Employee Training |
| | | Motivation |
| | | Development |
| | | Encourage Development |
| | | Tolerance for Mistakes |
| | | Knowledge Creation |
| | | Knowledge providers |
| | | Development Changes |
| | | Development Communication |

## 3.5 Manufacturing SME Characteristics

In this section, background and classification of the companies are reported. Ten manufacturing SMEs were considered for this study. Although all in the manufacturing sector, their performance first needed to be categorised. Performance

analysis was based on the CSFs identified in the literature review along with the questionnaires collected from the companies. The questionnaires were in Word format and included two sections, Section I (Company Profile) Section II (Financial Profile), with a total of 14 questions to identify financial performance and rank sustainability. Section 4.7, in the following chapter, includes the description of questionnaire formation.

### 3.5.1 Background to SME Manufacturing Companies in the UK

This section includes the companies' descriptions in terms of the manufacturing sectors, including the main machinery types and system processes. The following classification is based on the material used in each industry. The SMEs have been named alphabetically to keep their confidentiality.

#### 3.5.1.1 Glass Industry

SME E: glass washer and dryer, cutting table, polishing machine, sealing machine, lamination machine (2), and drilling machine.

SME H: glass washer and dryer, cutting table, polishing machine, sealing machine, lamination machine, and drilling machine.

SME C: glass washer and dryer, cutting table, polishing machine, sealing machine, lamination machine, and drilling machine.

SME A: mitre saw, angle grinder, planer, Makita jigsaw, and drill.

#### 3.5.1.2 Wood Industry

SME J: thickener planer, panel saw, band saw, spindle moulder, tenen, cross cut, drill, router, and gig saw.

SME B: thickener planer, panel saw, arm saw, spindle moulder, tenen, cross cut, and drill gig saw.

#### 3.5.1.3 Food Industry

SME G: Rheon machine-BUN, Tosel-Gyo2o9 machine, Ueschel dicing machine, Multivac-packaging, rational-oven, Tosel-Sui Mai machine, blue steel oven, and metal detector.

#### 3.5.1.4 Plastic Industry

SME D: extruder (5), converting machine (3), and recycle machine.

#### 3.5.1.5 Machine Tools Industry

SME I: band saw, piller drill (2), welding machine (5), and grinder.

SME F: CNC machine, lathe, milling machine, cutting machine, drill, angle grinder, welding machine, and bending machine.

### 3.5.2 Classification of Sustainability Factors for SME

Data needs to be logically and scientifically classified so that it can be used with optimum effectiveness and efficiency in numerous disciplines, such as finance (Stefana, 2012). Each system of classification is comprised of two or multiple categories, into which objects or phenomena being scrutinised are assigned accordingly. Such categories include all objects or phenomena with common properties. To ensure effective classification of SMEs, sustainability categories must meet several criteria. Firstly, they must be internally homogenous; all phenomena contained within a category must be identical (i.e., all case studies must be on SMEs). Secondly, all categories must be mutually exclusive. In other words, it is not possible to allocate manufacturing and healthcare to the same sector category. Lastly, category labels should be relevant, thus allowing all observations of objects or phenomena to be categorised identically regardless of who is performing the classification (Carton, 2004).

This section shows the inferences made from the data collected through the distributed questionnaires and interviews conducted throughout the research project.

The purpose of the data acquisition was to classify the SME's based on performance and consider them in three different categories, indicating their level of sustainability. Profitability and the number of years in operation (Figure 3.5) are two factors considered for classification by researchers (Simpson, Padmore and Newman, 2012; Mabhungu, 2017).

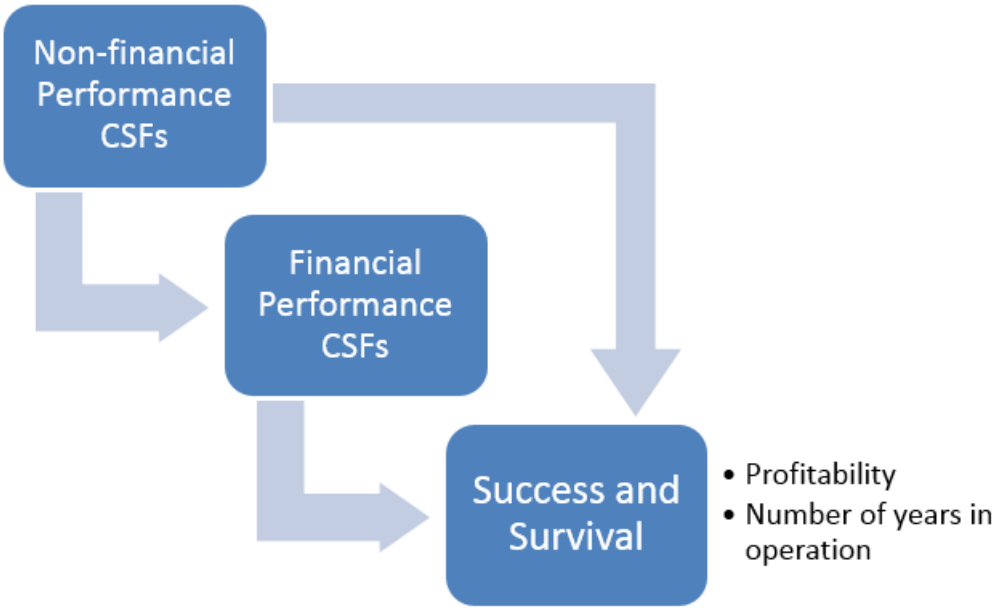



Figure 3.5: Defined influential factors on success and survival of SMEs (Mabhungu, 2017).

Box (2007) claims that the number of years a firm has been in operation is an indication of the enterprise's survival. It can be seen in Figure 3.5 that most of the SMEs (60%) selected for this study, have been in operation for at least ten years; and about 30% of have operated between five and ten years. However, only 10% of the SMEs have been in operation for less than five years. Most of the selected enterprises have survived for a relatively long time, so their sustainability status cannot be considered to have failed. In this study, the SMEs are classified into three groups namely: *Struggling*, *Surviving* and *Successful*. However, it should be mentioned that the Struggling SMEs are not in a stable condition, and they have a chance of failure

in the near future. One of the objectives of this study is to find the conditions that limit this chance by comparing the behaviour of SMEs in the three categories.

In addition, most of the selected SMEs (90%) have been in operation for more than five years. Consequently, in this study, the number of years in operation is not considered as a classification factor, since most of the enterprises have been running for a similar length of time.

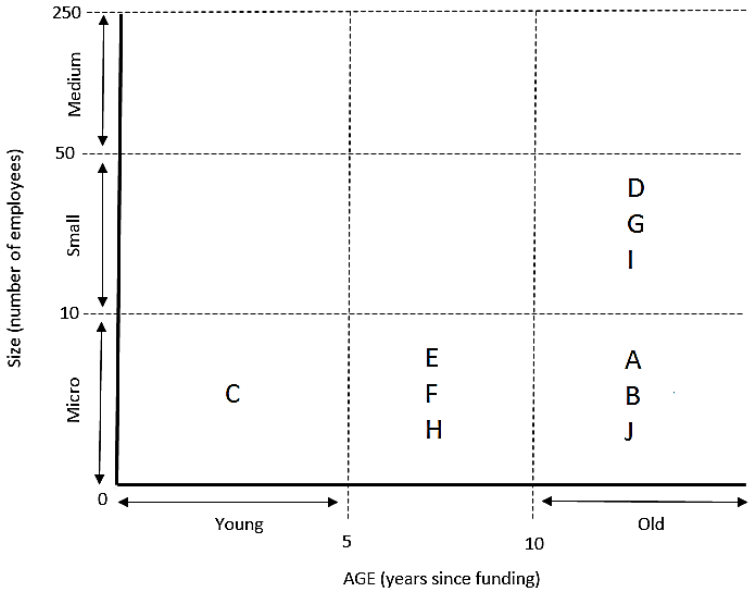



Figure 3.6: Comparing young-small SMEs to old-large SMEs across SMEs under study.

As has been discussed in section 2.6.2, profitability is one of the CSFs that indicate and control the success of business performance.

Previous research conducted on business performance by scholars from the field of accountancy has focused mostly on financial performance (Blackburn, Hart and Wainwright, 2013; Maduekwe and Kamala, 2016; Gerba and Viswanadham, 2016). A firm's financial performance is frequently assessed on the basis of its level of profit, sales expansion, market share and degree of debt (Ahmad and Seet, 2009), in

addition to cash flow and ratio analysis (Halabi, Barrett and Dyt, 2010). Financial measurements of particular importance for a firm's success include the current ratio, quick ratio, times interest earned, gearing (Hegazy and Hegazy, 2012), accounts receivable turnover, average collection period, inventory turnover, gross profit margin, net profit margin, return on investment (ROI), return on assets (ROA), return on equity (ROE), earnings per share (EPS), dividend yield, price-earnings, return on sales, return on capital employed, and inventory repurchases (Al-Matari et al., 2014).

Financial ratios permit close monitoring by managers of the firm's financial performance in comparison to its rivals or its own pre-determined targets (Otley, 2001). Nevertheless, it is evident from previous research (Gerba and Viswanadham, 2016) that there is no single group of ratios that offers an overall picture of the business performance of a firm (Al-Matari et al., 2014). Financial ratios including current, quick, inventory to cost of sales, debtors to sales and creditors to purchases, enable the firm's cash flow and liquidity situation to be measured (Otley, 2001). In combination with the debt to equity ratio, these measures can be used to evaluate the financial risk of the firm (Hegazy and Hegazy, 2012). It is important that multiple financial measures are utilised to ensure that distinct aspects of the firm's performance are covered (Simpson, Padmore and Newman, 2012). While financial measures have achieved a high degree of popularity, they have also been criticised to a certain extent. For example, they have received criticism on their historical nature; they measure previous performance rather than predicting future performance (Otley, 2001).

A different classical measure used to assess business performance is the ability of a firm to generate profit. This can be evaluated on the basis of earnings before interest and tax, profit after interest but prior to tax, and profit subsequent to tax (Hegazy and Hegazy, 2012; Williams and O'Donovan, 2015). It is also possible to express a firm's profitability (additionally defined as return) as the ratio of profit to capital used, whereby capital used can be either merely the equity of shareholders or the overall capital employed by the business (debt and equity) (Wu, 2009). The degree of profit is generally considered as a factor that can be used to measure the financial performance of a firm (Blackburn, Hart and Wainwright, 2013). If the goal is to evaluate the utilisation of financial resources by the entire firm then it would be more suitable to use the profit prior to interest and tax divided by overall capital used ratio;

on the other hand, the profit subsequent to interest and tax divided by the overall equity ratio is more appropriate for measuring shareholder fund performance (Correia, Kozak and Ferradeira, 2013). This could represent an advantageous measurement of SME performance as the majority of SMEs cannot obtain outside sources of funding, meaning that they are predominantly funded by the personal resources of the owner (Otley, 2001). Furthermore, profitability is the most widely used measure of financial performance employed in the assessment of business enterprise performance in spite of its commonly recognised shortcomings (Henri, 2004; Ahmad and Seet, 2009). Clark (2002) claims that the best output measure for marketing is profit. He defined the profit as profit margin, total profit or profit ratios such as return on sales, return on assets and return on investment.

In a study by Mabhungu (2017), success was measured through business growth, profitability and the ability of the SME to continue operating. The researcher in this study used the net profit margin as a variable for profitability. Mabhungu (2017) classified SMEs financial performance into four groups based on their net profit margin ratio namely: Loss (less than 0%), low (0%-5%), moderate (6%-15%) and High (more than 15%). this ratio has been defined as follows:

$$Net\ profit\ margin\ ratio = \left(\frac{net\ profit}{sales}\right)\ X\ 100 \qquad (3.1)$$

Similarly, in this study, the net profit margin ratio has been used to demonstrate the profitability and to classify the SMEs. The ordinal scale in this study has been broken down to smaller ranges compared with previous studies to have a better understanding of the enterprises' performances (Figure 3.7). However, similar to previous studies (Keppel and Zedeck, 1989; Mabhungu, 2017), *Successful* SMEs are considered those which have the highest profit margins (more than 15%), *Surviving* SMEs are those with moderate profit (6%- 15%), and finally, *Struggling* SMEs are those with low profit (0%-5%).

Consequently, the selected ten SMEs have been classified into three categories based on their profitability. Along with net profit margin, other financial performance information such as fixed and overhead costs, variable costs and annual sales have been collected from the SMEs to be considered in this study. Figure 3.7 indicates that most of the SMEs which responded to the questionnaire reported moderate profit

in the past three years. Two are in between groups; these have been placed in two categories. For instance, SME A is not as profitable as three other SMEs that scored high profit, but since it is close to them, it has been considered in both *Successful* and *Surviving* groups.

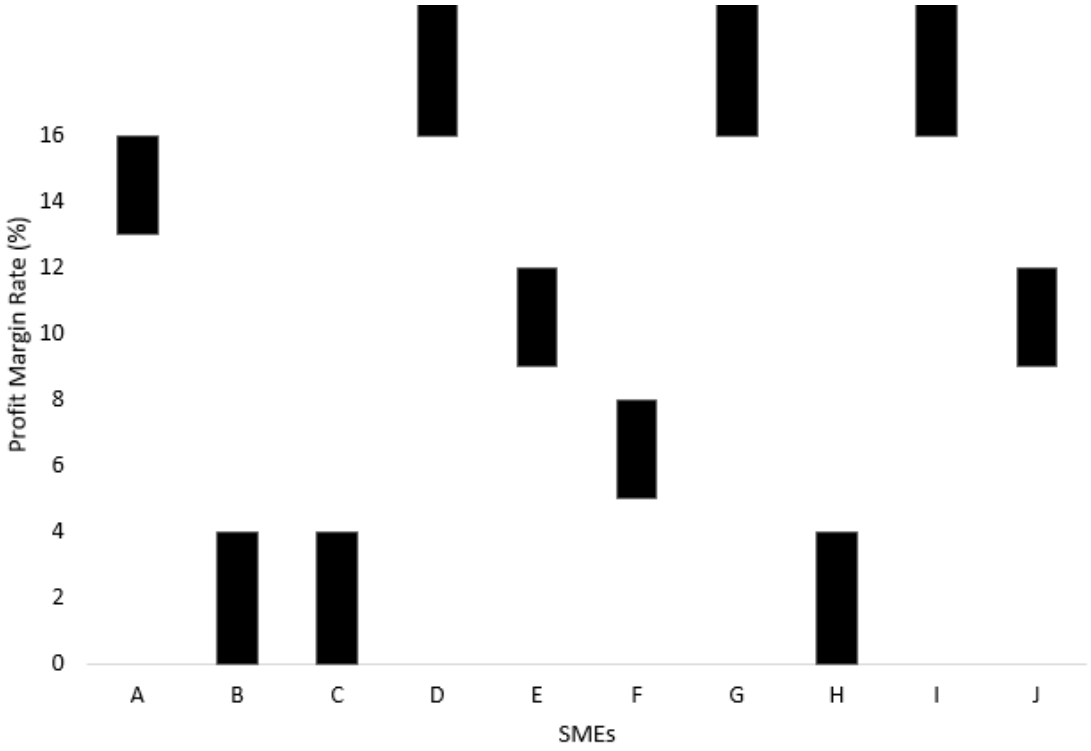



Figure 3.7: Comparing SMEs under study based on their profitability.

Table 3.3 demonstrates the final classification of SMEs under study.

Table 3.3: SME's Categories used in this study.

| ***Successful*** | ***Surviving*** | ***Struggling*** |
|---|---|---|
| D | A | F |
| G | E | H |
| I | J | C |
| A | F | B |

## 3.6 Chapter Summary

This chapter has developed the structure of the conceptual framework for this research in detail by explaining different priorities of manufacturing SMEs. The conceptual framework is based on four components, i.e. delivery (which includes speed/time and effectiveness/efficiency), quality (which includes waste, consistency and customer satisfaction), flexibility (which includes leadership and development) and cost. The effect of these factors on waste and development has been discussed. The last constituent to the framework is output, which is the SMEs sustainability. KPIs were identified from the literature for use in the proposed model, and their definitions and sources are available in Appendix B. These variables will be tested and validated in Chapter 6 to assess whether the proposed hypotheses are supported or not. Moreover, in this chapter, the selected SMEs background is been explained. The chosen companies have been classified in three sustainability categories, namely: *Successful*, *Survival* and *struggling*.

# Chapter 4

# Research design and Methodology

## 4.1 Introduction

In chapter 3 the literature on methods of measuring the performance of manufacturing systems, within the context of SMEs were reviewed. This chapter focuses on the methodology, covering the overall research approach and philosophy. The methodology includes the theoretical background which underpins the research design and the methods to answer the questions of the research. The research strategy impacts on the research design and data collection. More importantly, the reliability of research and the value of the conclusion of the research depend on the choice of research method. Consequently, it is essential to adopt a suitable research method (Collis and Hussey, 2009; Saunders, Lewis and Thornhill, 2009).

Hence, in this chapter, the selected method and approach are explained and justified. First the research philosophy is discussed, then the research strategies possible. The research design choices are then covered in sections 4.4–4.6. The questionnaire design, data analysis and pilot study are reported in sections 4.7–4.8.

## 4.2 Research Philosophy and Methods

A research paradigm is the set of notions about how the solution to a problem is approached and is based on ontology and epistemology (Collis and Hussy, 2009). It offers a fundamental structure including theories and data collection methods and methods of data analysis and interpretation (Glenn, 2009).

A research paradigm provides a wide overview guiding the research and patterns of practice (Tailor, Kenode and Roberts, 2007). Common paradigms are classified as positivism, interpretation and critical social theory.

### 4.2.1 Positivism versus Interpretivism

Social science research is often based on one of two research paradigms, positivism and interpretivism (Blumberg, Cooper and Schindler, 2008; Collins and Hussy, 2009).

Positivism comes from natural science and is linked with vital patterns and associations (Blaikie, 2000), often demonstrated through data collection in experiments and surveys. However, interpretivists argue that positivism cannot lead to clear understanding, so that another method is needed (Blumberg, Cooper and Schindler, 2008; Collins and Hussey, 2009).

Patterns based on statistics cannot be digested; hence we need to see the world through the eyes of reality. Also, the method of interpretivism focuses on contributors and interviews (Blaikie, 2000). Sunders, Lewis and Thornhill (2007) acknowledge that there are two research paradigms, positivism and interpretivism. Positivism is based on vital samples of phenomenon aiming to find associations between variables related to survey, while the interpretivist approach derives from social action theory, and data is collected in a less structured way, for example from interviews. Moreover, researchers such as Saunders, Lewis and Thornhill, (2009) discuss that the positivist's method stresses the significance of quantitative research and uses survey and questionnaires. Conversely, interpretivism needs consideration of investigational ways.

The most appropriate research paradigm to answer the research question in its context should be taken because of its effects on research (Hatch and Cunlidffe, 2006). Different types of knowledge can be acquired if phenomena are researched from different dimensions (Creswell and Plano-Clark, 2011).

A positive paradigm emphasises the existence of social reality (Hatch and Cunliffe, 2006) and development of theoretical models which can explain causes and effects which allows the prediction of results (Easterby-Smith and Lowe, 1991; Saunders, Lewis and Thornhill, 2009). However, with the interpretivism paradigm, individuals' experiences, memories and expectations construct social reality (Crotty, 1998). Denzin and Lincoln, (2003), believe that such a social world is a reflection of time to time, resulting in multiple realities. Researchers need to understand and consider carefully the concept of interpretation of research data from subjects as well as the world from their viewpoint (Creswell, 2006; Saunders, Lewis and Thornhill, 2009). The world opinion over this paradigm is subjective which is linked with qualitative data gathering (Eriksson and Kovalainen, 2008).

### 4.2.2 Deductive versus Inductive

All research is classified from general to specific. The deductive method is from general to specific, involving conceptual and theoretical structure and verified through observations (Collins and Hussy, 2009). In this approach, concept rises before the experiment and aligning with positivist research, which involves statistics seeking to prove what does not occur on a random basis (Saunders, Lewis and Thornhill, 2009). However, with the inductive method, the opposite is true; theories are developed from experimental realities (Collins and Hussy, 2009). The inductive approach is about theory coming from research. The process is applied in qualitative research, which depicts the experience of past and present (Margaret, 2008).

This study uses the inductive approach to design a PM framework based on a literature review and survey of the current PM practices in SMEs. This approach aligns with Gay and Weaver’s (2011) philosophy that inductive facts are the priority and theory is built based on these facts.

## 4.3 Research Strategy

Numerical information is quantitative which focuses on measurement and investigation, to inform on any connections between variables, predicted in hypotheses (Denzin and Lincoln, 2000). In contrast, qualitative research is about people's understanding and perspectives (Zikmund et al., 2012).

### 4.3.1 Qualitative or Quantitative Methods

In the method of qualitative research, the emphasis is based on words and we decode data (Collis and Hussey, 2009). This method is used for deeper research into phenomena, which also involves communication (Creswell, 2003).

A commonly used collection source for qualitative data is interviews, from which new evidence and precise data can be derived (Rubin and Rubin, 2011); however, Collis, Young and Goold, (2003) disagree with the universal value of these data, because they believe interviews are only suited to certain people. Interviews are a flexible approach of getting data on a large number of topics (Grbich, 2012), and can be in person or by phone (Rowly, 2012). However, they also can be conducted in groups, known as focus group interviews, to elicit the notions and experience of a specific category of people (Hiebl, 2014). However, Hiebl (2014) points out those interviewers have the power to lead conversations in a specific direction. On the other hand, Rowly (2012), in contrast argues this to be a benefit, because interviews can be structured to collect reliable facts. However, another disadvantage of interviews pointed out by Collins et al., (2003) is that they take considerable time.

Another method to conduct quantitative research is survey by case studies. To answer questions of how and why, case studies about real-life scenarios and real-life happenings are valuable (Yin, 2012). Case studies provide valid data and deep information, regardless of the complexity of the context of research.

Finally, simulation is recognised as a method in quantitative research. In terms of what-if questions, the technique of simulation is used to inspect an artificial world,

which gives researchers practical feedback; however, it cannot simulate real-world (Moshirvaziri and Benli, 2008). Observation is a quantitative method and concerns measurements and statistical analyses, which can be tested for reliability and result in the advancement of various statements about factors and causation (Creswell, 2003). Questionnaires are a popular data collection technique for collecting data in academic research (Grbich, 2012). Rubbin and Rubin (2011) emphasises that this method can be used for large scale analyses to collect targeted people's viewpoints. Demographic data can help analyse according to where people live, their age or gender. Participants can answer closed questions with a simple yes or no response, and open questions, which allow respondents to go into details (Moshirvaziri and Benli, 2008). Compared to other methods of data collection, a questionnaire is time-saving and economical. Being anonymous, participants can respond clearly and honestly (Stanton et al., 2005). While details can be asked through the open questions, this can be time-consuming for respondents and Saunders, Lewis and Thornhill (2009) point out that the response rate of questionnaires can be low unless presented in-person.

### 4.3.2 Mixed Methods Research

Using a mixed research method is a supplementary set of tools. Its primary merit is in improving the validity of research. Using mixed research methods allows collection of a variety of data types on the specific area of study (Harrison and Reilly, 2011). Mixed methods, after qualitative and quantitative, is believed to be a third paradigm (Creswell, 2009). Qualitative research explores from specific to general subjects (Creswell, 2009), while quantitative research focuses on variables. Employing the mixed research methods leads to a better understanding of the research question and answer, through using the benefits of different individual methods (Harrison and Reilly, 2011).

### 4.3.3 Cross-Sectional Versus Longitudinal Research

Research design also needs to consider time. In longitudinal research, the data is gathered over a period of time, while in cross-sectional research, data is collected at a certain time point (Blumberg, Cooper and Schindler, 2008). In cross-sectional research, existing differences (for example between different populations) might be the focus, whereas in longitudinal research, changes in variable with time is the focus.

## 4.4 Research Choices for Performance Measurement of SMEs

In Chapters 2 and 3, the Key Performance Indicators (KPIs) and metrics are identified as crucial aspects of a PMS. In sections 3.2 and 3.3, the selected KPIs and their definitions are presented. These KPIs should not only reflect effectiveness, but also the relationship between KPIs and an enterprise's sustainability (Taticchi and Balachandran, 2008). It is therefore essential to consider the type of data required for modelling. In general, there are two categories of data: feedback information (collected data from real life) and feedforward information (predicted data based on the existing information). Some scholars argue that KPIs should produce feed-forward information; such information allows owners/managers to be proactive and take action before harmful situations for the business evolve (Amir, 2011; Bhandari and Iyer, 2013). However, other researchers claim that feed-forward information is still backwards-looking especially when using financial performance data (Hegazy and Hegazy, 2012; Al-Matari et al., 2014). Similarly, feedback information has advantages and disadvantages. For instance, scholars claim that feedback information is reliable and objective and gives the ability to forecast future performance (Hegazy and Hegazy, 2012; Al-Matari et al., 2014). The selection of one of these approaches or both depends on the SME's specific circumstances and the presented framework (Garengo, Biazzo and Bititci, 2005). Considering the above arguments, in this investigation, both feedforward and feedback information is acceptable for performance measurement.

The created frameworks need to be able to lead the enterprise towards achieving its performance objectives (Simpson, Padmore and Newman, 2012). A holistic PMS is able to boost performance towards delivering the business objectives. This type of model is capable of providing the following features for a successful framework:

- Flexibility to quickly respond to fluctuating circumstances (McAdam, 2000);
- Be clear, simple and focused, to provide useful information (Cocca and Alberti, 2010);
- Balanced to include various performance dimensions (Garengo, Biazzo and Bititci, 2005), and be capable of considering both financial and non-financial measures (Taticchi et al., 2008).

While a study is being carried out, the research method becomes significant. The approach of this research is based on survey by questionnaires, case studies and interviews (Neely, 2007; Pradhan and Chaudhury, 2012).

Moreover, using the data collection techniques described in this PM research, links between variables could be searched for. Data could be collected in response to questions of who, what, where, how and why using survey questionnaires (Neely, 2007; Pradhan and Chaudhury, 2012).

Many researchers have chosen to adopt survey questionnaires and interviews for both quantitative and qualitative methods (Neely, 2007; Parthiban and Goh, 2011; Myeda and Pitt, 2012). For instance, Ates et al. (2013) investigates 37 European SMEs through 232 semi-structured and face-to-face interviews. Their aim was to provide a more effective performance management process for SMEs. Similar to the above studies, in this content, a holistic method is employed to collect the data through questionnaires and interviews.

## 4.5 Research Approaches Applied in this Study

There are two distinct phases in this research; a survey by questionnaire phase, followed by qualitative phase, as recommended by Creswell et al., (2003). The quantitative phase provides a numerical perspective on PM by collecting numerical data from managers/owners, while the qualitative study focuses more deeply on the phenomenon in performance measurement, and is about the detailed description of respondents' personal experiences.

To build on former literature and contribute to the field, a quantitative research method was chosen as most appropriate to the manufacturing SME analysis required, to identify a novel conceptual framework and analysis process to develop a PMS for manufacturing SMEs in the UK. The quantitative approach provides a rigorous and scientific examination of the research topic.

The survey questionnaire enables researchers to collect data from SMEs and identify performance factors used by SMEs.

It is an important step forward for SMEs to identify which crucial parameters should be measured at any given time. For this to become possible, the data collection method needs be comprehensive, quantitative, reputable and collect data with the relevant frequency (Stephen Town 2000, Wang and Ang, 2004), and cover an in-depth list of inputs from resources, operations, and outcome measures. This avoids missing unidentifiable or unfamiliar key information, which might happen if a particular PMS were adopted. This will also encourage all SMEs to find the nature of the input information they are most concerned with in their day-to-day business. Consequently, it is expected that by fitting this approach to a variety of SMEs, categories of common and different key information may be identified and published. As an example of common key information collected in this study, after three months of gathering data, most of the participant SME managers identified that they were highly concerned with waste reduction and development factors; therefore, their view has been reflected in the PMS generated from this study.

Moreover, it is valuable to provide a quantitative measure of the relative importance of each input parameter among the range of input parameters under study. This

relative importance may vary depending on the organisational culture of the SME or changes happening in its culture. A quantitative rank of the importance of the key inputs would support the implementation of an efficient PMS in terms of the most deterministic outcomes, from the optimal number of inputs in terms of minimal effort for data collection and data processing. Finally, the appropriate data collection frequency should be considered. For instance, an input parameter is identified as key measure to be taken into the account, for performance measurement, and its value proves to be constant over a relatively long period of time or fluctuates over a short period of time; then the relation of the other KPIs with the key measure can reveal the underlying issues in the SME.

The above three features for data collection (comprehensive, quantitative, reputable) are expected to generate effective clarification for every SME to enable them to become sustainable based on the most efficient PMS. The measure of the sustainability of SMEs as a result of implementation of the outcome of this approach is the aim of the study.

## 4.6 Sampling

The sampling technique is also critical to successful research design. In the field of social sciences, two main approaches are adopted for sampling: probability and non-probability sampling. In the former, each member of the population has an equal chance of being chosen. Conversely, in the latter, the probability of each member of the population being chosen is not the same (Henry, 1990).

The size of the sample is also an important factor in quantitative and qualitative research. Determination of the sample size depends on whether findings from the sample need to be generalised to the whole population and if so, the size can be calculated. Per Gill and Johnson (2002), it is not feasible for each member of the population to be included in research. Hence, it is essential that the sample is selected appropriately. According to Hussey and Hussey (1997), a population is comprised of a group of individuals being considered, whereas the sample is a sub-group of the overall population. Blumberg, Cooper and Schindler (2008) claim that non-

probability sampling should be used in situations where both cost and time are factors, and Saunders, Lewis and Thornhill, (2009) recommend a form of non-probability sampling called snowball sampling (which considers one or two cases in the population and identify the further cases based on the selected sample), when it is not possible to identify the population's members. Convenience sampling, used when respondents are selected on the basis of whether they can be reached conveniently is also a form of non-probability sampling. For the purposes of this research, a convenience sampling method has been used.

Boyer and Pagell (2000) suggest that it is relatively easy to conduct research in which one participant from each organisation is involved. Nevertheless, these types of studies are associated with considerable risk as decisions made with regard to operations and implementation are not made by one individual. In fact, various individuals throughout the organisation are involved in such decision-making processes. On the other hand, when researching SMEs, it is common that only the managers or owners have the required knowledge about the different areas of the business; hence, in this research, the owners/managers of the SMEs are invited to be respondents.

Gargeya (2005) researched performance management in the context of manufacturing factories. His research involved the utilisation of various performance measures within manufacturing firms. In the report of his study, he comments that in the majority of his past research, PM practices had not been determined and assessed effectively as only one respondent from each organisation participated. To resolve this problem, Boyer and Pagell (2000) suggest that multiple participants should be included to obtain a holistic picture of the overall organisation. The aim of the current research is to obtain precise opinions with regard to PM in the manufacturing industry. Therefore, data were gathered from several respondents and the manager/owner of the organisation.

The researcher could not find a comprehensive database of all the formal manufacturing SMEs operating in the UK. Correspondingly, this investigation focused on the identifiable active formal manufacturing SMEs whose directors were willing to take part in the research. The SMEs had to be operating in the UK and specialising in manufacturing.

The researcher was able to contact 25 formal manufacturing SMEs, which were listed in the records of the UK Government's Companies House, which met the criteria of being manufacturing SMEs operating within the UK. A director of these firms confirmed their willingness to take part in the study. For the main study, ten of these SMEs were specifically selected based on their understanding of the phenomenon of PM of SMEs in the manufacturing sector. As discussed in section 3.5, the SMEs were classified into three groups: *Successful*, *Surviving* and *Struggling*. The level of sustainability of SMEs in this research was evaluated through operating profitably (identified by profit margins).

## 4.7 Questionnaire Design

Based on the literature review regarding PM, research approaches and SME's analysis, the researcher quantitative research was chosen as most suitable for this research. Two types of survey questionnaire were prepared. The first questionnaire needed to be completed once, to gather general information about the SME. Most of the questions are the multiple-choice questions and it includes two sections, Section I (company profile) and Section II (financial profile), and was distributed with a cover letter. The company profile section collects data on number of employees, number of years in operation, type of SME, and the participant's position in the firm. The financial profile section includes the variable costs, fixed costs and overheads, profit margin, annual sales, annual turnover, financial resources and cost management. The questionnaire is available in Appendix D.

The second questionnaire was an excel file that needed to be filled once a month. The definitions of related KPIs are presented in the previous chapter. Preparation of an exhaustive set of performance measures could satisfy some of the objectives of this thesis; it allows a comprehensive cross-analysis of dependencies of the processes within an SME and identifies effective relationships between variables. Finally, it allows cross-analysis of performance measurements in SMEs within the different categories, (*Successful*, *Surviving* and *Struggling*) to identify the common and practical aspects of PM of SMEs. The selection of the performance measures was

associated with the measurement of the presented factors in Table 3.5. Appendix D includes a list of metrics and related questions.

For ease of approach, the questionnaire was designed in its most simplistic form as a spreadsheet. The first column of the spreadsheet introduces the identity of the variable. The next columns were designed to be filled by the SMEs with values that represent the status of the variable. The KPIs include Speed/Time, Effectiveness/Efficiency, Consistency and Waste, Cost, Leadership and Development. In general, the researcher administered a total of 118 questionnaires from 10 SMEs, for all categories excluding the missing data.

### 4.7.1 Data Collection

Data were collected from SMEs through a one-off questionnaire and monthly completion of an Excel sheet by representatives of the SMEs. Data collection was handled by the researcher personally between September and May 2016 to ensure high response rate compared to alternative questionnaire data collection methods (Sekaran, 2000; Zikmund, 2003). Questionnaires in the format of excel files were distributed to the directors of the SMEs. The questionnaire is included in Appendix D. The data were collected from the owners/managers at the end of each month, which allowed them the convenience of a month to complete each data set. Few participants claimed that the questionnaire was too complex or long. For those who had difficulty, assistance was provided. In these situations, a copy of the questionnaire was provided to the participant to have a better understanding of the contents. The questionnaires were then completed when the participants had indicated that they were ready to respond to the questions.

During prompting of the respondents, the researcher tried to be as neutral as possible to keep the validity of the collected data. This method of data collection had a positive impact on the clarity of the questions, as the participants had a chance to resolve issues about questions. However, after two months of the data collection, most of the SMEs were familiar with the questions, and the researcher followed up

by phone call just to check whether they had completed the questionnaires or needed further assistance.

The final data collection took place after the analysis and modelling of the data collected from questionnaires Part I and Part II. Interviews were held to gather information for the purpose of model validation. The interview participants were the owners/managers of the SMEs. Interviewing the directors of these companies allowed the study to employ the most knowledgeable respondent to validate the presented model. Before the interview, the participants were informed about the interview process and a cover letter was sent to them (see Appendix G).

### 4.7.2 Ethical Consideration

The ethical considerations for research (Bryman and Bell, 2007) are related to collecting, analysing and reporting data (Saunders, Lewis and Thornhill, 2009). These considerations were discussed with the supervisor and some steps were taken to address the related issues. Initially, in the design of the questionnaire, a cover letter (Appendix D) was attached that described the purpose of the study and the contact details of the researcher and supervisor. In this letter, the respondents were informed that their participation was entirely voluntary and that they could withdraw at any stage. In addition, it was stated that information they provided would be anonymised and destroyed upon completion of the study. The researcher ensured that all information from questionnaires would be treated confidentially. Similarly, another cover letter was sent to the interview participants before the event took place (see Appendix G).

A letter of ethical approval for the study (Appendix C) was awarded. Brunel University was informed about the study design and details of the questionnaire and interviews. In accordance with the UK Data Protection Act (1998), Brunel University will keep the data in a password-protected computer accessible only to the researcher and on the servers of the university for seven years, after which it will be discarded.

Some factors regarding participants were considered for risk assessment such as traveling accidents, psychological/emotional trauma and removal or loss of confidential data. The assessment confirmed that this study posed a low risk. In general, Visagie (2012) indicates that research should be designed in a way that social, psychological and financial risks for all stakeholders are minimal; also, potential benefits such as professional and personal growth and development should be maximised. Therefore, even these possible low risks were carefully monitored during the collecting, analysing and reporting of data. Moreover, the researcher tried to minimise any risks to participants and increase the benefits to both the participants and the researcher. The names of the research case studies are not disclosed in this thesis to ensure confidentiality and privacy. The next sections identify the data analysis methods used for the investigation such as the variable scales.

## 4.8 Data Analysis

The collected data from questionnaires in this investigation are mainly quantitative in nature; however, the data from the interview case studies are mainly qualitative in nature. Consequently, quantitative data analysis methods have been employed to examine the questionnaire data. For this purpose, SPSS version 25 has been used. The data analysis involved two stages associated with descriptive statistics. The methods such as ANOVA, paired-sampled-test and regression have been used widely by other similar studies on SMEs' PM (Zhu, Sarkis and Geng, 2005; Ukko, Karhu and Rantanen, 2007; Nouara, 2015; Mabhungu, 2017; Kaur, Kumar and Kumar, 2017). In the first stage, a comparison among manufacturing SME categories, (*Successful*, *Surviving* and *Struggling*) was completed using ANOVA and paired-sampled-test. The ANOVA variance analysis is a method to compare the scores of three or more different groups or conditions, through evaluating whether the sample groups differ statistically in terms of their means (Field, 2005; Pallant, 2011; Favero, Meier and O'Toole; Hair et al., 2010). The second stage the proposed model was tested with regression, using the factors, which emerged from the first analysis, considering the metrics, which were distinguishable between the three categories.

In the final stage of the data analysis, the qualitative data collected from interviews was analysed by revealing relevant themes and meanings. The advantage of qualitative data is that it enables scholars to find interrelationships, themes and patterns within the data; also, it allows researchers to understand the phenomenon of PM as a whole, rather than only the specific variables under investigation (Mabhungu, 2017).

Before the descriptive statistical analysis was conducted on the questionnaire data, the validity of the collected data for the selected type of analysis was considered. For this purpose, a reliability test (called Cornbach Alpha) was used to determine the validity of the collected data for analysis (Nouara, 2015; Mabhungu, 2017). Finally, after the reliability test, factor scales and units were computed to be used in the descriptive statistical analysis. The next section explains the details of the variable scales.

### 4.8.1 Units and Scales

Each variable for which data was collected retained its unit and scale of value. In other words, no indexing or normalisation were performed at this stage. Therefore, changes were recorded and counted along with their associated relationships. This allowed independent analysis of the significance of the variables concerning any other variable, regardless of the previous data collection. In addition, this helped respondents to understanding and continue with the data collection. The units of the variables at this stage were divided into three categories, namely: hours, number of products and number of events. This classification was selected based on the nature of the variables. For instance, any resource utilisation was considered in hours, for the quality of products, the number of high quality, average quality and failed quality were recorded as absolute numbers products. The leadership and development variable were counted as the number of events which had occurred, for example, how many times during one month the employees were appreciated for their work. After collecting the raw data, data reliability testing and scaling took place.

In the study of PM of manufacturing SMEs, ratios have previously been selected for scaling data (Sedehi, 2015). Similarly, in this investigation, all the variables were considered as rates between 0 and 1. Production in this context is the number of products. The leadership and development metrics are considered as actual number of events/maximum number of events. Table 4.1 demonstrates the input and output metrics with their scaling.

Table 4.1: Input and output of metrics. RSR: Resource Stability and Reliability; EE: Efficiency/Effectiveness; CW: Consistency and Waste; LD: Leadership and Development.

| **Metrics** | **Inputs** | **Outputs (ratio)** |
|---|---|---|
| Average Resource utilization | ARU=Total hours of resource utilization/ number of resources | RSR=(ARU-TDT)/ARU |
| Total down Time Hours | TDT=Scheduled downtime (hours)+unscheduled downtime (hours) | |
| Forecasting Production | FP (number of products) | EE1=FP/PC |
| Production Capacity | PC=number of actual Production | |
| Delivery Speed/On-time Delivery | DS=Defect free on time shipment (number of products) | EE2=DS/TD |
| Total Dispatch | TD=good products (number of products) | |
| Expertise Flexibility | EF=number of employees with different skills | EE1= EF/ total number of employees |
| Product Quality (Performance) | PQP=number of high-quality products | CW1=PQP/PC |
| Product Quality (Conformance) | PQC=number of average quality products | CW2=PQP/PC |
| Defect Free Products | DFT=good products (number of products) | CW3=DFT/PC |
| Customer Satisfaction Rate | CSR=number of complained products | CW4=(TD-CSR)/TD |
| Waste by Product loss | WPL=number of products failed quality control | CW5=(PC-WPL)/PC |
| Waste by Time loss | WTL= number of products lost due to shutdown | CW6=(PC-WTL)/PC |
| Employee appraisals | Number of event in one month/Maximum number of events during the nine months | LD1 |
| Competitiveness | Number of event in one month/Maximum number of events during the nine months | LD2 |
| Feedback Activities | Number of event in one month/Maximum number of events during the nine months | LD3 |
| Knowledge acquisition | Number of event in one month/Maximum number of events during the nine months | LD4 |
| Leadership Supports development | Number of event in one month/Maximum number of events during the nine months | LD5 |
| Focus of attention | Number of event in one month/Maximum number of events during the nine months | LD6 |
| Knowledge Transfer | Number of event in one month/Maximum number of events during the nine months | LD7 |
| Employee Training | Number of event in one month/Maximum number of events during the nine months | LD8 |
| Motivation | Number of event in one month/Maximum number of events during the nine months | LD9 |
| Development | Number of event in one month/Maximum number of events during the nine months | LD10 |

| | | |
|---|---|---|
| Encourage Development | Number of event in one month/Maximum number of events during the nine months | LD11 |
| Tolerance for Mistakes | Number of event in one month/Maximum number of events during the nine months | LD12 |
| Knowledge Creation | Number of event in one month/Maximum number of events during the nine months | LD13 |
| Knowledge providers | Number of event in one month/Maximum number of events during the nine months | LD14 |
| Development Changes | Number of event in one month/Maximum number of events during the nine months | LD15 |
| Development Communication | Number of event in one month/Maximum number of events during the nine months | LD16 |

## 4.9 Pilot Study

A pilot study was carried out in the UK to check the reliability of the questionnaire and therefore refine it. The test revealed concerns about the questionnaire in terms of wording and question comprehension; also, it explored the potential interest in participation for the main study. Saunders, Lewis and Thornhill (2009) claim that prior to using a questionnaire, a pilot test needs to be conducted. The survey questionnaire can then be refined and the respondents will not face difficulties in answering questions. Questionnaires were administered to 25 Manufacturing SMEs. This sample size is recognised as satisfactory by Isaac and Michael (1995) and Hill (1997); Hertzog (2008) also recommends a sample size of between 10 and 30 as being sufficient for a pilot study. However, some researchers (Crocker and Algina, 1986) believe that the minimum sample size for computing Cronbach alpha should be at least 30 (Johanson and Brooks, 2009). Consequently, the reliability test was conducted not only on the pilot study, but also on the final dataset to confirm the validity of using the collected data in the main study.

The pilot study participants were contacted through phone interviews. The pilot test was held with owners/managers or senior employees in the manufacturing SMEs specialising in five different manufacturing sectors; see Table 4.2. This pilot test confirmed the validity of the research instruments developed and used in this research. Conclusively, this test recognised domains for improvement and validated the questionnaire.

Table 4.2: Types of SMEs for pilot study, and number of responds.

| **Type of Classified manufacturing industries** | **Number of responds** |
|---|---|
| Wood | 5 |
| Glass | 8 |
| Food | 2 |
| Metal | 7 |
| Plastic | 3 |

### 4.9.1 Reliability Test

The collected data for the pilot study was tested for reliability employing Cronbach's coefficient alpha using SPSS version 25. This coefficient is suitable to determine internal consistency for data analysis and to measure internal reliability of a scale (Lee and Hooley, 2005). This method has been selected because it has been widely used in previous studies (Dobni, 2008). Researchers have different levels of acceptance of the alpha coefficient. In general, scholars (Nunnaly and Bernstein, 1994) estimate that for social science research at the stage of a pilot study (early stage) the alpha coefficient should be a minimum of 0.7. The Cronbach alpha results for the pilot study are displayed in Table 4.3. The presented results in this table reveal that the values of Cronbach alpha vary between 0.70 to 0.94. However, the value for the speed/time factor is 0.606 (i.e. less than 0.7). This suggests that the reliability test for this study is acceptable and the internal consistency is high.

Table 4.3: Reliability test for the pilot study with raw data.

| **Type of Classified Factors** | **Cronbach Alpha (α)** |
|---|---|
| Speed/Time (hours) | 0.606 |
| Consistency/waste and Effectiveness/ efficiency (number of Products) | 0.947 |
| Leadership and Development (number of events) | 0.814 |
| Total data reliability (ratios) | 0.704 |

## 4.10 Validity of the Study

The validation actions for this study have been carried out through the research process. The first stage involved theoretical validation of the PM framework from the literature and existing referenced definitions. In addition, SME directors were interviewed to confirm the influence of the proposed framework on SME sustainability. After designing the framework, collected data needed to be validated.

Validity refers to the extent to which results are accurate. Cronbach's alpha test as a reliability test provides a measure of the extent to which items in a scale provide consistent information. Reliability is the yardstick for measuring consistency. As suggested by classical test theory, every test score is influenced by different factors. The true score is one, which is based on all factors associated with consistency. There are several reasons for testing reliability in research. It helps measure the extent to which the results represent a random measurement error. Furthermore, reliability is considered to be the precursor to validity. If there is no consistency in the instrument and results, it is not possible to conclude that results are valid.

In the final stage, the validation of the tested model adopted a multiple case study approach. Case studies were selected from each study category of manufacturing SMEs (*Struggling*, *Surviving* and *Successful*) using purposive sampling. Face-to-face interviews were conducted to confirm the model developed with three manufacturing SMEs. The interview questions covered factors in the created model

(i.e. waste and development). Appendix G presents the cover letter that was provided to all three participants; in this letter, the purpose of the research was explained and the participants were informed that their participation was voluntary and the information provided would be kept confidential.

## 4.11 Research Design

Hussey and Hussey (1997) posit that the selection of the right research process determines the success of the research. Figure 4.1 illustrates the steps of the research process in the current study. The first part of the study involved a thorough and extensive review of literature on performance measurements, which influence SMEs' business performance, and this review identified the relationship between CSFs. The information obtained from the literature review guided the appropriate choice of performance measures and the overall design of the PMS. The second part of the study involved designing (and piloting) a questionnaire to collect data from manufacturing SMEs operating in the UK. The pilot study helped the researcher to identify the shortcomings of the questionnaire and improve it. Data collection for the main study was through an Excel sheet questionnaire completed by 10 manufacturing SMEs monthly for 9 months. Following the data collection, a statistical analysis was completed focusing on the three categories of SMEs, *Successful*, *Surviving* and *Struggling*. In this part of the investigation the relationships between selected factors were under study. Stage four in the study involved model testing on multiple case studies, which were classified based on their profitability to see how the PM framework would affect enterprises to improve manufacturing SME performance. Finally, the last stage was model validation and discussion of the results.

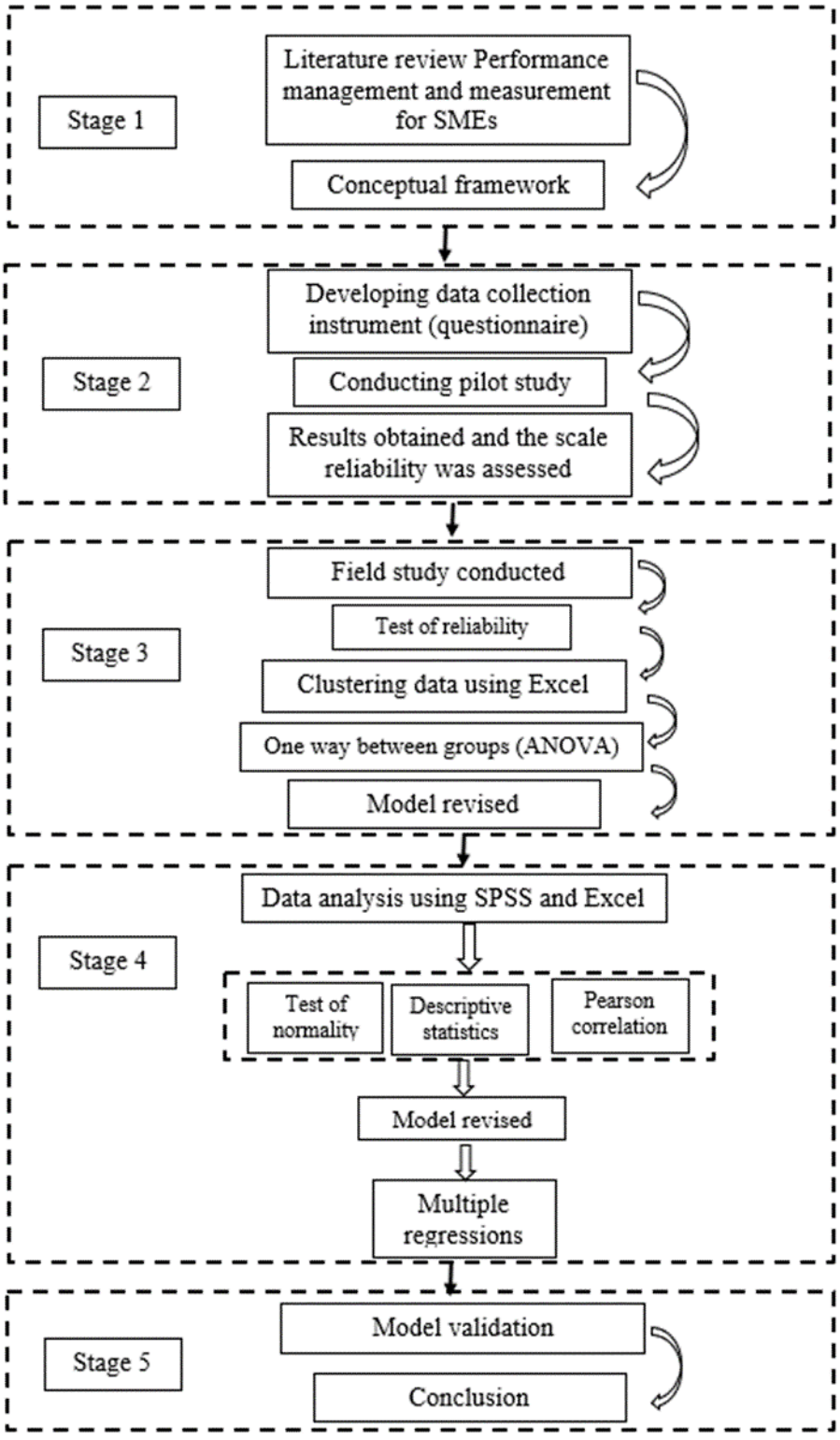



Figure 4.1: Research process.

## 4.12 Chapter Summary

The focus of this chapter was on the philosophy and research approach guiding the design of this research. It provided an overview of positivist and interpretivist research paradigms and quantitative and qualitative data collection methods. A mixed methods approach was adopted in this research to collect both quantitative and qualitative data. Purposive sampling was used to identify 25 SMEs for study. A questionnaire was designed based on the KPIs and CSFs identified from the literature review. A pilot study tested and lead to improvement of a questionnaire to be used in a survey to collect key performance data from 10 SMEs during over 9 Months.

# Chapter 5

# Data Analysis

## 5.1 Introduction

In chapter 4 the definition and specification of the selected SMEs were explained. The method for classifying them was also explained in Chapter 3. Ten Manufacturing SME's participated in this study. All were in manufacturing sector and were categorized to allow detailed study in relation to performance. Performance analysis was completed based on the success factors identified in the literature review, along with data collected using questionnaires. The questionnaires were in Word and Excel format: Section I (Company Profile) and Section II (Financial Profile), with a total of 14 questions to identify financial performance and rank sustainability. Following data collection, a reliability test was performed, which confirmed that the row data and the scaled data were both in an acceptable range to continue further study.

In this chapter, the data analysis completed following the proposed Research process (Figure 4.5) is detailed in Table 5.1. Table 5.2 presents the abbreviations used for the measures in this study. All the variables are considered as ratios between 0 and 1.

Table 5.1: Test Used.

| Test name | Description |
|---|---|
| Cronbach's alpha | Assesses the degree to which a set of measures which make up the scale are sharing high inter-consistency (DeVellis, 2003). |
| Normality | The distribution of a variable should follow a normal distribution (Hair et al, 2010). |
| Multicollinearity | Examines the correlation between independent variables; high correlation affects the regression coefficient and statistical significance (Hair et al, 2010). |
| Regression analysis | Explores the relationship between one dependent variable and a number of independent variables or predictors (Field, 2005; Pallant, 2011). |
| Paired-samples t-test | To determine whether the mean difference between two sets of observations is zero. Each subject or entity is measured twice, resulting in pairs of observations. |
| One-way analysis of variance (ANOVA) | To compare the scores of three or more different groups or conditions (Field, 2005; Pallant, 2011). |

Table 5.2: Metrics IDs used in this study.

| KPIs | Variables | Metrics |
|---|---|---|
| Speed/Time | RSR | Resource Stability and Reliability |
| Effectiveness/ Efficiency | EE1 | Forecasting Production |
| | EE2 | Delivery Speed |
| | EE3 | Expertise Flexibility |
| Consistency and Waste | CW1 | Product Quality (Performance) |
| | CW2 | Product Quality (Conformance) |
| | CW3 | Defect Free Products |
| | CW4 | Customer Satisfaction Rate |
| | CW5 | Waste by Product loss |
| | CW6 | Waste by Time loss |
| Leadership and Development | LD1 | Employee appraisals |
| | LD2 | Competitiveness |
| | LD3 | Feedback Activities |
| | LD4 | Knowledge acquisition |
| | LD5 | Leadership Supports development |
| | LD6 | Focus of attention |
| | LD7 | Knowledge Transfer |
| | LD8 | Employee Training |
| | LD9 | Motivation |
| | LD10 | Development |
| | LD11 | Encourage Development |
| | LD12 | Tolerance for Mistakes |
| | LD13 | Knowledge Creation |
| | LD14 | Knowledge providers |
| | LD15 | Development Changes |
| | LD16 | Development Communication |

## 5.2 Reliability Test (Cronbach's Alpha)

One of the tests used in the study was a reliability test. This test was conducted to study the properties of items used in the test. The reliability of items is indicated by Cronbach's alpha. It is a measure of internal consistency of items. The reliability of items through Cronbach's alpha was tested using SPSS version 23 software. The items are said to be reliable if their values fall within the acceptable range. According to Pallant (2010), the values of alpha must not be less than **0.70**. Table 5.3 shows the reliability test for the pilot study with raw data. All results are above 0.7 in this table except the speed/time for struggling SMEs, which its result is 0.64.

Although, the standards for what makes a 'good' α coefficient are entirely arbitrary and depend on theoretical knowledge of the scale in question, many methodologists recommend a minimum α coefficient between 0.65 and 0.8 (or higher in many cases). α coefficients less than 0.5 are usually unacceptable, especially for scales purporting to be unidimensional (please see Section 4.8.1 for more on dimensionality, unit and scale). Therefore, the presented results in the following table considered as acceptable.

Table 5.3: Reliability test for the pilot study with raw data.

| Type of Classified Factors | *Struggling* SMEs | *Surviving* SMEs | *Successful* SMEs |
|---|---|---|---|
| Speed/Time (hours) | 0.640 | 0.778 | 0.494 |
| Consistency/waste and Effectiveness/ efficiency (number of Products) | 0.946 | 0.939 | 0.943 |
| Leadership and Development (number of events) | 0.854 | 0.631 | 0.786 |
| Total data reliability (ratios) | 0.853 | 0.748 | 0.734 |

## 5.3 Analysis of Variance (ANOVA)

An ANOVA test was conducted to identify differences in means of different variables such as speed/time, efficiency/effectiveness, consistency and leadership

and development. The resulting tables of the ANOVA test are included in Appendix E. The following details and explains the results.

### 5.3.1 Speed/Time

The ANOVA test was performed on the basis of speed/time of SMEs. Companies were categorised into *Successful*, *Surviving*, and *Struggling* SMEs. The test was conducted to determine whether the changes in speed/time factors of the organization caused variation in the study variables. The means of the three categories were compared to identify differences.

Table 5.4: Descriptive data of SMEs clustering.

| RSR | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean | | Minimum | Maximum |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound | | |
| *Straggling* | 36 | .9796 | .02203 | .00367 | .9721 | .9870 | .92 | 1.00 |
| *Survival* | 36 | .9917 | .01044 | .00174 | .9882 | .9952 | .96 | 1.00 |
| *Successful* | 36 | .9945 | .00636 | .00106 | .9924 | .9967 | .97 | 1.00 |
| Total | 108 | .9886 | .01582 | .00152 | .9856 | .9916 | .92 | 1.00 |

The number of *Successful* SMEs in this study is 4, *Surviving* SMEs is 4 and *Struggling* SMEs is 4, considering the fact that 2 SMEs are inbetweeners. In addition, 9 sets of data were collected for each SME. The results show that there are differences between the means of the SMEs, indicating that the categories of SMEs differ on the basis of speed/time.

Table 5.5: ANOVA test comparing the mean of *Successful*, *Surviving*, and *Struggling* SMEs.

| RSR | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | .005 | 2 | .002 | 10.756 | .000 |
| Within Groups | .022 | 105 | .000 | | |
| Total | .027 | 107 | | | |

Table 5.4 indicates that the System Stability and Reliability (RSR) level of means for *Successful* SMEs is 0.994%, compared to 0.991% and 0.979% for *Surviving* and *Struggling* SMEs respectively. Table 5.5 confirms that there is a statistically significant difference at the p<.05 level between the three company categories for speed/time performance.

In Table 5.6, post-hoc comparisons are presented using the Tukey HSD test. The results show that there are statistically significant differences at the p<.05 level between *Successfu*l and *Struggling* SMEs. However, no significant difference was found between *Surviving* and *Successful* SMEs.

The mean score for *Successful* companies (M=.9945, SD=.00636) was significantly different from *Struggling* SMEs (M=.9796, SD=.02203), and the mean score for Surviving SMEs (M=.9917, SD=.01044) was significantly different from *Struggling* SMEs (M=.9796, SD=.02203), but there was no significant difference found between Successful SMEs and Surviving SMEs in Speed/time Performance level.

According to these results, there are differences in the RSR level in *Successfu*l and *Struggling* SMEs, *Surviving* SMEs and *Struggling* SMEs. However, the Speed/Time level of Surviving SMEs and *Successfu*l SMEs does not vary significantly.

Table 5.6: Multiple comparisons, Tukey HSD (Speed/Time) (*. The mean difference is significant at the 0.05 level.).

| (I) SME | (J) SME | Mean Difference (I-J) | Std. Error | Sig. | 95% Confidence Interval | |
|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound |
| *Straggling* | *Survival* | -.01214* | .00343 | .002 | -.0203 | -.0040 |
| | *Successful* | -.01496* | .00343 | .000 | -.0231 | -.0068 |
| *Survival* | *Straggling* | .01214* | .00343 | .002 | .0040 | .0203 |
| | *Successful* | -.00282 | .00343 | .689 | -.0110 | .0053 |
| *Successful* | *Straggling* | .01496* | .00343 | .000 | .0068 | .0231 |
| | *Survival* | .00282 | .00343 | .689 | -.0053 | .0110 |

### 5.3.2 Effectiveness/Efficiency (Forecasting Production: EE1)

The difference between *Successful*, *Surviving*, and *Struggling* SMEs was also determined on the basis of forecast production. This was done by comparing means of *Successful*, *Surviving*, and *Struggling* SMEs.

Forecast production level for *Successful* SMEs was 1.1104%, *Surviving* SMEs, 1.1628%, and *Struggling* SMEs, .9120%. There is a statistically significant difference in company forecast production scores for the three groups.

According to these results, the SMEs studied in this research differ on the basis of forecast production. However, a significant difference was only found between *Surviving* and *Struggling* SMEs. The mean score for *Surviving* SMEs (M=1.1628, SD=.25629) was significantly different from *Struggling* SMEs (M=.9120, SD=.62069). *Successful* SMEs did not differ significantly from either *Surviving* or *Struggling* SMEs.

The differences in forecast production are higher between *Surviving* and *Struggling* SMEs. However, there are no differences between *Successful* and *Surviving* SMEs, or between *Successful* and *Struggling* SMEs.

### 5.3.3 Effectiveness/Efficiency (Delivery Speed: EE2)

A similar comparison was conducted to identify differences between SME categories in their Delivery Speed activity. This was done by comparing means of Successful, *Surviving*, and *Struggling* SMEs. The Delivery Speed mean level for Successful SMEs was .9799%, for *Surviving* SMEs, .9162%, and for *Struggling* SMEs, .8355%. There is a statistically significant difference in company Delivery Speed scores for the three groups.

The mean score for *Successful* SMEs (M=.9799, SD=.03894) was significantly different from *Struggling* SMEs (M=.8355, SD=.15241), and the mean score for *Surviving* SMEs (M=.9162, SD=.12147) was significantly different from *Struggling*

SMEs (M=.8355, SD=.15241), but there was no significant difference between Successful and *Surviving* SMEs in Delivery Speed Performance level.

According to these results, there are differences in the Delivery Speed level in *Successful* and *Struggling* SMEs, *Surviving* SMEs and *Struggling* SMEs. However, the Delivery Speed level of *Surviving* and *Successful* SMEs did not vary significantly.

### 5.3.4 Effectiveness/Efficiency (Expertise Flexibility: EE3)

A similar comparison was conducted to identify differences between SME categories in their Expertise Flexibility. The Expertise Flexibility mean level for *Successful* SMEs was .3724%, for *Surviving* SMEs, .6683%, and for *Struggling* SMEs, .9400%. There is a statistically significant difference in SMEs Expertise Flexibility scores for the three groups.

The mean score for *Success*ful companies (M=.3724, SD=.16453) was significantly different from *Struggling* SMEs (M=.9400, SD=.42873), and the mean score for *Surviving* SMEs (M=.6683, SD=.09422) was significantly different from *Struggling* SMEs (M=.9400, SD=.42873); similarly the mean for *Successful* companies (M=.3724, SD=.16453) was significantly different from *Surviving* SMEs (M=.6683, SD=.09422).

According to these results, *Successful*, *Surviving*, and *Struggling* SMEs differ significantly in terms of Expertise Flexibility.

### 5.3.5 Consistency (Product Quality (Performance): CW1)

A similar comparison was conducted to identify differences between SME categories in their Product Quality Performance.

The Expertise Flexibility mean level for *Successful* SMEs was .9065%, *Surviving* SMEs, .6956%, and *Struggling* SMEs, .5296%. There is a statistically significant difference in SMEs Expertise Flexibility scores for the three groups.

The mean score for *Successful* companies (M=.9065, SD=.08078) was significantly different from *Struggling* SMEs (M=.5296, SD=.11266), and the mean score for *Surviving* SMEs (M=.6956, SD=.15852) was significantly different from *Struggling* SMEs (M=.5296, SD=.11266); similarly, the mean for *Successful* companies (M=.9065, SD=.08078) was significantly different from *Surviving* SMEs (M=.6956, SD=.15852).

According to these results, *Successful*, *Surviving*, and *Struggling* SMEs differ significantly in terms of Product Quality Performance.

### 5.3.6 Consistency (Product Quality (Conformance): CW2)

A similar comparison was also conducted to identify differences between SME categories in their Product Quality Conformance.

The Product Quality Conformance mean level for *Successful* SMEs was .0527%, *Surviving* SMEs, .1753%, and *Struggling* SMEs, .2023%. There is a statistically significant difference in company Product Quality Conformance scores for the three groups.

The mean score for *Successful* SMEs (M=.0527, SD=.06705) was significantly different from *Struggling* SMEs (M=.2023, SD=.10894), and the mean score for *Surviving* SMEs (M=.1753, SD=.10618) was significantly different from *Successful* SMEs (M=.0527, SD=.06705), but there was no significant difference between *Struggling* and *Surviving* SMEs in Product Quality Conformance level.

According to these results, there are differences in the Product Quality Conformance between *Successful* and *Struggling* SMEs, and between *Surviving* and *Successfu*l SMEs. However, the Product Quality Conformance of *Surviving* SMEs and *Struggling* SMEs do not vary significantly.

### 5.3.7 Consistency (Defect Free Products: CW3)

A similar comparison was conducted to identify differences between SME categories in their Defect Free Products level.

The Defect Free Products mean level for *Successful* SMEs was .9608%, *Surviving* SMEs, .8723%, and *Struggling* SMEs, .7304%. There is a statistically significant difference in SMEs Defect Free Products scores for the three groups.

The mean score for *Successful* companies (M=.9608, SD=.04308) was significantly different from *Struggling* SMEs (M=.7304, SD=.11825), and the mean score for *Surviving* SMEs (M=.8723, SD=.11873) was significantly different from *Struggling* SMEs (M=.7304, SD=.11825); similarly, the mean for *Successful* companies (M=.9608, SD=.04308) was significantly different from *Surviving* SMEs (M=.8723, SD=.11873).

According to these results, *Successful*, *Surviving*, and *Struggling* SMEs differ significantly in terms of Defect Free Products.

### 5.3.8 Consistency (Customer Satisfaction Rate: CW4)

A similar comparison was conducted to identify differences between SME categories in their Customer Satisfaction Rate.

The Customer Satisfaction Rate mean level for *Successful* SMEs was .9769%, *Surviving* SMEs, .9017%, and *Struggling* SMEs, .8061%. There is a statistically significant difference in SMEs Customer Satisfaction Rate for the three groups.

The mean score for *Successful* companies (M=.9769, SD=.03717) was significantly different from *Struggling* SMEs (M=.8061, SD=.14229), and the mean score for *Surviving* SMEs (M=.9017, SD=.08719) was significantly different from *Struggling* SMEs (M=.8061, SD=.14229); similarly, the mean for *Successful* companies (M=.9769, SD=.03717) was significantly different from *Surviving* SMEs (M=.9017, SD=.08719).

According to these results, *Successful*, *Surviving*, and *Struggling* SMEs differ significantly in terms of Customer Satisfaction Rate.

### 5.3.9 Consistency (Waste by Product Loss: CW5)

The comparison was conducted to identify differences between SME categories in their Waste by Product loss.

The Waste by Product Loss mean level for *Successful* SMEs was .9458%, *Surviving* SMEs, .8769%, and *Struggling* SMEs, .7431%. There is a statistically significant difference in SMEs Waste by Product loss for the three groups.

The mean score for *Successful* companies (M=.9458, SD=.06148) was significantly different from *Struggling* SMEs (M=.7431, SD=.10384), and the mean score for *Surviving* SMEs (M=.8769, SD=.11479) was significantly different from *Struggling* SMEs (M=.7431, SD=.10384); similarly, the mean for *Successful* companies (M=.9458, SD=.06148) was significantly different from *Surviving* SMEs (M=.8769, SD=.11479).

According to these results, *Successful*, *Surviving*, and *Struggling* SMEs differ significantly in terms of Waste by Product Loss.

### 5.3.10 Consistency (Waste by Time Loss: CW6)

A similar comparison was conducted to identify differences between SME categories in their Waste by Time Loss.

The Waste by Time Loss mean level for *Successful* SMEs was .9703%, *Surviving* SMEs, .9364%, and *Struggling* SMEs, .8911%. There is a statistically significant difference in SMEs Waste by Time loss for the three groups.

The mean score for *Successful* SMEs (M=.9703, SD=.05730) was significantly different from *Struggling* SMEs (M=.8911, SD=.16475), but there was no significant

difference between and Surviving SMEs, or between *Successful* and *Surviving* SMEs in Waste by Time Loss.

### 5.3.11 Leadership (LD1-LD16)

A similar comparison was conducted to identify differences between SME categories in their Leadership and Development. The comparison was done by comparing means of *Successful*, *Surviving*, and *Struggling* SMEs. The following are the results of ANOVA analysis on the different variables included in the Leadership and Development factors in this study. The samples of results tables are presented in Appendix E.

**Employee appraisals (LD1):**

The mean score for *Successful* SMEs (M=.6560, SD=.34529) was significantly different from *Struggling* SMEs (M=.3333, SD=.43507), but there was no significant difference found between Struggling and Surviving SMEs, or between *Successful* and *Surviving* SMEs for Employee appraisal.

**Competitiveness (LD2):**

The mean score for *Successful* SMEs (M=.6011, SD=.26000) was significantly different from *Struggling* SMEs (M=.3056, SD=.45163), but there was no significant difference between *Struggling* and *Surviving* SMEs, or between *Successful* SMEs and *Surviving* SMEs for Competitiveness level.

**Feedback Activities (LD3):**

The mean score for *Successful* SMEs (M=.4713, SD=.40057) was significantly different from *Struggling* SMEs (M=.2083, SD=.34589), and the mean score for *Surviving* SMEs (M=.4621, SD=.40339) was significantly different from *Struggling* SMEs (M=.2083, SD=.34589), but there was no significant difference between *Successful* and *Surviving* SMEs for Feedback Activities.

**Knowledge Acquisition (LD4):**

The Knowledge Acquisition mean level for *Successful* SMEs was .4873, *Surviving* SMEs, .5174, and *Struggling* SMEs, .3056. However, there were no significant differences between categories for Knowledge Acquisition.

**Leadership Supports Development (LD5):**

The mean score for Successful SMEs (M=.4944, SD=.41262) was significantly different from *Struggling* SMEs (M=.1389, SD=.35074), and the mean score for *Surviving* SMEs (M=.4111, SD=.46830) was significantly different from *Struggling* SMEs (M=.1389, SD=.35074), but there was no significant difference found between *Successful* and *Surviving* SMEs for Leadership Supports Development.

**Focus of Attention (LD6):**

The mean score for *Successful* SMEs (M=.6306, SD=.32915) was significantly different from *Struggling* SMEs (M=.2778, SD=.38627), but there was no significant difference between *Struggling* and *Surviving* SMEs, or between *Successful* and *Surviving* SMEs for Focus of Attention.

**Knowledge Transfer (LD7):**

The mean score for *Successful* SMEs (M=.6181, SD=.38025) was significantly different from *Struggling* SMEs (M=.2083, SD=.38499), and the mean score for *Surviving* SMEs (M=.5417, SD=.46866) was significantly different from *Struggling* SMEs (M=.2083, SD=.38499), but there was no significant difference between *Successful* and *Surviving* SMEs for Knowledge Transfer.

**Employee Training (LD8):**

The mean score for *Successful* SMEs (M=.5463, SD=.43755) was significantly different from *Surviving* SMEs (M=.2407, SD=.41105), but there was no significant difference between *Struggling* and *Surviving* SMEs, or between *Struggling* and *Successful* SMEs for Employee Training.

**Motivation (LD9):**

The Motivation mean level for *Successful* SMEs was .3819, *Surviving* SMEs, .3333, and *Struggling* SMEs, .3056. There were no significant differences between the three groups for Motivation.

**Development (LD10):**

The Development mean level for *Successful* SMEs was .4028, *Surviving* SMEs, .4537, and *Struggling* SMEs, .3611. There were no significant differences between the three groups for Development.

**Encourage Development (LD11):**

The mean score for *Successful* SMEs (M=.3704, SD=.38237) was significantly different from *Struggling* SMEs (M=.1389, SD=.35074), but there were no significant differences found between *Struggling* and *Surviving* SMEs, or between *Successful* and *Surviving* SMEs for Encourage Development.

**Tolerance for Mistakes (LD12):**

The Tolerance for Mistakes mean level for *Successful* SMEs was .4583, *Surviving* SMEs, .3611, and *Struggling* SMEs, .2778. There were no significant differences between the three groups for Tolerance for Mistakes.

**Knowledge Creation (LD13):**

The Knowledge Creation mean level for *Successful* SMEs was .4861, Surviving SMEs, .4861, and Struggling SMEs, .3194. There were no significant differences between the three groups for Tolerance for Mistakes.

**Knowledge Providers (LD14):**

The Knowledge Providers mean level for Successful SMEs was .3148, *Surviving* SMEs, .3750, and *Struggling* SMEs, .2083. There were no significant differences between the three groups for Knowledge Providers.

**Development Changes (LD15):**

The Development Changes mean level for *Successful* SMEs was .2778, *Surviving* SMEs, .3889, and *Struggling* SMEs, .2361. There were no significant differences between the three groups for Development Changes.

**Development Communication (LD16):**

The Development Communication mean level for *Successful* SMEs was .2222, *Surviving* SMEs.2917, and *Struggling* SMEs.2500. There were no significant differences between the three groups for Development Communication.

## 5.4 Chapter Summary

In this chapter data analysis has been performed. First the reliability test took place. This test is indicated by Cronbach's alpha. It confirmed that the collected data are acceptable for the further analysis. In the next step comparison between classified SMEs took place by One-way analysis of variance (ANOVA). Table 5.7 summarises the ANOVA results between the three SME categories. In addition, the results of the Paired Samples Tests can be found in Appendix E. Considering the following table, only the variables that are different in at least two categories considered for further analysis. The reason for this selection is to reveal the difference among SMEs in different categories. The results presented in these tables have been used to revise and shape a model that will be explained in next chapter.

Table 5.7: Summary of the ANOVA results between clustering SMEs: *Successful, Surviving, Struggling*.

| **Dependent variable (s)** | **Level of significance (p)** | **Interpretation** |
|---|---|---|
| Speed/Time (RSR) | Significant ($p<0.05$) | Differences were detected between *Struggling* and *Successful, Surviving* and *Struggling* |
| Forecast production (EE1) | Significant ($p<0.05$) | A difference was detected only between *Struggling* and *Surviving* |
| Delivery speed (EE2) | Significant ($p<0.05$) | Differences were detected between *Struggling* and *Successful, Surviving* and *Struggling* |
| Expertise Flexibility (EE3) | Significant ($p<0.05$) | Difference was detected among all three groups |
| Product Quality Performance (CW1) | Significant ($p<0.05$) | Difference was detected among all three groups |
| Product Quality Conformance (CW2) | Significant ($p<0.05$) | Differences were detected between *Struggling* and *Successful, Surviving* and *Successful* |
| Defect Free Products (CW3) | Significant ($p<0.05$) | Difference was detected among all three groups |
| Customer Satisfaction Rate (CW4) | Significant ($p<0.05$) | Difference was detected among all three groups |
| Waste by Product loss (CW5) | Significant ($p<0.05$) | Difference was detected among all three groups |
| Waste by Time loss (CW6) | Significant ($p<0.05$) | A difference was detected only between *Struggling* and *Successful* |
| Employee appraisals (LD1) | Significant ($p<0.05$) | A difference was detected only between *Struggling* and *Successful* |
| Competitiveness (LD2) | Significant ($p>0.05$) | A difference was detected only between *Struggling* and *Successful* |
| Feedback Activities (LD3) | Significant ($p>0.05$) | Differences were detected between *Struggling* and *Successful, Surviving* and *Struggling* |
| Knowledge acquisition (LD4) | Significant ($p>0.05$) | No difference was detected |
| Leadership Supports development (LD5) | Significant ($p>0.05$) | Differences were detected between *Struggling* and *Successful, Surviving* and *Struggling* |
| Focus of attention (LD6) | Significant ($p<0.05$) | A difference was detected only between *Struggling* and *Successful* |
| Knowledge Transfer (LD7) | Significant ($p<0.05$) | Differences were detected between *Struggling* and *Successful, Surviving* and *Struggling* |
| Employee Training (LD8) | Significant ($p<0.05$) | A difference was detected only between *Surviving* and *Successful* |
| Motivation (LD9) | Significant ($p<0.05$) | No difference was detected |
| Development (LD10) | Significant ($p<0.05$) | No difference was detected |
| Encourage Development (LD11) | Significant ($p<0.05$) | A difference was detected only between *Struggling* and *Successful* |
| Tolerance for Mistakes (LD12) | Significant ($p<0.05$) | No difference was detected |
| Knowledge Creation (LD13) | Significant ($p<0.05$) | No difference was detected |
| Knowledge providers (LD14) | Not Significant ($p>0.05$) | No difference was detected |
| Development Changes (LD15) | Not Significant ($p>0.05$) | No difference was detected |
| Development Communication (LD16) | Not Significant ($p>0.05$) | No difference was detected |

# Chapter 6

# Model Testing

## 6.1 Introduction

Following the analysis in the previous chapter, in this chapter, three dependent variables have been selected for testing the model. This chapter includes the regression assumptions, and regression and hypothesis testing. The aim is to find the relationship between each of these three dependent variables with the independent variables of the study. Table 6.1 demonstrates the variables classifications.

Table 6.1: Variables under study, Waste by Product Loss, Waste by Time Loss and Encourage Development are considered as dependent variables.

| **Competitive Priorities** | **Variables** | **Metrics** |
|---|---|---|
| Speed/Time | RSS | Resource Stability and Reliability |
| Effectiveness/ Efficiency | EE1 | Forecasting Production |
| | EE2 | Delivery Speed |
| | EE3 | Expertise Flexibility |
| Consistency and Waste | CW1 | Product Quality (Performance) |
| | CW2 | Product Quality (Conformance) |
| | CW3 | Defect Free Products |
| | CW4 | Customer Satisfaction Rate |
| | CW5 | Waste by Product Loss |
| | CW6 | Waste by Time Loss |
| Leadership and Development | LD1 | Employee Appraisals |
| | LD2 | Competitiveness |
| | LD3 | Feedback Activities |
| | LD5 | Leadership Supports Development |
| | LD6 | Focus of Attention |
| | LD7 | Knowledge Transfer |
| | LD8 | Employee Training |
| | LD11 | Encourage Development |

## 6.2 Regression Assumptions

Before conducting multiple regression analysis, it is important to check a few assumptions including multicollinearity, normality, linearity and outliers (Pallant, 2010).

### 6.2.1 Data Screening

Before entering data into SPSS, it is important to examine it to determine whether there are missing values. There are different factors associated with data screening. For example, it is important to check whether the surveys were completed fully by respondents and whether data were missing for any questions. In this research, the researcher discarded questionnaires, which were not fully completed by respondents. This meant that there were no missing data values in the analysis.

### 6.2.2 Normality and Linearity

In multiple regression, it is important to estimate relationship between dependent and independent variables. The relationship between these variables must be linear in nature. If the relationship is not linear, the regression analysis will not yield effective results. There are several ways to test the assumption of normality, including data plots, kurtosis and skewness (Pallant, 2010). The kurtosis and skewness values must be within ±3.0. In this research, as shown in Table 6.2, 6.3 and 6.4, the values are within the acceptable range; therefore, distribution is said to be normal.

The assumption of linearity can be checked visually with graphs. If the line on the graph is straight, the relationship is linear. Figure 6.1, 6.2 and 6.3 demonstrate that the relationship between variables is linear; the values of Y are the outcomes and the values of X are the predictors. In addition, the visual inspection of the histogram has been tested for the factors for normality (Appendix F). The histogram results suggest

that variables are normally distributed; therefore, the set of collected data are valid to be used in regression test.

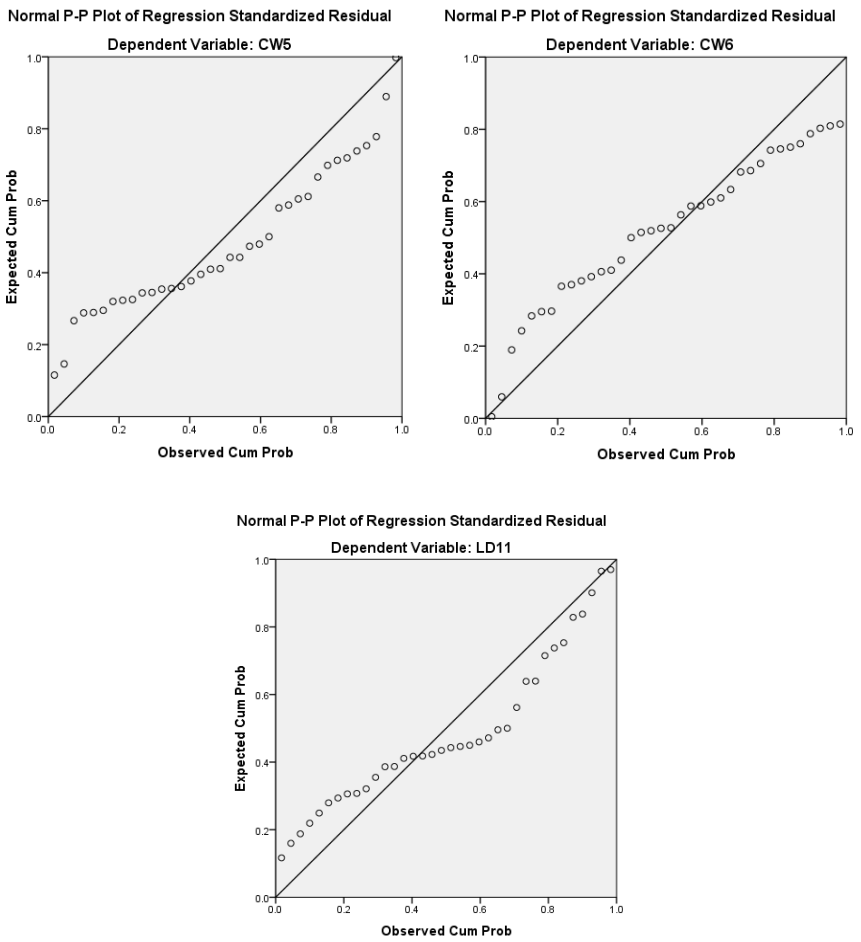



Figure 6.1: Normal P-P plot of regression standardized residual for *Struggling* group. CW5: Waste by Product loss; CW6: Waste by Time loss; LD11: Encourage Development.

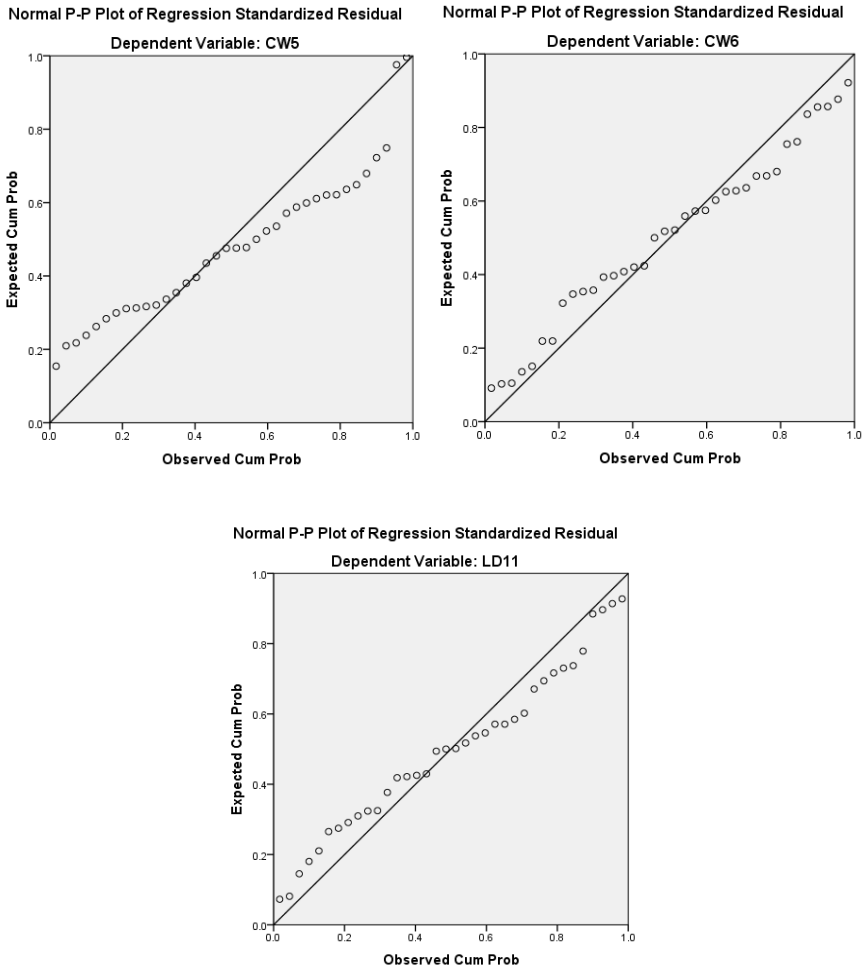
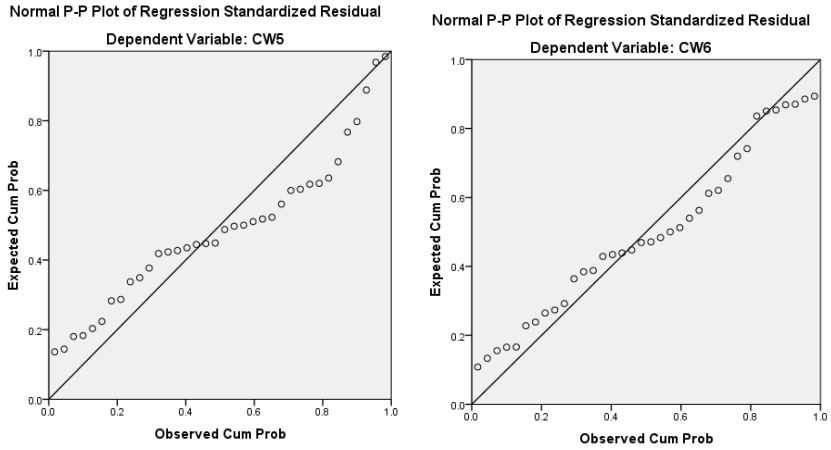



Figure 6.2: Normal P-P plot of regression standardized residual for *Surviving* group. CW5: Waste by Product loss; CW6: Waste by Time loss; LD11: Encourage Development.



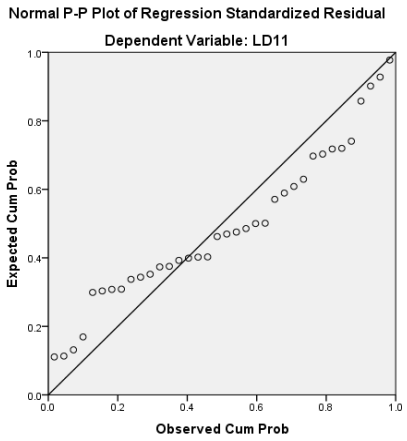



Figure 6.3: Normal P-P plot of regression standardized residual for *Successful* group. CW5: Waste by Product loss; CW6: Waste by Time loss; LD11: Encourage Development.

Table 6.2: Skewness and Kurtosis scores for *Struggling* group.

| Variable | Metric | Skewness | | Kurtosis | |
|---|---|---|---|---|---|
| | | Statistic | Std. Error | Statistic | Std. Error |
| RSS | Resource Stability & Reliability | -1.225 | 0.393 | 0.510 | 0.768 |
| EE1 | Forecasting | -0.810 | 0.393 | -0.178 | 0.768 |
| EE2 | Production Capacity | -0.435 | 0.393 | -1.022 | 0.768 |
| EE3 | Delivery Speed | 1.184 | 0.393 | -0.602 | 0.768 |
| EE4 | On-time Delivery | 0.199 | 0.393 | 0.227 | 0.768 |
| EE5 | Expertise Flexibility | 1.118 | 0.393 | 1.616 | 0.768 |
| CW1 | Product Quality (Performance) | 0.625 | 0.393 | 0.738 | 0.768 |
| CW2 | Product Quality (Conformance) | -0.809 | 0.393 | 0.702 | 0.768 |
| CW3 | Defect Free Products | 1.177 | 0.393 | 1.256 | 0.768 |
| CW4 | Customer Satisfaction Rate | -1.991 | 0.393 | 4.287 | 0.768 |
| CW5 | Waste by Product loss | 0.761 | 0.393 | -1.301 | 0.768 |
| CW6 | Waste by Time loss | 0.880 | 0.393 | -1.206 | 0.768 |
| LD1 | Employee appraisals | 1.413 | 0.393 | 0.679 | 0.768 |
| LD2 | Competitiveness | 2.180 | 0.393 | 2.913 | 0.768 |
| LD3 | Feedback Activities | 0.985 | 0.393 | -0.559 | 0.768 |
| LD5 | Leadership Supports development | 1.488 | 0.393 | 0.476 | 0.768 |
| LD6 | Focus of attention | 0.724 | 0.393 | -1.268 | 0.768 |
| LD7 | Knowledge Transfer | 2.180 | 0.393 | 2.913 | 0.768 |
| LD8 | Employee Training | -1.225 | 0.393 | 0.510 | 0.768 |
| LD11 | Encourage Development | -0.810 | 0.393 | -0.178 | 0.768 |

Table 6.3: Skewness and Kurtosis scores for *Surviving* group.

| Variable | Metric | Skewness | | Kurtosis | |
|---|---|---|---|---|---|
| | | Statistic | Std. Error | Statistic | Std. Error |
| RSS | Resource Stability & Reliability | -1.734 | 0.393 | 2.698 | 0.768 |
| EE1 | Forecasting | 1.439 | 0.393 | 2.377 | 0.768 |
| EE2 | Production Capacity | -1.454 | 0.393 | 1.107 | 0.768 |
| EE3 | Delivery Speed | -0.974 | 0.393 | 0.825 | 0.768 |
| CW1 | Product Quality (Performance) | -0.177 | 0.393 | -0.941 | 0.768 |
| CW2 | Product Quality (Conformance) | 1.644 | 0.393 | 3.363 | 0.768 |
| CW3 | Defect Free Products | -0.619 | 0.393 | -1.024 | 0.768 |
| CW4 | Customer Satisfaction Rate | -0.986 | 0.393 | 0.355 | 0.768 |
| CW5 | Waste by Product loss | -0.559 | 0.393 | -1.194 | 0.768 |
| CW6 | Waste by Time loss | -2.308 | 0.393 | 5.373 | 0.768 |
| LD1 | Employee appraisals | 0.178 | 0.393 | -1.401 | 0.768 |
| LD2 | Competitiveness | 0.248 | 0.393 | -1.614 | 0.768 |
| LD3 | Feedback Activities | 0.123 | 0.393 | -1.595 | 0.768 |
| LD5 | Leadership Supports development | 0.410 | 0.393 | -1.806 | 0.768 |
| LD6 | Focus of attention | 0.034 | 0.393 | -1.102 | 0.768 |
| LD7 | Knowledge Transfer | -0.173 | 0.393 | -1.901 | 0.768 |
| LD8 | Employee Training | 1.244 | 0.393 | -0.329 | 0.768 |
| LD11 | Encourage Development | 0.985 | 0.393 | -0.559 | 0.768 |

Table 6.4: Skewness and Kurtosis scores for *Successful* group.

| Variable | Metric | Skewness | | Kurtosis | |
|---|---|---|---|---|---|
| | | Statistic | Std. Error | Statistic | Std. Error |
| STS | Average Resource utilization | -1.636 | 0.393 | 3.121 | 0.768 |
| EE1 | Forecasting | 2.936 | 0.393 | 9.713 | 0.768 |
| EE2 | Production Capacity | -1.693 | 0.393 | 1.297 | 0.768 |
| EE3 | Delivery Speed | 0.413 | 0.393 | -1.517 | 0.768 |
| CW1 | Product Quality (Performance) | -0.232 | 0.393 | -1.313 | 0.768 |
| CW2 | Product Quality (Conformance) | 0.836 | 0.393 | -0.759 | 0.768 |
| CW3 | Defect Free Products | -0.797 | 0.393 | 0.345 | 0.768 |
| CW4 | Customer Satisfaction Rate | -1.409 | 0.393 | 0.833 | 0.768 |
| CW5 | Waste by Product loss | -0.657 | 0.393 | -1.216 | 0.768 |
| CW6 | Waste by Time loss | -1.857 | 0.393 | 2.105 | 0.768 |
| LD1 | Employee appraisals | -0.638 | 0.393 | -0.832 | 0.768 |
| LD2 | Competitiveness | -0.057 | 0.393 | 0.207 | 0.768 |
| LD3 | Feedback Activities | 0.158 | 0.393 | -1.498 | 0.768 |
| LD5 | Leadership Supports development | 0.073 | 0.393 | -1.571 | 0.768 |
| LD6 | Focus of attention | -0.431 | 0.393 | -0.707 | 0.768 |
| LD7 | Knowledge Transfer | -0.408 | 0.393 | -1.244 | 0.768 |
| LD8 | Employee Training | -0.240 | 0.393 | -1.730 | 0.768 |
| LD11 | Encourage Development | 0.328 | 0.393 | -1.420 | 0.768 |

### 6.2.3 The Outliers

The presence of outliers also has an effect on the results of regression analysis. However, it is not required to remove outliers in all cases. Outliers can be transformed through square root transformation, log transformation, and inverse transformation. The transformation of outliers can improve normality (Pallant, 2010). A scatter plot indicates the presence of outliers in a study. The values with a

standardised residual of more than +3.3 or less than -3.3 are outliers (Pallant, 2010; Tabachnick and Fidell, 2007). Outliers in data can occur through incorrect entry of data, failure to identify errors, or for other reasons. From the scatterplots shown in Figures 6.4, 6.5 and 6.6, it is not possible to detect the presence of outliers with a standard residual of more than +3.3 or less than -3.3, which means that there are no outliers.

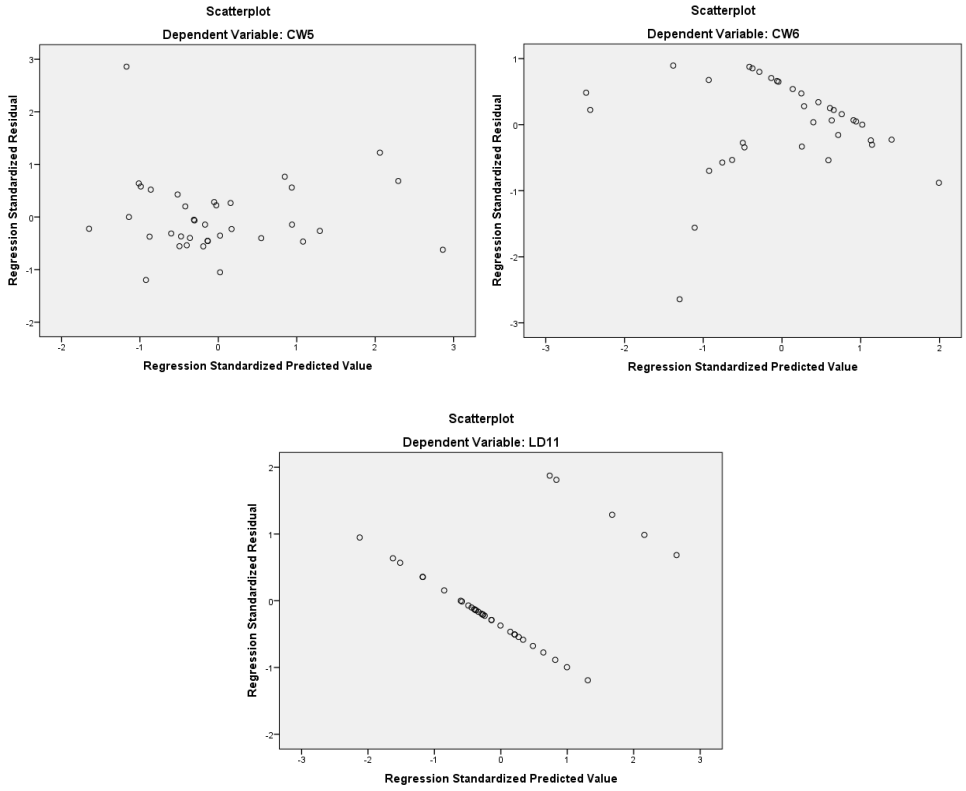



Figure 6.4: Scatterplot showing distribution of residuals for each dependent variable for *Struggling* group. CW5: Waste by Product loss; CW6: Waste by Time loss; LD11: Encourage Development.

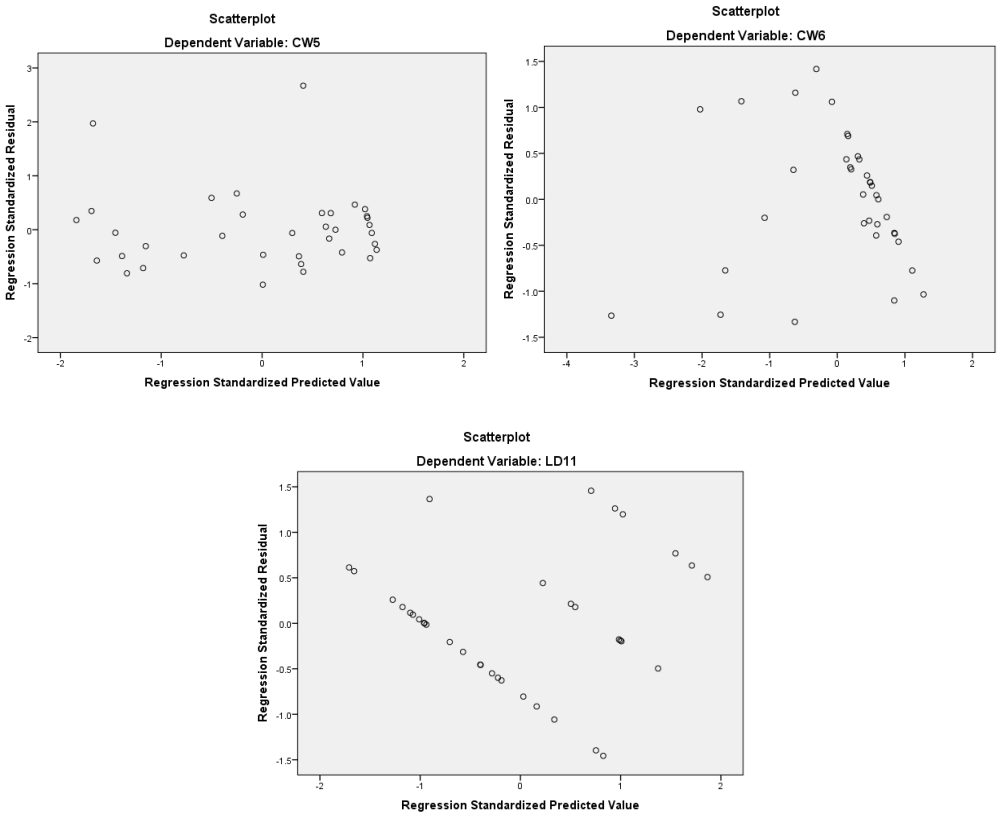
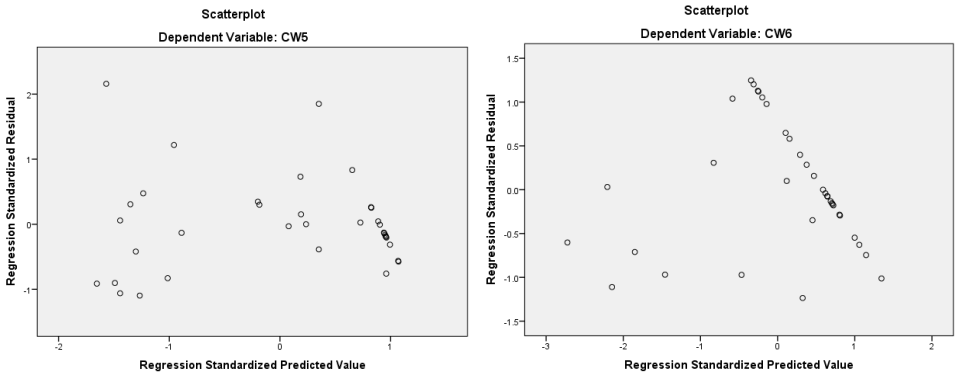



Figure 6.5: Scatterplot showing distribution of residuals for each dependent variable for *Surviving* group. CW5: Waste by Product loss; CW6: Waste by Time loss; LD11: Encourage Development.



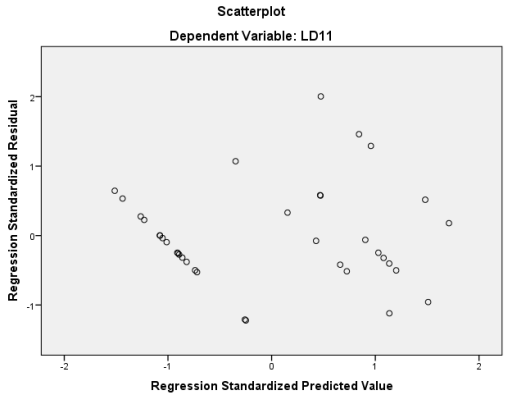



Figure 6.6: Scatterplot showing distribution of residuals for each dependent variable for *Successful* group. CW5: Waste by Product loss; CW6: Waste by Time loss; LD11: Encourage Development.

### 6.2.4 Multicollinearity

Multicollinearity shows the relationship between different variables used in the study. Pallant (2010) argues that it is important to check correlation among variables and to test that the value of correlation is not too high (0.9). In the following table, the values of correlations have been given. Tables 6.5, 6.6 and 6.7 show that multicollinearity does not exist. (** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed)).

Table 6.5: Pearson's correlation matrix for *struggling* group.

| | RSS | EE1 | EE2 | EE3 | CW1 | CW2 | CW3 | CW4 | CW5 | CW6 | LD1 | LD2 | LD3 | LD5 | LD6 | LD7 | LD8 | LD11 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RSS | 1 | | | | | | | | | | | | | | | | | |
| EE1 | .650** | 1 | | | | | | | | | | | | | | | | |
| EE2 | .616** | .382* | 1 | | | | | | | | | | | | | | | |
| EE3 | 0.294 | .357* | .400* | 1 | | | | | | | | | | | | | | |
| CW1 | 0.321 | .609** | 0.326 | 0.178 | 1 | | | | | | | | | | | | | |
| CW2 | -0.027 | 0.021 | -.347* | -.330* | -.453** | 1 | | | | | | | | | | | | |
| CW3 | 0.270 | .596** | -0.016 | -0.156 | .542** | .501** | 1 | | | | | | | | | | | |
| CW4 | .644** | .753** | .392* | .434** | .438** | -0.045 | .373* | 1 | | | | | | | | | | |
| CW5 | 0.219 | .614** | -0.155 | -0.129 | .496** | .469** | .918** | .365* | 1 | | | | | | | | | |
| CW6 | .460** | 0.196 | 0.277 | 0.212 | 0.011 | -0.139 | -0.126 | 0.154 | -0.070 | 1 | | | | | | | | |
| LD1 | .444** | .357* | 0.233 | -0.141 | 0.115 | 0.010 | 0.100 | 0.279 | 0.083 | 0.204 | 1 | | | | | | | |
| LD2 | 0.298 | 0.291 | 0.176 | 0.040 | 0.209 | -0.166 | 0.055 | 0.304 | 0.037 | 0.143 | 0.248 | 1 | | | | | | |
| LD3 | .345* | 0.274 | 0.280 | -0.151 | 0.068 | 0.115 | 0.178 | 0.261 | 0.121 | 0.159 | .403** | -0.008 | 1 | | | | | |
| LD5 | 0.228 | 0.123 | -0.08 | -0.211 | 0.018 | 0.235 | 0.239 | 0.149 | 0.223 | 0.091 | .531** | .536** | .343* | 1 | | | | |
| LD6 | .418* | 0.224 | .381* | -0.079 | 0.271 | -0.242 | 0.011 | 0.140 | 0.000 | 0.109 | 0.220 | 0.155 | 0.303 | 0.129 | 1 | | | |
| LD7 | 0.254 | .357** | 0.111 | -0.281 | 0.004 | 0.303 | 0.289 | 0.260 | 0.262 | -0.151 | 0.256 | 0.199 | 0.255 | 0.203 | .368* | 1 | | |
| LD8 | .416* | .445** | .344* | 0.309 | 0.188 | -0.129 | 0.041 | 0.318 | 0.047 | 0.103 | 0.190 | 0.196 | 0.000 | -0.126 | 0.286 | 0.172 | 1 | |
| LD11 | .332* | 0.164 | 0.133 | 0.139 | -0.176 | 0.183 | 0.006 | 0.269 | -0.051 | 0.106 | 0.156 | .356* | -0.010 | 0.303 | -0.082 | 0.203 | 0.063 | 1 |

Table 6.6: Pearson's correlation matrix for *Surviving* group.

| | SSR | EE1 | EE2 | EE3 | CW1 | CW2 | CW3 | CW4 | CW5 | CW6 | LD1 | LD2 | LD3 | LD5 | LD6 | LD7 | LD8 | LD11 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SSR | 1 | | | | | | | | | | | | | | | | | |
| EE1 | -.348* | 1 | | | | | | | | | | | | | | | | |
| EE2 | 0.305 | -.549** | 1 | | | | | | | | | | | | | | | |
| EE3 | 0.047 | 0.081 | -0.323 | 1 | | | | | | | | | | | | | | |
| CW1 | -0.136 | 0.081 | 0.249 | -.721** | 1 | | | | | | | | | | | | | |
| CW2 | -0.079 | .354* | -.569** | .400* | -.668** | 1 | | | | | | | | | | | | |
| CW3 | -0.242 | .421* | -0.171 | -.610** | .746** | -0.006 | 1 | | | | | | | | | | | |
| CW4 | 0.205 | 0.300 | 0.115 | -.427** | .396* | -0.093 | .451** | 1 | | | | | | | | | | |
| CW5 | -0.229 | .410* | -0.192 | -.612** | .758** | -0.033 | .991** | .440** | 1 | | | | | | | | | |
| CW6 | .561** | -0.244 | .450** | -0.218 | 0.290 | -.487** | -0.041 | .522** | -0.023 | 1 | | | | | | | | |
| LD1 | -.664** | 0.000 | -0.089 | -0.072 | 0.012 | -0.018 | -0.008 | 0.059 | -0.029 | 0.078 | 1 | | | | | | | |
| LD2 | -0.047 | -0.018 | 0.260 | -0.123 | 0.200 | -0.182 | 0.120 | 0.187 | 0.133 | 0.121 | 0.101 | 1 | | | | | | |
| LD3 | 0.082 | 0.048 | 0.260 | -.347* | 0.304 | -0.240 | 0.053 | 0.234 | 0.069 | 0.218 | 0.251 | -0.058 | 1 | | | | | |
| LD5 | 0.034 | -0.115 | 0.010 | -0.216 | 0.096 | -0.087 | 0.039 | 0.099 | 0.067 | 0.145 | 0.120 | 0.198 | .504** | 1 | | | | |
| LD6 | 0.222 | -.440* | 0.348* | 0.187 | -0.204 | -0.262 | -.506** | -0.255 | -.512** | 0.025 | -0.019 | 0.196 | 0.194 | 0.216 | 1 | | | |
| LD7 | 0.047 | 0.054 | 0.204 | -0.183 | 0.016 | -0.023 | -0.014 | 0.194 | -0.024 | -0.126 | -0.269 | 0.101 | .377* | 0.284 | 0.315 | 1 | | |
| LD8 | -0.141 | 0.168 | -0.091 | -0.216 | -0.138 | 0.241 | 0.023 | -0.030 | 0.020 | -0.326 | 0.064 | 0.166 | 0.050 | 0.154 | -0.016 | 0.293 | 1 | |
| LD11 | -0.141 | -0.070 | 0.120 | -0.297 | 0.124 | -0.081 | 0.084 | 0.287 | 0.074 | -0.009 | .477** | 0.063 | 0.304 | -0.018 | -0.082 | 0.171 | 0.077 | 1 |

Table 6.7: Pearson's correlation matrix for Successful group.

| | LD11 | LD8 | LD7 | LD6 | LD5 | LD3 | LD2 | LD1 | CW6 | CW5 | CW4 | CW3 | CW2 | CW1 | EE3 | EE2 | EE1 | RSS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LD11 | 1 | | | | | | | | | | | | | | | | | |
| LD8 | 0.236 | | | | | | | | | | | | | | | | | |
| LD7 | .362* | .603** | | | | | | | | | | | | | | | | |
| LD6 | .392* | .355* | .469** | 1 | | | | | | | | | | | | | | |
| LD5 | 0.240 | .402* | .469** | .381* | 1 | | | | | | | | | | | | | |
| LD3 | .560** | .349* | 0.293 | .578** | .523** | 1 | | | | | | | | | | | | |
| LD2 | 0.104 | -0.162 | 0.089 | .360* | 0.023 | 0.074 | 1 | | | | | | | | | | | |
| LD1 | 0.271 | .482** | 0.193 | .402* | 0.319 | .458** | 0.028 | 1 | | | | | | | | | | |
| CW6 | 0.217 | -0.109 | 0.025 | 0.224 | .336* | 0.180 | 0.161 | -0.003 | 1 | | | | | | | | | |
| CW5 | .531** | 0.076 | 0.269 | 0.026 | 0.212 | 0.243 | -0.110 | 0.156 | .423* | 1 | | | | | | | | |
| CW4 | -0.005 | 0.094 | 0.319 | .339* | 0.217 | 0.137 | 0.048 | .400* | 0.069 | 0.017 | 1 | | | | | | | |
| CW3 | .382* | 0.111 | 0.276 | 0.144 | .331* | 0.236 | -0.139 | .350* | .358* | .866** | 0.319 | 1 | | | | | | |
| CW2 | 0.088 | -.461** | -0.312 | -.566** | -0.213 | -0.178 | -0.110 | -.574** | 0.003 | 0.246 | -.516** | 0.014 | 1 | | | | | |
| CW1 | 0.149 | .465** | .437** | .555** | .375* | 0.280 | -0.011 | .685** | 0.179 | 0.253 | .618** | .523** | -.838** | 1 | | | | |
| EE3 | 0.076 | -.599** | -.399* | -.506** | -.382* | -0.297 | 0.110 | -.636** | 0.266 | 0.281 | -.561** | -0.050 | .827** | -.743** | 1 | | | |
| EE2 | 0.166 | 0.306 | 0.253 | 0.267 | 0.275 | 0.167 | -0.233 | .410* | -0.128 | -0.121 | .740** | 0.121 | -.464** | .494** | -.608** | 1 | | |
| EE1 | 0.006 | 0.039 | -0.033 | 0.079 | -0.256 | -0.267 | -0.026 | 0.112 | 0.170 | 0.213 | -0.184 | 0.185 | -0.175 | 0.250 | 0.022 | -0.068 | 1 | |
| RSS | -.358* | -.551** | -.430* | -0.140 | -0.072 | -0.222 | 0.255 | -.455** | 0.162 | -.436** | 0.043 | -.414* | 0.116 | -.333* | 0.309 | -0.094 | -.484** | 1 |

## 6.3 Regression and Hypotheses Testing

Multiple regression analysis is the extension of simple regression. This technique is used for predicting the value of a variable. The value is predicted on the basis of the value of two or more variables. The variable predicted in this technique is known as the dependent variable. The variables used for prediction are known as independent variables. This technique is helpful in determining the overall fit of a model. Regression analysis is also used to indicate the contribution of each predictor variable. Following presents the calculation of the standard regression:

$$Y = a + b_1X_1 + b_2X_2 + \cdots + b_nX_n \quad (6.1)$$

In this equation, Y is dependent variable and Xs presents the independent variables. In addition, a is the constant and $b_1$ to $b_n$ presents the slop for the related Xs (Braimah, 2008).

In this research, multiple regression analysis was used to test the hypotheses, which are listed in the following section. Figure 6.7 presents the research model of this study.

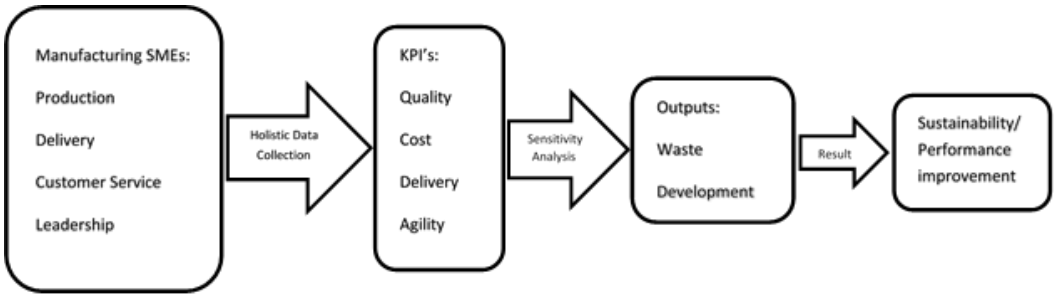



Figure 6.7: Conceptual model.

### 6.3.1 Multiple Regression

This first part of the analysis focused on the impact of quality, delivery and agility benefits to SME performance (waste and development). The first part of the model is shown in Figure 6.8.


Figure 6.8: Regression analysis (influence on Waste by Product loss, Waste by Time loss and Encourage Development).

### 6.3.2 Model Hypotheses

H1A. Resource Stability and Reliability (RSS) positively influences Waste by Product loss (CW5).

H1B. Resource Stability and Reliability (RSS) positively influences Waste by Time loss (CW6).

H1C. Resource Stability and Reliability (RSS) positively influences Encourage Development (LD11).

H2A. Forecasting Production (EE1) positively influences Waste by Product loss (CW5).

H2B. Forecasting Production (EE1) positively influences Waste by Time loss (CW6).

H2C. Forecasting Production (EE1) positively influences Encourage Development (LD11).

H3A. Delivery Speed (EE2) positively influences Waste by Product loss (CW5).

H3B. Delivery Speed (EE2) positively influences Waste by Time loss (CW6).

H3C. Delivery Speed (EE2) positively influences Encourage Development (LD11).

H4A. Expertise Flexibility (EE3) positively influences Waste by Product loss (CW5).

H4B. Expertise Flexibility (EE3) positively influences Waste by Time loss (CW6).

H4C. Expertise Flexibility (EE3) positively influences Encourage Development (LD11).

H5A. Product Quality (Performance) (CW1) positively influences Waste by Product loss (CW5).

H5B. Product Quality (Performance) (CW1) positively influences Waste by Time loss (CW6).

H5C. Product Quality (Performance) (CW1) positively influences Encourage Development (LD11).

H6A. Product Quality (Conformance) (CW2) positively influences Waste by Product loss (CW5).

H6B. Product Quality (Conformance) (CW2) positively influences Waste by Time loss (CW6).

H6C. Product Quality (Conformance) (CW2) positively influences Encourage Development (LD11).

H7A. Defect Free (CW3) Products positively influences Waste by Product loss (CW5).

H7B. Defect Free (CW3) Products positively influences Waste by Time loss (CW6).

H7C. Defect Free (CW3) Products positively influences Encourage Development (LD11).

H8A. Customer Satisfaction Rate (CW4) positively influences Waste by Product loss (CW5).

H8B. Customer Satisfaction Rate (CW4) positively influences Waste by Time loss (CW6).

H8C. Customer Satisfaction Rate (CW4) positively influences Encourage Development (LD11).

H9A. Employee appraisals (LD1) positively influences Waste by Product loss (CW5).

H9B. Employee appraisals (LD1) positively influences Waste by Time loss (CW6).

H9C. Employee appraisals (LD1) positively influences Encourage Development (LD11).

H10A. Competitiveness (LD2) positively influences Waste by Product loss (CW5).

H10B. Competitiveness (LD2) positively influences Waste by Time loss (CW6).

H10C. Competitiveness (LD2) positively influences Encourage Development (LD11).

H11A. Feedback Activities (LD3) positively influences Waste by Product loss (CW5).

H11B. Feedback Activities (LD3) positively influences Waste by Time loss (CW6).

H11C. Feedback Activities (LD3) positively influences Encourage Development (LD11).

H12A. Leadership Supports Development (LD5) positively influences Waste by Product loss (CW5).

H12B. Leadership Supports Development (LD5) positively influences Waste by Time loss (CW6).

H12C. Leadership Supports Development (LD5) positively influences Encourage Development (LD11).

H13A. Focus of Attention (LD6) positively influences Waste by Product loss (CW5).

H13B. Focus of Attention (LD6) positively influences Waste by Time loss (CW6).

H13C. Focus of Attention (LD6) positively influences Encourage Development (LD11).

H14A. Knowledge Transfer (LD7) positively influences Waste by Product loss (CW5).

H14B. Knowledge Transfer (LD7) positively influences Waste by Time loss (CW6).

H14C. Knowledge Transfer (LD7) positively influences Encourage Development (LD11).

H15A. Employee Training (LD8) positively influences Waste by Product loss (CW5).

H15B. Employee Training (LD8) positively influences Waste by Time loss (CW6).

H15C. Employee Training (LD8) positively influences Encourage Development (LD11).

The effects of Resource Stability and Reliability, Forecasting Production, Delivery Speed, Expertise Flexibility, Product Quality (Performance), Product Quality (Conformance), Defect Free Products, Customer Satisfaction Rate, Employee appraisals, Competitiveness, Feedback Activities, Leadership Supports Development, Focus of Attention, Knowledge Transfer and Employee Training on Waste by Product Loss, Waste by Time Loss and Encourage Development are tested using multiple regression analysis.

## 6.4 Regression and Hypotheses Results

In this section, six stages of multiple regression analyses are presented in the following tables. The variables group including Resource Stability and Reliability, Forecasting Production, Delivery Speed, Expertise Flexibility, Product Quality (Performance), Product Quality (Conformance), Defect Free Products, Customer Satisfaction Rate, Employee appraisals, Competitiveness, Feedback Activities, Leadership Supports Development, Focus of Attention, Knowledge Transfer and Employee Training, were independent variables. Waste by Product loss, Waste by Time loss and Encourage Development were dependent variables.

### 6.4.1 Regression Results for *Struggling* SMEs

#### 6.4.1.1 Stage 1: tests on the effects of the variables on the Waste by Product Loss

The results from Table 6.8 show that only Forecasting Production has a significant relationship with Waste by Product Loss, and the rest of variables have no significant relationship with Waste by Product Loss. This supports H2A and rejects H1A, H3A, H4A, H5A, H6A, H7A, H8A, H9A, H10A, H11A, H12A, H13A, H14A and H15A.

VIF values indicate there is no sign of multicollinearity (Hair et al, 2010: 200); VIF (Variance Inflation Factor) values are <10 for all variables except Product Quality (Performance), Product Quality (Conformance) and Defect Free Products. However, these variables do not have a significant relationship with Waste by Product Loss. These findings suggest that Forecasting Production is beneficial for manufacturing SMEs in terms of controlling their waste.

Table 6.8: Multiple regression analysis for *Struggling* SMEs - Waste by Product Loss.

| | Unstandardized Coefficients | | Standardized Coefficients | | | Collinearity Statistics | |
|---|---|---|---|---|---|---|---|
| Model 1 | B | Std. Error | Beta | t | Sig. | Tolerance | VIF |
| (Constant) | .441 | .557 | | .791 | .438 | | |
| Resource Stability & Reliability | -.057 | .610 | -.012 | -.093 | .927 | .280 | 3.572 |
| Forecasting Production | .073 | .033 | .434 | 2.176 | .042 | .118 | 8.462 |
| Delivery Speed | -.110 | .079 | -.161 | -1.394 | .179 | .350 | 2.855 |
| Expertise Flexibility | -.034 | .034 | -.142 | -.995 | .332 | .232 | 4.317 |
| Product Quality (Performance) | 1.031 | 1.213 | 1.118 | .850 | .405 | .003 | 369.063 |
| Product Quality (Conformance) | 1.036 | 1.186 | 1.087 | .873 | .393 | .003 | 330.251 |
| Defect Free Products | -.437 | 1.190 | -.498 | -.368 | .717 | .003 | 391.620 |
| Customer Satisfaction Rate | .001 | .088 | .001 | .012 | .990 | .324 | 3.086 |
| Employee appraisals | -.034 | .031 | -.144 | -1.114 | .279 | .281 | 3.563 |
| Competitiveness | -.022 | .027 | -.096 | -.822 | .421 | .343 | 2.912 |
| Feedback Activities | -.016 | .030 | -.054 | -.543 | .593 | .474 | 2.111 |
| Leadership Supports development | .038 | .042 | .128 | .899 | .379 | .231 | 4.331 |
| Focus of attention | -.002 | .031 | -.006 | -.052 | .959 | .359 | 2.782 |
| Knowledge Transfer | -.014 | .028 | -.052 | -.502 | .621 | .444 | 2.250 |
| Employee Training | -.005 | .021 | -.020 | -.221 | .828 | .599 | 1.670 |

#### 6.4.1.2 Stage 2: tests on the effects of the variables on the Waste by Time Loss

The results from Table 6.9 show that only Resource Stability and Reliability has a significant relationship with Waste by Time Loss, and the rest of variables have no significant relationship with Waste by Time Loss, thus supporting H1B and rejecting H2B, H3B, H4B, H5B, H6B, H7B, H8B, H9B, H10B, H11B, H12B, H13B, H14B and H15B. VIF values indicate there is no sign of multicollinearity (Hair et al, 2010: 200); VIF values are <10 for all variables except Product Quality (Performance), Product Quality (Conformance) and Defect Free Products. However, these variables do not have a significant relationship with Waste by Time Loss. These findings suggest that Resource Stability and Reliability is beneficial for manufacturing SMEs in terms of controlling their waste.

Table 6.9: Multiple regression analysis for *Struggling* SMEs - Waste by Time Loss.

| | Unstandardized Coefficients | | Standardized Coefficients | | | Collinearity Statistics | |
|---|---|---|---|---|---|---|---|
| Model 1 | B | Std. Error | Beta | t | Sig. | Tolerance | VIF |
| (Constant) | -3.108 | 2.231 | | -1.393 | 0.179 | | |
| Resource Stability & Reliability | 4.836 | 2.442 | 0.647 | 1.980 | 0.062 | 0.280 | 3.572 |
| Forecasting Production | 0.143 | 0.133 | 0.537 | 1.069 | 0.298 | 0.118 | 8.462 |
| Delivery Speed | -0.027 | 0.316 | -0.025 | -0.086 | 0.932 | 0.350 | 2.855 |
| Expertise Flexibility | -0.046 | 0.138 | -0.119 | -0.332 | 0.743 | 0.232 | 4.317 |
| Product Quality (Performance) | -0.983 | 4.854 | -0.672 | -0.203 | 0.842 | 0.003 | 369.063 |
| Product Quality (Conformance) | -0.796 | 4.749 | -0.526 | -0.168 | 0.869 | 0.003 | 330.251 |
| Defect Free Products | 0.245 | 4.764 | 0.176 | 0.051 | 0.959 | 0.003 | 391.620 |
| Customer Satisfaction Rate | -0.306 | 0.351 | -0.264 | -0.870 | 0.395 | 0.324 | 3.086 |
| Employee appraisals | -0.029 | 0.123 | -0.076 | -0.232 | 0.819 | 0.281 | 3.563 |
| Competitiveness | 0.003 | 0.108 | 0.008 | 0.029 | 0.977 | 0.343 | 2.912 |
| Feedback Activities | 0.011 | 0.120 | 0.023 | 0.092 | 0.928 | 0.474 | 2.111 |
| Leadership Supports development | 0.031 | 0.169 | 0.065 | 0.182 | 0.857 | 0.231 | 4.331 |
| Focus of attention | -0.013 | 0.123 | -0.031 | -0.107 | 0.916 | 0.359 | 2.782 |
| Knowledge Transfer | -0.141 | 0.111 | -0.331 | -1.276 | 0.217 | 0.444 | 2.250 |
| Employee Training | -0.052 | 0.085 | -0.136 | -0.611 | 0.548 | 0.599 | 1.670 |

#### 6.4.1.3 Stage 3: tests on the effects of the variables on the Encourage Development

The results from Table 6.10 show that none of variables have a significant relationship with Encourage Development, thus rejecting H1C, H2C, H3C, H4C, H5C, H6C, H7C, H8C, H9C, H10C, H11C, H12C, H13C, H14C and H15C. VIF values indicate there is no sign of multicollinearity (Hair et al, 2010: 200); VIF values are <10 for all variables except Product Quality (Performance), Product Quality (Conformance) and Defect Free Products. However, these variables do not have a significant relationship with Encourage Development.

Table 6.10: Multiple regression analysis for *Struggling* SMEs - Encourage Development.

| | Unstandardized Coefficients | | Standardized Coefficients | | | Collinearity Statistics | |
|---|---|---|---|---|---|---|---|
| Model 1 | B | Std. Error | Beta | t | Sig. | Tolerance | VIF |
| (Constant) | -5.058 | 4.759 | | -1.063 | 0.301 | | |
| Resource Stability & Reliability | 5.640 | 5.209 | 0.354 | 1.083 | 0.292 | 0.280 | 3.572 |
| Forecasting Production | 0.065 | 0.285 | 0.115 | 0.228 | 0.822 | 0.118 | 8.462 |
| Delivery Speed | 0.221 | 0.673 | 0.096 | 0.328 | 0.746 | 0.350 | 2.855 |
| Expertise Flexibility | 0.029 | 0.294 | 0.035 | 0.097 | 0.923 | 0.232 | 4.317 |
| Product Quality (Performance) | -4.027 | 10.353 | -1.294 | -0.389 | 0.701 | 0.003 | 369.063 |
| Product Quality (Conformance) | -2.960 | 10.128 | -0.919 | -0.292 | 0.773 | 0.003 | 330.251 |
| Defect Free Products | 2.709 | 10.160 | 0.913 | 0.267 | 0.792 | 0.003 | 391.620 |
| Customer Satisfaction Rate | 0.242 | 0.749 | 0.098 | 0.323 | 0.750 | 0.324 | 3.086 |
| Employee appraisals | -0.073 | 0.263 | -0.091 | -0.279 | 0.783 | 0.281 | 3.563 |
| Competitiveness | 0.097 | 0.229 | 0.125 | 0.425 | 0.676 | 0.343 | 2.912 |
| Feedback Activities | -0.218 | 0.255 | -0.215 | -0.854 | 0.403 | 0.474 | 2.111 |
| Leadership Supports development | 0.272 | 0.360 | 0.272 | 0.756 | 0.459 | 0.231 | 4.331 |
| Focus of attention | -0.172 | 0.262 | -0.189 | -0.655 | 0.520 | 0.359 | 2.782 |
| Knowledge Transfer | 0.130 | 0.237 | 0.143 | 0.552 | 0.587 | 0.444 | 2.250 |
| Employee Training | -0.054 | 0.182 | -0.066 | -0.294 | 0.771 | 0.599 | 1.670 |

### 6.4.2 Regression Results for *Surviving* SMEs

#### 6.4.2.1 Stage 1: tests on the effects of the variables on the Waste by Product Loss

The results from Table 6.11 show that none of variables have no significant relationship with Waste by Product, thus rejecting H1A, H2A, H3A, H4A, H5A, H6A, H7A, H8A, H9A, H10A, H11A, H12A, H13A, H14A and H15A. VIF values indicate there is no sign of multicollinearity (Hair et al, 2010: 200); VIF values are <10 for all variables except for Product Quality (Performance), Product Quality (Conformance) and Defect Free Products. However, these variables do not have a significant relationship with Waste by Product Loss.

Table 6.11: Multiple regression analysis for *Surviving* SMEs - Waste by Product Loss.

| | Unstandardized Coefficients | | Standardized Coefficients | | | Collinearity Statistics | |
|---|---|---|---|---|---|---|---|
| Model 1 | B | Std. Error | Beta | t | Sig. | Tolerance | VIF |
| (Constant) | -0.120 | 0.334 | | -0.358 | 0.724 | | |
| Resource Stability & Reliability | 0.257 | 0.339 | 0.023 | 0.756 | 0.458 | 0.622 | 1.608 |
| Forecasting Production | -0.018 | 0.021 | -0.041 | -0.879 | 0.390 | 0.276 | 3.627 |
| Delivery Speed | -0.071 | 0.039 | -0.075 | -1.845 | 0.080 | 0.357 | 2.802 |
| Expertise Flexibility | 0.022 | 0.064 | 0.018 | 0.341 | 0.737 | 0.212 | 4.711 |
| Product Quality (Performance) | 0.217 | 0.364 | 0.300 | 0.598 | 0.557 | 0.002 | 425.326 |
| Product Quality (Conformance) | 0.149 | 0.364 | 0.138 | 0.409 | 0.687 | 0.005 | 191.309 |
| Defect Free Products | 0.741 | 0.360 | 0.767 | 2.060 | 0.053 | 0.004 | 233.226 |
| Customer Satisfaction Rate | -0.007 | 0.049 | -0.005 | -0.144 | 0.887 | 0.428 | 2.336 |
| Employee appraisals | -0.013 | 0.009 | -0.042 | -1.424 | 0.170 | 0.683 | 1.463 |
| Competitiveness | 0.004 | 0.009 | 0.014 | 0.461 | 0.650 | 0.604 | 1.657 |
| Feedback Activities | 0.014 | 0.011 | 0.051 | 1.290 | 0.212 | 0.385 | 2.595 |
| Leadership Supports development | 0.002 | 0.008 | 0.007 | 0.203 | 0.841 | 0.539 | 1.857 |
| Focus of attention | -0.012 | 0.012 | -0.037 | -1.013 | 0.323 | 0.447 | 2.235 |
| Knowledge Transfer | -0.005 | 0.008 | -0.019 | -0.569 | 0.576 | 0.517 | 1.933 |
| Employee Training | 0.005 | 0.009 | 0.019 | 0.579 | 0.569 | 0.526 | 1.903 |

#### 6.4.2.2 Stage 2: tests on the effects of the variables on the Waste by Time Loss

The results from Table 6.12 show that Resource Stability and Reliability and Customer Satisfaction Rate have significant relationships with Waste by Time Loss, and the rest of variables have no significant relationship with Waste by Time Loss, thus supporting H1B and H8B, and rejecting H2B, H3B, H4B, H5B, H6B, H7B, H9B, H10B, H11B, H12B, H13B, H14B and H15B. VIF values indicate there is no sign of multicollinearity (Hair et al, 2010: 200). VIF values are <10 for all variables except Product Quality (Performance), Product Quality (Conformance) and Defect Free Products. However, these variables do not have a significant relationship with Waste by Time Loss. These findings suggest that Resource Stability and Reliability and Customer Satisfaction Rate are beneficial for manufacturing SMEs in terms of controlling their waste by Time Loss.

Table 6.12: Multiple regression analysis for *Surviving* SMEs - Waste by Time Loss.

| | Unstandardized Coefficients | | Standardized Coefficients | | | Collinearity Statistics | |
|---|---|---|---|---|---|---|---|
| Model 1 | B | Std. Error | Beta | t | Sig. | Tolerance | VIF |
| (Constant) | -3.716 | 1.373 | | -2.707 | 0.014 | | |
| Resource Stability & Reliability | 4.257 | 1.395 | 0.385 | 3.051 | 0.006 | 0.622 | 1.608 |
| Forecasting Production | 0.013 | 0.085 | 0.028 | 0.147 | 0.884 | 0.276 | 3.627 |
| Delivery Speed | 0.177 | 0.158 | 0.186 | 1.116 | 0.278 | 0.357 | 2.802 |
| Expertise Flexibility | 0.019 | 0.265 | 0.016 | 0.072 | 0.943 | 0.212 | 4.711 |
| Product Quality (Performance) | 0.711 | 1.495 | 0.975 | 0.476 | 0.640 | 0.002 | 425.326 |
| Product Quality (Conformance) | 0.386 | 1.497 | 0.354 | 0.258 | 0.799 | 0.005 | 191.309 |
| Defect Free Products | -0.940 | 1.478 | -0.965 | -0.636 | 0.532 | 0.004 | 233.226 |
| Customer Satisfaction Rate | 0.590 | 0.201 | 0.445 | 2.931 | 0.008 | 0.428 | 2.336 |
| Employee appraisals | -0.001 | 0.037 | -0.002 | -0.021 | 0.984 | 0.683 | 1.463 |
| Competitiveness | 0.035 | 0.035 | 0.127 | 0.989 | 0.334 | 0.604 | 1.657 |
| Feedback Activities | 0.027 | 0.046 | 0.094 | 0.586 | 0.564 | 0.385 | 2.595 |
| Leadership Supports development | 0.034 | 0.033 | 0.136 | 1.002 | 0.328 | 0.539 | 1.857 |
| Focus of attention | -0.062 | 0.049 | -0.186 | -1.254 | 0.224 | 0.447 | 2.235 |
| Knowledge Transfer | -0.068 | 0.034 | -0.276 | -1.997 | 0.060 | 0.517 | 1.933 |
| Employee Training | -0.039 | 0.039 | -0.139 | -1.017 | 0.321 | 0.526 | 1.903 |

#### 6.4.2.3 Stage 3: tests on the effects of the variables on the Encourage Development

The results from Table 6.13 show that only Employee Appraisals has a significant relationship with Encourage Development thus supporting H9C and rejecting H1C, H2C, H3C, H4C, H5C, H6C, H7C, H8C, H10C, H11C, H12C, H13C, H14C and H15C. VIF values indicate there is no sign of multicollinearity (Hair et al, 2010: 200). VIF values are <10 for all variables except Product Quality (Performance), Product Quality (Conformance) and Defect Free Products. However, these variables do not have a significant relationship with Encourage Development.

Table 6.13: Multiple regression analysis for *Surviving* SMEs - Encourage Development.

| | Unstandardized Coefficients | | Standardized Coefficients | | | Collinearity Statistics | |
|---|---|---|---|---|---|---|---|
| Model 1 | B | Std. Error | Beta | t | Sig. | Tolerance | VIF |
| (Constant) | 8.103 | 7.194 | | 1.126 | 0.273 | | |
| Resource Stability & Reliability | -7.328 | 7.314 | -0.198 | -1.002 | 0.328 | 0.622 | 1.608 |
| Forecasting Production | -0.624 | 0.448 | -0.414 | -1.393 | 0.179 | 0.276 | 3.627 |
| Delivery Speed | -0.673 | 0.830 | -0.212 | -0.810 | 0.427 | 0.357 | 2.802 |
| Expertise Flexibility | -0.647 | 1.388 | -0.158 | -0.466 | 0.646 | 0.212 | 4.711 |
| Product Quality (Performance) | 4.588 | 7.837 | 1.883 | 0.585 | 0.565 | 0.002 | 425.326 |
| Product Quality (Conformance) | 4.704 | 7.848 | 1.293 | 0.599 | 0.556 | 0.005 | 191.309 |
| Defect Free Products | -5.010 | 7.748 | -1.540 | -0.647 | 0.525 | 0.004 | 233.226 |
| Customer Satisfaction Rate | 1.468 | 1.056 | 0.331 | 1.390 | 0.180 | 0.428 | 2.336 |
| Employee appraisals | 0.422 | 0.196 | 0.406 | 2.150 | 0.044 | 0.683 | 1.463 |
| Competitiveness | 0.038 | 0.184 | 0.042 | 0.207 | 0.838 | 0.604 | 1.657 |
| Feedback Activities | 0.260 | 0.241 | 0.271 | 1.079 | 0.293 | 0.385 | 2.595 |
| Leadership Supports development | -0.302 | 0.175 | -0.367 | -1.725 | 0.100 | 0.539 | 1.857 |
| Focus of attention | -0.160 | 0.259 | -0.144 | -0.618 | 0.544 | 0.447 | 2.235 |
| Knowledge Transfer | 0.215 | 0.179 | 0.261 | 1.205 | 0.242 | 0.517 | 1.933 |
| Employee Training | -0.008 | 0.202 | -0.009 | -0.042 | 0.967 | 0.526 | 1.903 |

### 6.4.3 Regression Results for *Successful* SMEs

#### 6.4.3.1 Stage 1: tests on the effects of the variables on the Waste by Product Loss

The results from Table 6.14 show that Resource Stability and Reliability and Expertise Flexibility have significant relationships with Waste by Product Loss, and the rest of variables have no significant relationship with Waste by Product Loss, thus supporting H1A and H4A, and rejecting H2A, H3A, H5A, H6A, H7A, H8A, H9A, H10A, H11A, H12A, H13A, H14A and H15A. VIF values indicate there is no sign of multicollinearity (Hair et al, 2010: 200). VIF values are <10 for all variables except for Product Quality (Performance), Product Quality (Conformance) and Defect Free Products. However, these variables do not have significant relationship with Waste by Product. Expertise Flexibility has VIF value close to 10, and is therefore considered acceptable. These findings suggest that the Resource Stability and Reliability and Expertise Flexibility are beneficial for manufacturing SMEs in terms of controlling Waste by Product Loss.

Table 6.14: Multiple regression analysis for *Successful* SMEs - Waste by Product Loss.

| Model 1 | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | Collinearity Statistics | |
|---|---|---|---|---|---|---|---|
| | B | Std. Error | Beta | | | Tolerance | VIF |
| (Constant) | 3.228 | 1.338 | | 2.413 | 0.026 | | |
| Resource Stability & Reliability | -3.377 | 1.319 | -0.350 | -2.561 | 0.019 | 0.122 | 8.214 |
| Forecasting Production | -0.069 | 0.048 | -0.149 | -1.440 | 0.165 | 0.213 | 4.704 |
| Delivery Speed | 0.022 | 0.158 | 0.014 | 0.139 | 0.891 | 0.226 | 4.425 |
| Expertise Flexibility | 0.334 | 0.058 | 0.894 | 5.738 | 0.000 | 0.093 | 10.695 |
| Product Quality (Performance) | 0.224 | 0.425 | 0.294 | 0.526 | 0.604 | 0.007 | 137.652 |
| Product Quality (Conformance) | -0.171 | 0.415 | -0.187 | -0.413 | 0.684 | 0.011 | 90.172 |
| Defect Free Products | 0.833 | 0.428 | 0.584 | 1.946 | 0.066 | 0.025 | 39.695 |
| Customer Satisfaction Rate | 0.004 | 0.212 | 0.003 | 0.021 | 0.983 | 0.138 | 7.247 |
| Employee appraisals | -0.006 | 0.018 | -0.034 | -0.341 | 0.736 | 0.231 | 4.329 |
| Competitiveness | -0.014 | 0.017 | -0.059 | -0.827 | 0.418 | 0.442 | 2.262 |
| Feedback Activities | 0.013 | 0.014 | 0.084 | 0.941 | 0.358 | 0.286 | 3.496 |
| Leadership Supports development | 0.010 | 0.012 | 0.067 | 0.815 | 0.425 | 0.333 | 3.003 |
| Focus of attention | 0.001 | 0.018 | 0.007 | 0.075 | 0.941 | 0.253 | 3.956 |
| Knowledge Transfer | 0.006 | 0.017 | 0.034 | 0.317 | 0.755 | 0.194 | 5.164 |
| Employee Training | 0.009 | 0.013 | 0.061 | 0.647 | 0.525 | 0.258 | 3.875 |

#### 6.4.3.2 Stage 2: tests on the effects of the variables on the Waste by Time Loss

The results from Table 6.15 show that Delivery Speed, Expertise Flexibility, Customer Satisfaction Rate and Leadership Supports Development have significant relationships with Waste by Time Loss, and the rest of variables have no significant relationships with Waste by Time Loss, thus supporting H3B, H4B, H8B and H12B, and rejecting H1B, H2B, H5B, H6B, H7B, H9B, H10B, H11B, H13B, H14B and H15B. VIF values indicate there is no sign of multicollinearity (Hair et al, 2010: 200). VIF values are <10 for all variables except Product Quality (Performance), Product Quality (Conformance) and Defect Free Products. However, these variables

do not have significant relationships with Waste by Time Loss. Expertise Flexibility has VIF value close to 10, and is therefore considered acceptable. These findings suggest that Delivery Speed, Expertise Flexibility, Customer Satisfaction Rate and Leadership Supports Development are beneficial for manufacturing SMEs in terms of controlling Waste by Time Loss.

Table 6.15: Multiple regression analysis for *Successful* SMEs - Waste by Time Loss.

| | Unstandardized Coefficients | | Standardized Coefficients | | | Collinearity Statistics | |
|---|---|---|---|---|---|---|---|
| Model 1 | B | Std. Error | Beta | t | Sig. | Tolerance | VIF |
| (Constant) | 0.013 | 2.885 | | 0.005 | 0.996 | | |
| Resource Stability & Reliability | 0.123 | 2.844 | 0.014 | 0.043 | 0.966 | 0.122 | 8.214 |
| Forecasting Production | 0.145 | 0.103 | 0.336 | 1.407 | 0.175 | 0.213 | 4.704 |
| Delivery Speed | -0.732 | 0.341 | -0.498 | -2.147 | 0.044 | 0.226 | 4.425 |
| Expertise Flexibility | 0.489 | 0.126 | 1.405 | 3.898 | 0.001 | 0.093 | 10.695 |
| Product Quality (Performance) | 0.321 | 0.917 | 0.453 | 0.350 | 0.730 | 0.007 | 137.652 |
| Product Quality (Conformance) | -0.153 | 0.894 | -0.179 | -0.171 | 0.866 | 0.011 | 90.172 |
| Defect Free Products | -0.438 | 0.923 | -0.329 | -0.474 | 0.640 | 0.025 | 39.695 |
| Customer Satisfaction Rate | 1.340 | 0.457 | 0.869 | 2.930 | 0.008 | 0.138 | 7.247 |
| Employee appraisals | -0.006 | 0.038 | -0.037 | -0.160 | 0.874 | 0.231 | 4.329 |
| Competitiveness | -0.055 | 0.037 | -0.249 | -1.504 | 0.148 | 0.442 | 2.262 |
| Feedback Activities | 0.006 | 0.029 | 0.045 | 0.218 | 0.830 | 0.286 | 3.496 |
| Leadership Supports development | 0.102 | 0.027 | 0.732 | 3.833 | 0.001 | 0.333 | 3.003 |
| Focus of attention | 0.053 | 0.038 | 0.306 | 1.395 | 0.178 | 0.253 | 3.956 |
| Knowledge Transfer | -0.057 | 0.038 | -0.380 | -1.519 | 0.144 | 0.194 | 5.164 |
| Employee Training | 0.043 | 0.028 | 0.329 | 1.517 | 0.145 | 0.258 | 3.875 |

#### 6.4.3.3 Stage 3: tests on the effects of the variables on the Encourage Development

The results from Table 6.16 show that Forecasting Production, Delivery Speed, Expertise Flexibility and Customer Satisfaction Rate have significant relationships

with Encourage Development, and the rest of variables have no significant relationships with Encourage Development, thus supporting H2C, H3C, H4C and H8C, and rejecting H1C, H5C, H6C, H7C, H9C, H10C, H11C, H12C, H13C, H14C and H15C. VIF values indicate there is no sign of multicollinearity (Hair et al, 2010: 200). VIF values are <10 for all variables except Product Quality (Performance), Product Quality (Conformance) and Defect Free Products. However, these variables do not have significant relationships with the Waste by Time Loss. Expertise Flexibility has a VIF value close to 10, and is therefore considered acceptable. These findings suggest that Forecasting Production, Delivery Speed, Expertise Flexibility and Customer Satisfaction Rate are beneficial for manufacturing SMEs in terms of controlling Encourage Development.

Table 6.16: Multiple regression analysis for *Successful* SMEs - Encourage Development.

| | Unstandardized Coefficients | | Standardized Coefficients | | | Collinearity Statistics | |
|---|---|---|---|---|---|---|---|
| Model 1 | B | Std. Error | Beta | t | Sig. | Tolerance | VIF |
| (Constant) | 24.604 | 17.653 | | 1.394 | 0.179 | | |
| Resource Stability & Reliability | -27.927 | 17.400 | -0.465 | -1.605 | 0.124 | 0.122 | 8.214 |
| Forecasting Production | -1.355 | 0.629 | -0.472 | -2.155 | 0.043 | 0.213 | 4.704 |
| Delivery Speed | 7.944 | 2.087 | 0.809 | 3.806 | 0.001 | 0.226 | 4.425 |
| Expertise Flexibility | 2.157 | 0.768 | 0.928 | 2.808 | 0.011 | 0.093 | 10.695 |
| Product Quality (Performance) | 5.055 | 5.612 | 1.068 | 0.901 | 0.378 | 0.007 | 137.652 |
| Product Quality (Conformance) | 2.751 | 5.471 | 0.482 | 0.503 | 0.621 | 0.011 | 90.172 |
| Defect Free Products | -1.821 | 5.650 | -0.205 | -0.322 | 0.751 | 0.025 | 39.695 |
| Customer Satisfaction Rate | -7.255 | 2.798 | -0.705 | -2.593 | 0.017 | 0.138 | 7.247 |
| Employee appraisals | 0.120 | 0.233 | 0.108 | 0.516 | 0.612 | 0.231 | 4.329 |
| Competitiveness | 0.267 | 0.223 | 0.181 | 1.194 | 0.246 | 0.442 | 2.262 |
| Feedback Activities | 0.207 | 0.180 | 0.217 | 1.150 | 0.264 | 0.286 | 3.496 |
| Leadership Supports development | -0.166 | 0.162 | -0.179 | -1.020 | 0.320 | 0.333 | 3.003 |
| Focus of attention | 0.429 | 0.233 | 0.369 | 1.836 | 0.081 | 0.253 | 3.956 |
| Knowledge Transfer | 0.174 | 0.231 | 0.173 | 0.752 | 0.461 | 0.194 | 5.164 |
| Employee Training | -0.122 | 0.174 | -0.139 | -0.701 | 0.491 | 0.258 | 3.875 |

## 6.4 Summary of Research Model

The models as shown in Figures 6.9, 6.10 and 6.11 are based on the results of regression analyses performed in the study. The original model aimed to study different factors that have an effect on the activities of manufacturing SMEs as well as their performance. These figures show that more success is encountered with more factors involved. For *Struggling* SMEs, only two variables have a significant effect on waste and development. However, the number of effective variables increases to three for *Surviving* and to ten for *Successful* SMEs. The key findings, summarised in Tables 6.17, 6.18 and 6.19, show how these three categories perform differently by accepted hypothesises.

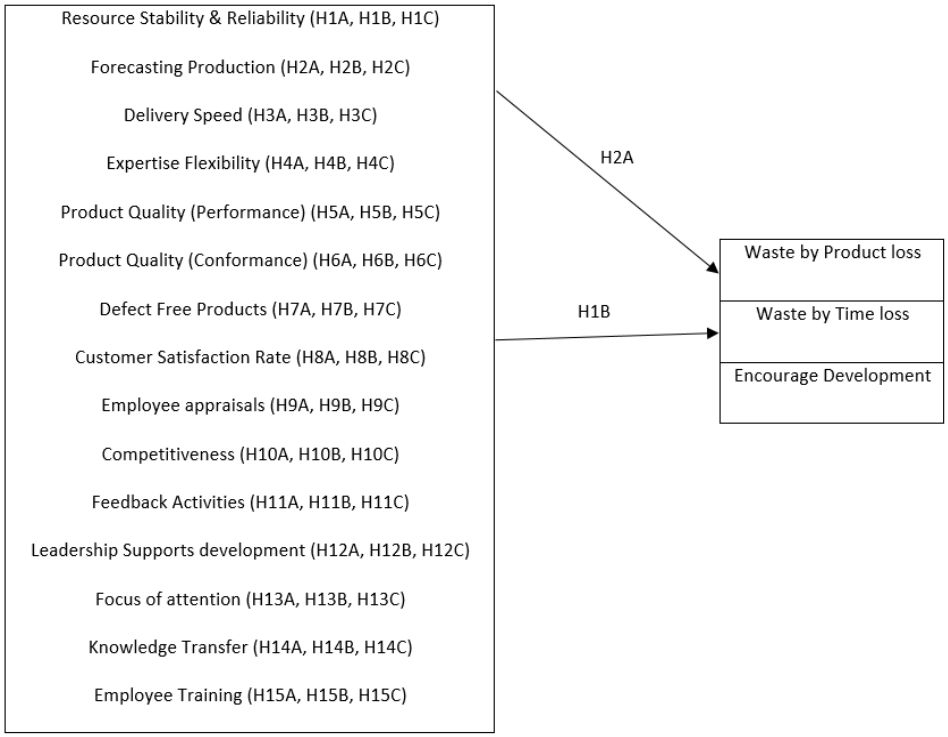



Figure 6.9: Revised Model for *Struggling* SMEs based on regression analysis (influence on Waste by Product Loss, Waste by Time Loss and Encourage Development).

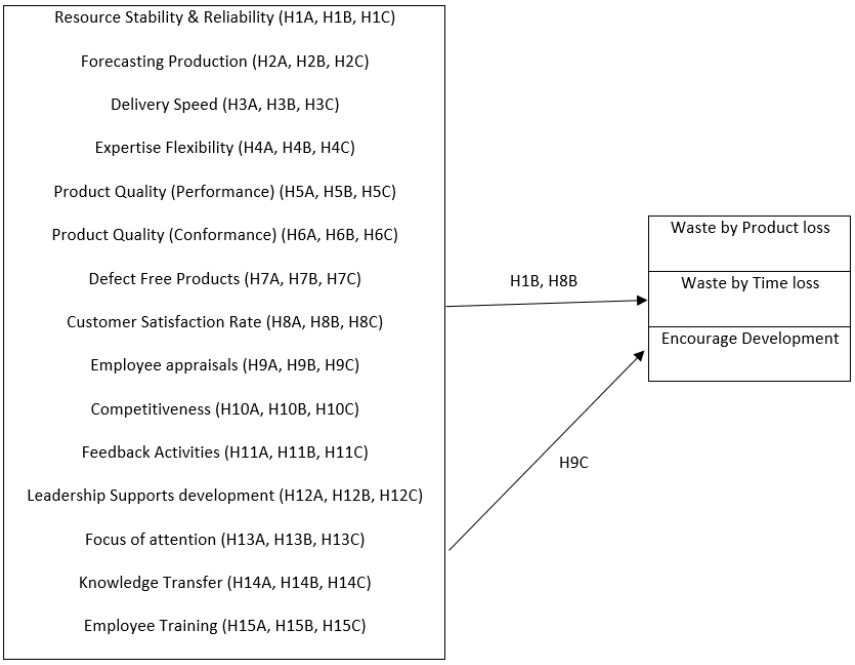



Figure 6.10: Revised Model for *Surviving* SMEs based on regression analysis (influence on Waste by Product Loss, Waste by Time Loss and Encourage Development).


Figure 6.11: Revised Model for *Successful* SMEs based on regression analysis (influence on Waste by Product Loss, Waste by Time Loss and Encourage Development).

The Waste by Product Loss for *Surviving* SMEs does not show any dependency on any of the measured variables. Similarly, Encourage Development does not show any dependency on any of the measured variables. However, Waste by Time Loss has similarities among all three categories.

This model consists of different factors that have been found to have significant effects from this research. The factors which aligned with the hypothesises include Resource Stability & Reliability, Forecasting Production, Delivery Speed, Expertise Flexibility, Customer Satisfaction Rate, Employee Appraisals, and Leadership Supports development.

Table 6.17: Accepted hypothesises related to Waste by product loss from regression test for three categories.

| **Variables** | **Metrics** | **Categories** | **Sig (p)** | **t-value** | **Beta** |
|---|---|---|---|---|---|
| RSS | Resource Stability & Reliability | *Successful* | 0.019 | -0.350 | -2.561 |
| EE1 | Forecasting Production | *Struggling* | 0.042 | 2.176 | 0.434 |
| EE3 | Expertise Flexibility | *Successful* | 0.000 | 0.894 | 5.738 |

Table 6.18: Accepted hypothesises related to Waste by time loss from regression test for three categories.

| **Variables** | **Metrics** | **Categories** | **Sig (p)** | **t-value** | **Beta** |
|---|---|---|---|---|---|
| RSS | Resource Stability & Reliability | *Struggling* | 0.062 | 1.980 | 0.647 |
| | | *Surviving* | 0.006 | 3.051 | 0.385 |
| EE2 | Delivery Speed | *Successful* | 0.044 | -2.147 | -0.498 |
| EE3 | Expertise Flexibility | *Successful* | 0.001 | 3.898 | 1.405 |
| CW4 | Customer Satisfaction Rate | *Surviving* | 0.008 | 2.931 | 0.445 |
| | | *Successful* | 0.008 | 2.930 | 0.869 |
| LD5 | Leadership Supports development | *Successful* | 0.001 | 3.833 | 0.732 |

Table 6.19: Accepted hypothesises related to Encourage Development from regression test for three categories.

| Variables | Metrics | Categories | Sig (p) | t-value | Beta |
|---|---|---|---|---|---|
| EE1 | Forecasting Production | *Successful* | 0.043 | -2.155 | -0.472 |
| EE2 | Delivery Speed | *Successful* | 0.001 | 3.806 | 0.809 |
| EE3 | Expertise Flexibility | *Successful* | 0.011 | 2.808 | 0.928 |
| CW4 | Customer Satisfaction Rate | *Successful* | 0.017 | -2.593 | -0.705 |
| LD1 | Employee appraisals | *Surviving* | 0.044 | 2.150 | 0.406 |

## 6.6 Chapter Summary

This chapter presented the tests performed in this study, including the correlation test, t-test, ANOVA test and regression, to examine the proposed model and the related hypotheses.

Analyses using t-test, ANOVA and regression examined whether the factors identified in this study had a statistically significant impact on SME performance. From these analyses, Resource Stability & Reliability, Forecasting Production, Delivery Speed, Expertise Flexibility, Customer Satisfaction Rate, Employee appraisals, and Leadership Supports Development play a major role in waste reduction and SME development. The category of a company has an effect on how these factors affect the performance. The performance of *Struggling* SMEs differed by number of effective factors from the other two categories. The charts in this chapter also show that there are differences between *Surviving* and *Successful* SMEs in terms of performance.

In addition, the model in this research was tested using regression analysis. The empirical findings indicate the important role of different factors in waste reduction and SME development. The findings reported in this thesis will be discussed in the following chapter.

# Chapter 7

# Validation and Discussion

## 7.1 Introduction

In chapter 6, a proposed model for manufacturing SMEs in the UK was investigated (Figure 7.1). The chapter also explored the relationship between selected CSFs. It was demonstrated that these relationships are different for the three categories of SMEs, *Successful*, *Surviving* and *Struggling*. This chapter presents the validation of the tested model, and discusses the results from data analysis, reported in chapters 5 and 6. The proposed framework will be reviewed. The PMS in chapter 3, is projected based on previous literature and data gathered during this research. The research aims to identify on which PMs, manufacturing SMEs should place emphasis to enhance their sustainability. CSFs for manufacturing SMEs and the most important measures to use are recommended. Figure 7.2 shows the PMS that emerged from the literature review. Discussion of interview data aims to validate the final framework. The interview responses of three directors of three SMEs are presented in Section 7.2.1. One Director was selected from each SMEs category: *Successful*, *Surviving* and *Struggling*. The discussion on the results of the model and the interviews is presented in the Section 7.3. Finally, section 7.4 concludes and summarises the chapter.

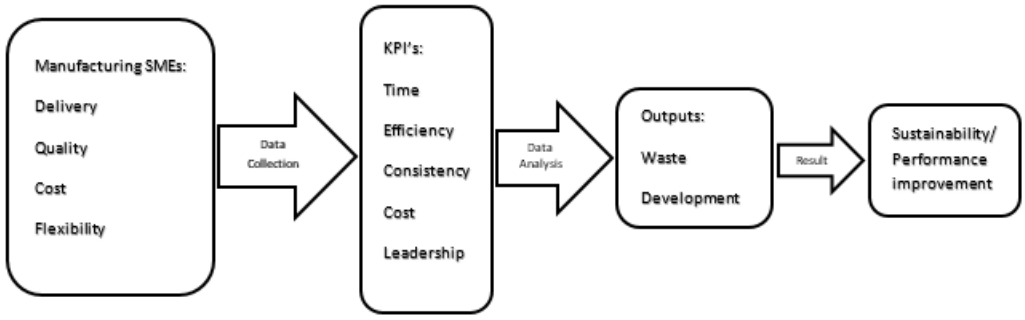



Figure 7.1: Conceptual framework for the study.

## 7.2 Validation of the Research Model

In order to validate findings of the study, semi-structured interviews were conducted. The purpose of conducting the interviews was to test the model developed, which was derived from data collected using the questionnaires. The questions asked in the interviews were related to those asked in the questionnaire, for example relating to waste and development of manufacturing SMEs (Appendix H).

The interviews were conducted with three managers of SMEs in UK. The managers were selected from different companies, one each from the three categories *Successful*, *Surviving* and *Struggling*. The interviews were conducted in June 2019 in UK. The duration of interviews was 1 to 2 hours.

The findings from the interviews were helpful in supporting the findings from the questionnaires. This resulted in increasing the validity of research. The following table shows the profile of interview participants. All are directors of their companies, and it can be seen that all managers are highly experienced in their fields, with 10 to 30 years of experience.

Table 7.1: Accepted hypothesises related to Encourage Development from regression test for three categories.

| Number | Manufacturing Category | Years of work experience | SME's Category | Number of employees | SME's Name |
|---|---|---|---|---|---|
| 1 | Wood industry | 20+ | *Struggling* | 3 | B |
| 2 | Wood industry | 11-20 | *Surviving* | 5 | J |
| 3 | Glass industry | 3-5 | *Successful* | 8 | A |

### 7.2.1 Validation Interviews Results

#### 7.2.1.1 Waste

All interviewees agree that waste is a very important tool for SMEs and it has an influence on companies' operations; this claim confirmed the findings from the literature review. Waste is therefore concluded to have an effect on performance of manufacturing SMEs. One interviewee stated that small companies should pay more attention to reduce their waste in all areas. One suggested that more investigation should be done regarding product default, as he thinks that product loss is their largest waste, which is costly for them. The importance of waste has been highlighted by the findings of both the literature review and from the interviews. For manufacturing SMEs to improve performance, it is important to reduce their waste either in the production or in the processes.

The results obtained from the survey questionnaire showed that Resource Stability and Reliability, Forecasting Production, Delivery Speed, Expertise Flexibility, Customer Satisfaction Rate and Leadership Supports Development have a positive influence on SME waste reduction.

- Resource Stability and Reliability

According to all interviewees, Resource Stability and Reliability has a positive effect on the waste of manufacturing SMEs. This is because if resources, such as employees and machinery, are reliable, less product and time is wasted. Thus, stability and reliability of resources have an effect on the waste by product and by time losses.

- Forecasting Production

Interviewees 1 and 2 agreed that improving forecasting production has positive effect on their waste. Smooth Forecasting Production allows SMEs to allocate sufficient time for the production and allows resources to perform their tasks in an efficient manner without producing waste, which therefore improves performance. However, interviewee 3 stated that he is not surprised by the result, because generally, forecasting production is well implemented in his company and employees do not feel too worried about this issue.

- Delivery Speed

Interviewee 1 claimed that he is not quite sure if the relationship between Delivery Speed and waste should be positive or negative. This could be because of the lack of awareness of employees regarding the significance of Delivery Speed. However, interviewees 2 and 3 (especially3), emphasised that Delivery Speed has a positive effect on waste. A higher rate of Delivery Speed demonstrates a higher rate of Defect Free Products, which is one indication of waste reduction.

- Expertise Flexibility

Interviewee 1 reported that Expertise Flexibility has no direct effect on the waste in manufacturing SMEs. Interviewees 2 and 3 claimed that Expertise Flexibility has a positive impact on the company performance. Overall, it can be seen that the Expertise Flexibility has direct association with the waste reduction in manufacturing SMEs.

- Customer Satisfaction Rate

Interviewees believed that Customer Satisfaction Rate is a fundamental measure for company income. Customer Satisfaction Rate increases are an indication that waste would be increased immediately. Hence, Customer Satisfaction Rate appears to be directly related to waste either by product or by time loss.

- Leadership Supports Development

Only interviewee 3 agreed that Leadership Supports Development has an effect on waste. He argued that development adoption and utilisation affect performance

because it can result in increasing ease of tasks and reducing the time needed; it also has a positive effect on Waste by Production Loss. The other two interviewees claimed that they are not quite sure if this relation should be positive or negative.

#### 7.2.1.2 Development

Interviewees agreed with the relationships resulting from the analyses and confirmed that development is very important for their companies. They reported that encouraging development assists SMEs to grow and helps them to increase their incomes. Therefore, encouraging development results in improving the performance of manufacturing SMEs. Interviewee 1 stated that development did not have a positive relationship for some operations, which is not surprising because SMEs, especially the *Struggling* ones, are not used to adapting with change. In general, Encouraging Development has a positive effect on SME performance because it assists not only by introducing new activities but also by improving existing tasks.

The results obtained from the survey questionnaire showed that Resource Stability and Reliability, Forecasting Production, Delivery Speed, Expertise Flexibility, Customer Satisfaction Rate and Employee appraisals all have positive influences on SME development.

- Forecasting Production

According interviewees 2 and 3, Forecasting Production has a direct effect on development encouragement, which will generate more income. Therefore, increase in success of Forecasting Production could result in enhancing the development of manufacturing SMEs.

- Delivery Speed

Interviewees 1 and 2 stated that Encouraging Development in an SME could not be associated with by Delivery Speed. If a company has a good delivery speed rate, it is expected to perform better than others. Delivery speed indicates how powerful a company is. Hence, SMEs with better delivery speeds perform better than SMEs with slower delivery speeds. However, Delivery Speed is not associated with Encourage Development.

- Expertise Flexibility

Interviewees 2 and 3agreed that having Expertise Flexibility gives an SME the opportunity of considering developments Therefore, Expertise Flexibility is assumed to be positively associated with Encourage Development of manufacturing SMEs. Therefore, in order to enhance development, it is important for SMEs to have Expertise Flexibility and see the potential for development.

- Customer Satisfaction Rate

All three interviewees believe that Customer Satisfaction Rate has no direct effect on SME development. According to the questionnaire findings, Customer Satisfaction Rate does not affect Encourage Development of *Struggling* or *Surviving* SMEs. However, interviewee 3 indicated that customer satisfaction has an indirect effect on their development.

- Employee Appraisals

According to two interviewees, Employee Appraisals have a positive effect on SME development. They stated that managers failing to consider Employee appraisals would negatively affect development encouragement. Interviewee 1 reported that the Employee Appraisals have no influence on encouraging development. He felt that this factor would be important after development had taken place.

### 7.2.2 Interviews Summary

The purpose of conducting the interviews was to test and/or support the findings of the questionnaire. Interviews were conducted with managers of manufacturing SME's in UK, one from each SME category type, *Successful*, *Surviving* and *Struggling*. The findings of the interviews supported the model, revealing that Resource Stability and Reliability, Forecasting Production, Delivery Speed, Expertise Flexibility, Customer Satisfaction Rate, Employee Appraisals, and Leadership Supports Development all have an effect on the performance of SMEs. Tables 7.2 and 7.3 compare the results of the model with the interview data,

regarding the positive effects of factors on waste and development, based on the SME categories.

Table 7.2: Categories comparison for accepted hypothesises related to Waste (by Product Loss and by Time Loss).

| Variables | Metrics | Model | interview |
|---|---|---|---|
| RSS | Resource Stability & Reliability | *Struggling, Surviving* | *Struggling, Surviving, Successful* |
| EE1 | Forecasting Production | *Struggling* | *Struggling, Surviving* |
| EE2 | Delivery Speed | *Successful* | *Surviving, Successful* |
| EE3 | Expertise Flexibility | *Successful* | *Surviving, Successful* |
| CW4 | Customer Satisfaction Rate | *Surviving, Successful* | *Struggling, Surviving, Successful* |
| LD5 | Leadership Supports development | *Successful* | *Successful* |

Table 7.3: Categories comparison for accepted hypothesises related to Encourage Development.

| Variables | Metrics | Model | Interview |
|---|---|---|---|
| EE1 | Forecasting Production | *Successful* | *Surviving, Successful* |
| EE2 | Delivery Speed | *Successful* | *Successful* |
| EE3 | Expertise Flexibility | *Successful* | *Surviving, Successful* |
| CW4 | Customer Satisfaction Rate | *Successful* | *Successful* |
| LD1 | Employee appraisals | *Surviving* | *Surviving, Successful* |

## 7.3 Discussion

Initially, 32 performance measurement items in the questionnaire were considered. However, after scaling and ANOVA analysis, the total number of metrics for model testing was reduced to 18 (see Table 7.4). The analysis revealed differences between performance of the SME categories. This section discusses the differences that can transform *Struggling* SMEs into *Successful* ones.

Table 7.4: Identified Critical Factors.

| **Competitive Priorities** | **Metrics** |
|---|---|
| Speed/Time | Resource Stability & Reliability |
| Effectiveness/ Efficiency | Forecasting Production |
| | Delivery Speed |
| | Expertise Flexibility |
| Consistency and Waste | Product Quality (Performance) |
| | Product Quality (Conformance) |
| | Defect Free Products |
| | Customer Satisfaction Rate |
| | Waste by Product loss |
| | Waste by Time loss |
| Leadership and Development | Employee appraisals |
| | Competitiveness |
| | Feedback Activities |
| | Leadership Supports development |
| | Focus of attention |
| | Knowledge Transfer |
| | Employee Training |
| | Encourage Development |

### 7.3.1 *Struggling* SMEs' Performance

In this context, resource stability and reliability are defined as a ratio of resource utilisation in the manufacturing process. The considered resources for this variable are machinery, employees and vehicles. There is some research on manufacturing that emphasises the key measures such as optimised production timetable (OPT). The time-related factor in this type of study is the cycle time (Wu, Qiao and Poon, 2014; Benavides and Landeghem, 2015). The findings in this study for *Struggling* SMEs reveal that Resource Stability and Reliability has a positive effect on reducing waste created by downtime, both scheduled and unscheduled (Figure 7.2). *Struggling* SMEs are in the stage of their performance when time management is the only factor that can reduce their Waste by Time Loss; the other factors do not play an important role for better performance in terms of their downtime production loss.

Similarly, in Figure 7.3, there is only one factor, Forecast Production, that affects waste increase created during production. This demonstrates that this type of SMEs might not be capable of default-free production without predicting their expected

orders. In addition, none of the measured factors has a significant effect on Development Encouragement. Thus, it can be concluded that this type of SMEs does not show any sensitivity to development. Encouraging development comes directly from the owner/manager of the small enterprise. Their experience, personality, skills and expectations have a direct influence on the business plans (Guo, Zhao and Tang, 2013). Many researchers (Mazzarol, Reboud and Soutar, 2009) have proved the positive effect of business plans on SME performance (Blackburn, Hart and Wainwright, 2013). Therefore, it can be concluded that the leadership in *Struggling* SMEs have ignored the potential of the development in their firms.

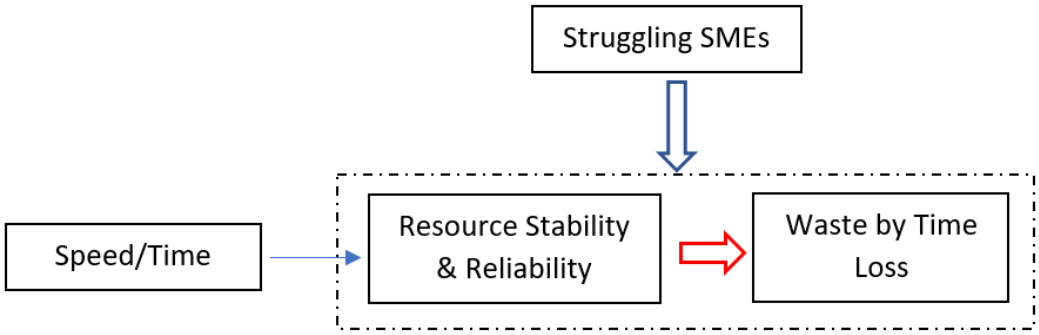



Figure 7.2: Accepted hypothesises related to Waste by Time Loss from regression test for *Struggling* SMEs.

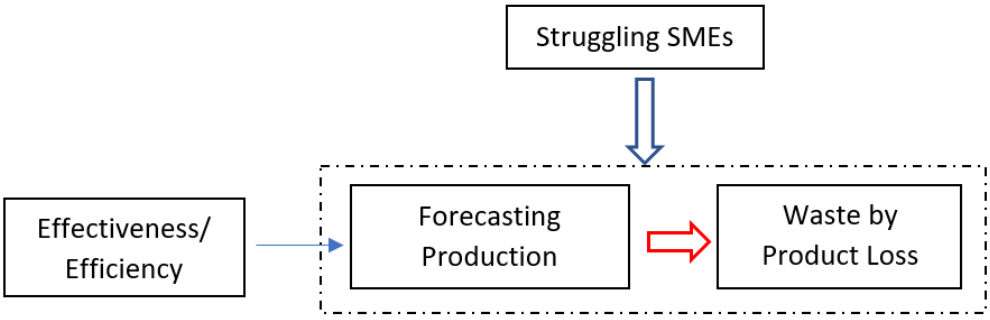



Figure 7.3: Accepted hypothesises related to Waste by Product Loss from regression test for *Struggling* SMEs.

### 7.3.2 *Surviving* SMEs' Performance

Similar to *Struggling* SMEs, for *Surviving* SMEs Resource Stability and Reliability has a positive effect on reducing waste created by downtime, both scheduled and unscheduled (Figure 7.4). This similarity indicates that the circumstances of the performance of *Surviving* are not far from those of *Struggling* SMEs, even though the *Surviving* SMEs are more stable in terms of business performance. This stability can be seen as the effect of Customer Satisfaction on the Waste by Time Loss. Previous research has shown that firms can have a successful growth when they have close contact with their customers (Feindt, Jeffcoate and Chappell, 2002); also, SMEs should be committed to the quality of their services and products (Bulak et al., 2016). Thus, it is essential for *Surviving* SMEs to maintain a good relationship with their customers to continue their successful growth. These positive connections will encourage the SMEs to develop functional business plans even for their downtimes.

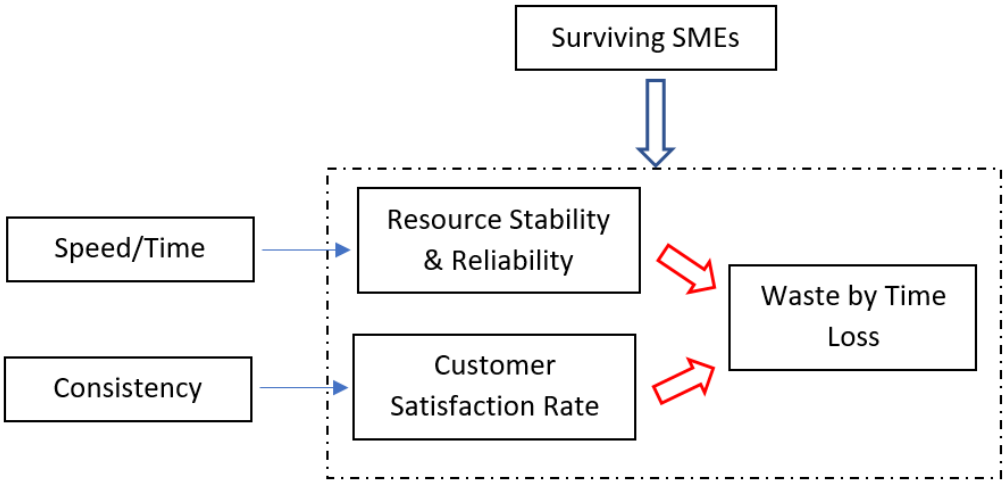



Figure 7.4: Accepted hypothesises related to Waste by Time Loss from regression test for *Surviving* SMEs.

Similarly, the leadership of enterprises should maintain a good relationship with their employees. It has been confirmed that Employee Appraisal has a positive effect on Encourage Development for *Surviving* SMEs (Figure 7.5). When employees are appreciated for their work, the organisation can encourage new action more confidently. This confidence is a reflection of the created commitment that is

essential for the success of *Surviving* SMEs (Valaei and Rezaei, 2017). The acceptance of new actions will affect the business plans and developments.

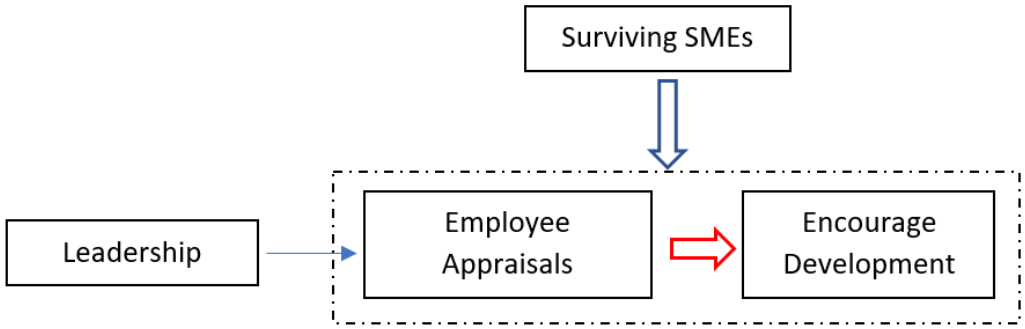



Figure 7.5: Accepted hypothesises related to Encourage Development from regression test for *Surviving* SMEs.

Finally, the positive impact of the waste reduction has been confirmed by many scholars (Hajmohammad et al., 2013; Tan, Smyrnios and Xiong, 2014a; Govindan et al., 2015; Sedehi, 2015). Therefore, it can be concluded that in order to continue to be successful, *Surviving* SMEs should consider the factors that lead to a decrease in waste created during the production process.

### 7.3.3 *Successful* SMEs' Performance

Unlike *Struggling* and *Surviving* SMEs, the data analysis for *Successful* SMEs revealed the impact of many factors on waste and development. Figure 7.6 shows that Resource Stability and Reliability and Expertise Flexibility have a significant relationship with Waste by Product Loss. The influence of these metrics on waste reduction during production was not detected for the other two SME categories. Lack of technical expertise has been identified as one of the main barriers for green manufacturing and waste reduction (Kaur et al., 2017). In the current investigation, it has been proved that the human resource expertise has a direct impact on reducing waste during the production process.

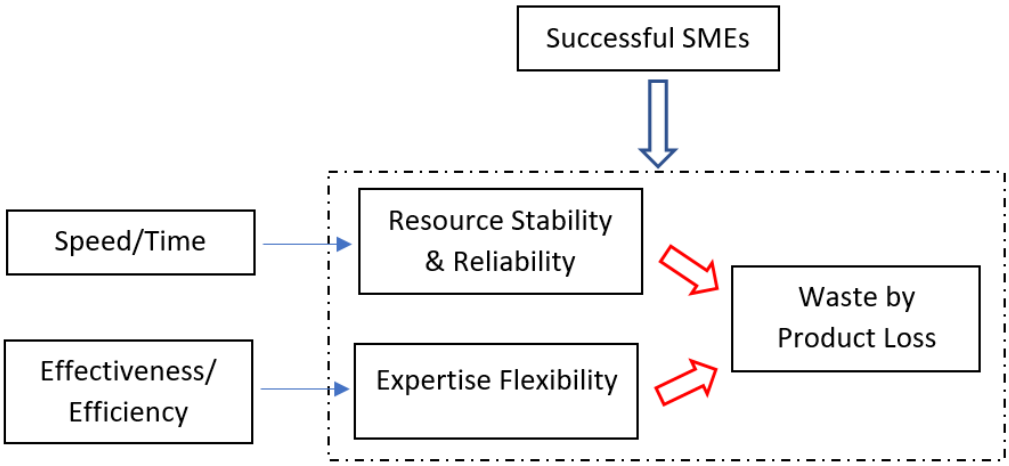



Figure 7.6: Accepted hypothesises related to Waste by Product Loss from regression test for *Successful* SMEs.

Figure 7.7 demonstrates that Delivery Speed, Expertise Flexibility, Customer Satisfaction Rate and Leadership Supports Development have a significant relationship with Waste by Time Loss. In terms of measured factors, no similarities have been found between *Struggling* SMEs and *Successful* SMEs. On the other hand, *Surviving* SMEs show some similarities with *Successful* SMEs. The results from both these SME types detected Customer Satisfaction as a positive factor to reduce the waste created by downtime, scheduled or unscheduled.

In addition, the time of delivery can be seen as a competitive priority for companies. Kaur et al. (2017) claim that on-time delivery of orders affects the customer satisfaction; this satisfaction will be beneficial in the business plans; hence the appropriate business plan will lead to reducing the waste created by downtime.

Another significant factor to reduce waste is when Leadership Supports Development. This means that managers pass employees' ideas to the upper levels of the organisation. This metric presents the relationship between the owner/manager and employees. Scholars (Asah, Fatoki and Rungani, 2015) claim that management skills are the leading factor in the success of a firm rather than technical skills (Bager et al., 2015). When managers take employees' ideas to the upper level, the employees will be motivated. Thus, this motivation will lead to their commitment resulting in desirable outcomes such as waste reduction.

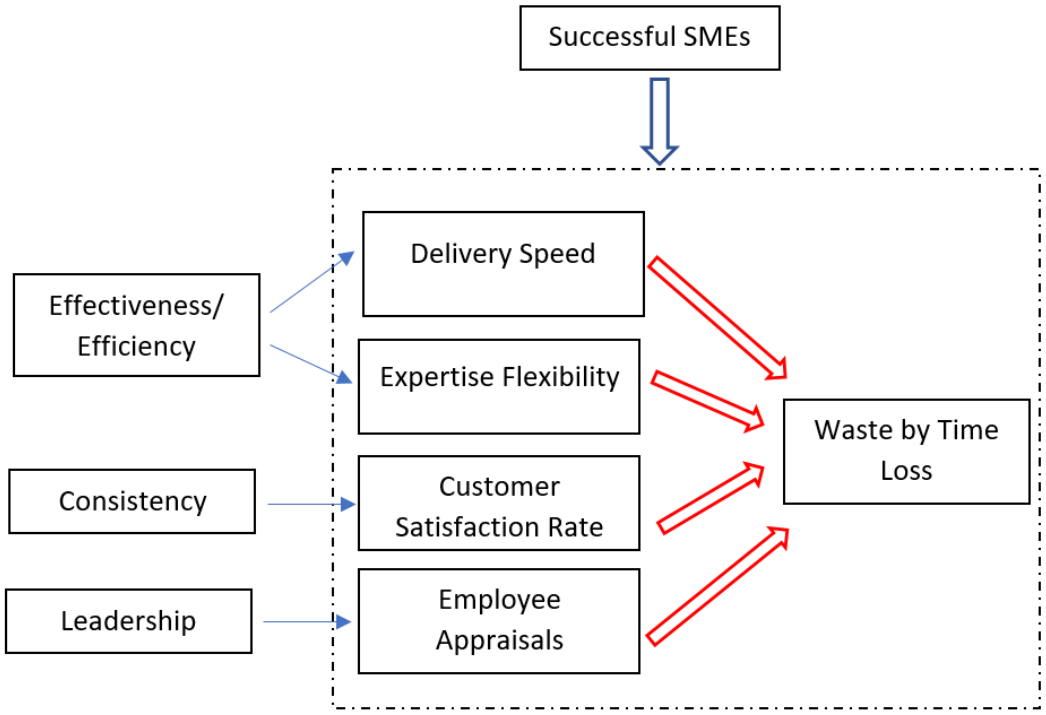



Figure 7.7: Accepted hypothesises related to Waste by Time Loss from regression test for *Successful* SMEs.

Figure 7.8 shows that Forecasting Production, Delivery Speed, Expertise Flexibility and Customer Satisfaction Rate have a significant relationship with Encourage Development. Similar to the Waste by Production Loss, the influence of these metrics on Encourage Development has not been detected for *Struggling* or *Surviving* SMEs.

Shirokova, Vega and Sokolova (2013) define an enterprise as being innovative when it constantly explores new ideas and new ways of doing business. Thus, in this context, Encourage Development is defined as encouraging new action by SMEs. This is a CSF for small businesses considering their lack of resources, specifically expertise. Koste and Malhotra (1999) found that employees' flexibility is one of the essential factors to enhance the performance of an enterprise. The variety of employees' expertise will allow the organisation to introduce new ideas and be innovative. On-time delivery, Customer Satisfaction and Forecast Production have a similar impact on Encourage Development.

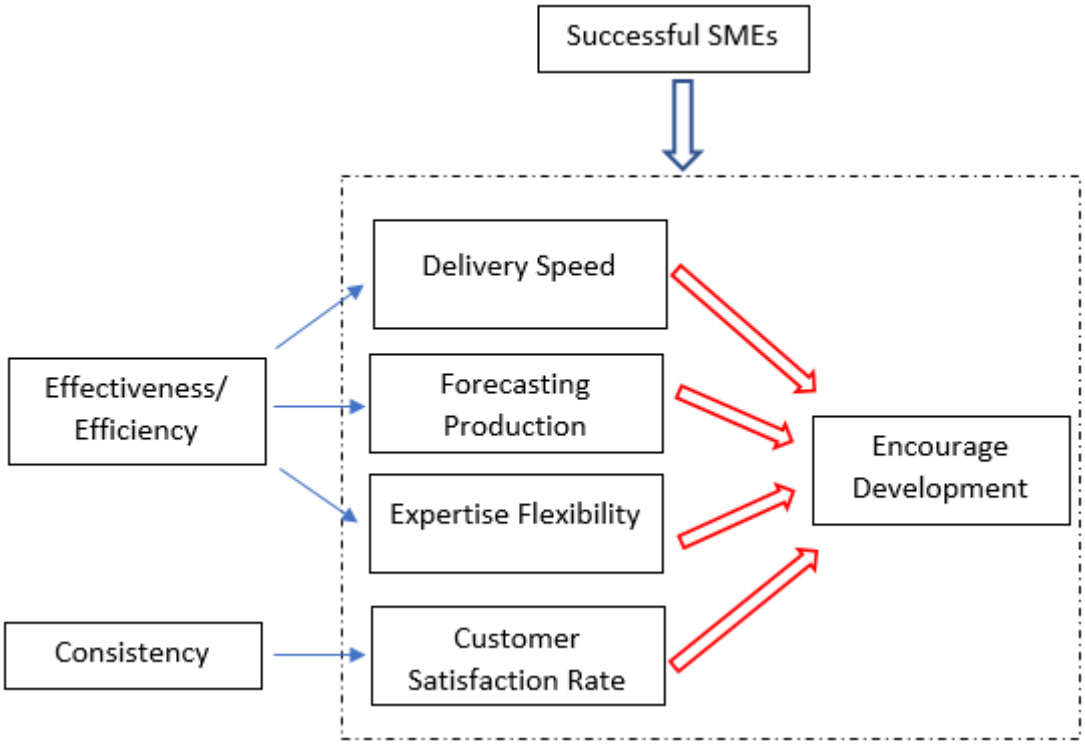



Figure 7.8: Accepted hypothesises related to Encourage Development from regression test for *Successful* SMEs.

### 7.3.4 The sustainability of SMEs

As discussed in section 2.6, sustainability is defined as an enterprises' capability to survive, adapt, and grow (Fiksel, 2006). Other researchers consider a firm as sustainable when it is not failing. In this study, SMEs have been classified into three groups. The *Surviving* and *Successful* enterprises are considered as sustainable; however, the *Struggling* ones are not sustainable. *Struggling* SMEs have not completely failed during the years of their operation, but still, they fail to adapt and grow especially when facing turbulent changes. Leite, Brazdil and Vanschoren (2012) claim that sustainability should be considered as a useful tool at a strategic level that can play the role of a 'trigger' for change in the PMS. In the current study, most of the *Struggling* companies have been in operation for more than five years. Although they have not completely failed and they are still active in the market, they are unlikely to be able to sustain their performance and growth in the long term (Ates

et al., 2013). The findings in this study show that *Successful* and *Surviving* SMEs are capable of creating opportunities through waste reduction and encouraging development. Especially, they seem to be able to discover innovative pathways for recovery and reduction of waste even with the lack of resources (Fiksel, 2006).

In addition, the comparison between the three categories reveals that the more sustainable SMEs are, the more sensitive they are about their business performance. Especially for the *Successful* businesses, all of the studied factors (Speed/Time, Effectiveness/ Efficiency, Consistency and Waste, Leadership and Development) have a significant influence on waste reduction and development. In contrast, the *Struggling* SMEs did not show much sensitivity to the factors, especially in terms of encouraging development. This fact emphasises the importance of management quality and leadership for SMEs (Berns et al., 2009; Timans et al., 2012).

Finally, this study is a practice, which tries to provide a framework for SME sustainability. Considering the above discussions, the proposed framework (Figure 7.1) is acceptable and assists with the successful growth of SMEs.

## 7.4 Chapter Summary

This chapter validated the results from the tested model using interviews. Interviews were conducted with managers of manufacturing SME's in the UK. The findings of the interview supported the model, and revealed that Resource Stability and Reliability, Forecasting Production, Delivery Speed, Expertise Flexibility, Customer Satisfaction Rate, Employee Appraisals, and Leadership Supports Development have an effect on the performance of SME's. The findings revealed differences between the performances of the categorised enterprises namely: *Struggling*, *Surviving*, and *Successful* SMEs. Moreover, it has been proved that the proposed framework is acceptable and assists with the successful growth of SMEs. The following chapter will conclude on the study by highlighting the findings, limitations and assumptions of the study, and provide recommendations for future research.

# Chapter 8

# Conclusions and Recommendations for Future Work

## 8.1 Introduction

Review of the literature showed that not every PMS fits every SME's business model. Performance of an SME has many dimensions, such as human resources, finance, quality and customer satisfaction. Further, various performance dimensions call for different methods of measurement. For instance, customer satisfaction requires customer surveys, whereas cost performance can be measured through an existing accounting system. Additionally, some of the dimensions are measured through quantitative data, whereas others are qualitative in nature.

It was concluded from the literature review that design and implementation of an effective PMS would require a wide range of inputs from several dimensions. The focus of this study was therefore trimmed to support the development of such a holistic model using a method that could identify and report the key requirements.

## 8.2 Summary of Research Findings

The wide gap between SMEs' sustainability and their business performance was evident in the manufacturing sector of the UK. The created PMS considered the measurement of factors concluded (from the literature review) to have an impact on the sustainability of SMEs. The selected SMEs were classified based on their

profitability into three groups namely: *Struggling*, *Surviving* and *Successful*. The studied factors in this research were Speed/Time, Effectiveness/Efficiency, Consistency and Waste, and Leadership and Development, aiming to consider a wide range of factors that affect SMEs' performance.

In general, the directors of these small enterprises were of the view that the proposed framework may be useful in enhancing the sustainability of manufacturing SMEs in the UK. From early on in the study, the owner/managers who participated in the research had a few concerns that were taken to account. Some expected that the proposed framework could be adopted for practice; however, some felt that the framework should be amended to meet each SME's unique circumstances. For this purpose, the researcher examined a wide variety of metrics to avoid missing any related circumstances, which might impact on performance. After implementing these changes, some participants mentioned that the PMS had too many items and may not be easy to use in practice. The appropriate changes were made to the PMS and Excel data collection tool (questionnaire) to solve this issue and make it possible for owner/managers to respond to the requests in a practical way.

In addition, differences between the core objectives of PM, concerning manufacturing SMEs in UK, were put forward by all those who participated in this study. While *Successful* SMEs' primary concern was to improve development and waste reduction simultaneously, the main purpose of the *Struggling* firms in the sector was to focus on only time-related factors to reduce waste.

In general, the *Successful* SMEs have an edge when it concerns waste and development as compared to the *Surviving* and *Struggling* SMEs. For the *Successful* businesses, all the studied factors (Speed/Time, Effectiveness/Efficiency, Consistency and Waste, Leadership and Development) have a significant influence on waste reduction and development. In contrast, the Struggling SMEs did not show much sensitivity to the factors, especially for Encouraging Development. Similarly, concerning the evaluation and measurement of KPIs for the manufacturing SMEs, there was a gap in all three categories. The *Successful* enterprises put more emphasis than *Surviving* and *Struggling* SMEs on KPIs, which affected overall performance of their firm. The following are the research findings from regression analysis and model validation.

*Struggling* SMEs:

- With Beta 0.434, Forecast Production made a significant contribution to Waste by Product Loss.
- With Beta 0.647, Resource Stability and Reliability made a significant contribution to Waste by Time Loss.
- All variables had no significant relationships with Encourage Development.

*Surviving* SMEs:

- All variables had no significant relationships with Waste by Product Loss.
- With Beta 0.385, Resource Stability and Reliability made the strongest contribution to Waste by Time Loss. Thus, this waste was significantly affected by Customer Satisfaction Rate.
- With Beta 0.406, Employee Appraisals made a significant contribution to Encourage Development.

*Successful* SMEs:

- With Beta 0.894, Waste by Product Loss was strongly supported by Expertise Flexibility. Thus, Resource Stability and Reliability had a positive impact on this type of waste.
- With Beta 0.732, the Waste by Time Loss was heavily impacted by Leadership Supports Development. Leadership Supports Development along with Delivery Speed, Expertise Flexibility and Customer Satisfaction Rate had a significant impact on the Waste by Time Loss. The $R^2$ for these factors was 75%.

  With Beta 0.809, Encourage Development was heavily impacted on by Delivery Speed. Delivery Speed along with Expertise Flexibility, Customer Satisfaction Rate and Forecasting Production had a significant impact on Encourage Development. The $R^2$ for these factors was 79%.

This study identified criteria for PM in UK manufacturing SMEs and condensed them into a practical holistic PMS that can be used to reasonably evaluate the performances of SME's within the manufacturing sector. The presented framework attempts to recognise existing activities as well as their influence on PM. Following

the literature review, advantages and disadvantages of existing PMS models were identified. The main effective factors were condensed into an effective model which was validated in practice.

## 8.3 Research Contribution to Knowledge

This research has made four main contributions to knowledge in the field:

1. The research has developed a holistic PMS for real time data collection, which is rare for SMEs and mostly only implemented for large companies.
2. A practical approach to support further PMS monitoring in SMEs has been tested and found practical in use.
3. A new combination of variables and their relationships for SMEs has been researched.
4. A classification technique has been developed for reflecting SME sustainability.

## 8.4 Achieving the Research Objectives

The objectives of this investigation were achieved through two approaches. First, a comprehensive and critical review of related literature provided a thorough understanding of the background of PM and manufacturing. Secondly, field research developed and examined a conceptual framework of performance measures for manufacturing, along with their sustainability. The presented research process empirically confirmed the factors that influence success or failure of manufacturing SMEs. The following portrays how the objectives of the study were achieved.

The first objective is reported in chapters 2 and 3 and was achieved through a comprehensive literature review, particularly regarding three main areas: performance management, manufacturing SMEs and their sustainability.

The second and third objectives were achieved by conducting a critical review of the existing research on success and failure of manufacturing SMEs, as presented in detail in chapters 2 and 3.

The fourth objective was achieved by carrying out questionnaires and interviews with managers of manufacturing SMEs in the UK; this research is presented in chapter 4.

The fifth objective was accomplished by employing analytical tools offered by SPSS software to calculate descriptive statistics with regards to PM metrics, as presented in chapters 5 and 6.

The final two objectives were achieved by carrying out interviews to evaluate the presented model, and discussion to find the relationship amongst the classified SMEs based on their sustainability (*Successful*, *Surviving*, and *Struggling*); the findings are presented in chapter 7.

Through the objectives described above, the following research questions have been addressed and studied concerning manufacturing SMEs' performance in the UK, along with factors influencing their sustainability. If SMEs understand these factors, they can easily enhance their performance and operations:

**Research question 1**: What aspects of manufacturing SMEs have the greatest influence on their performance? For recognising what factors have the greatest influences on the SMEs' performance, the review of the literature along with the SMEs' classifications were studied in chapter 2 and 3. To answer this question, a conceptual framework has been developed. The framework is based on four components, i.e. delivery (which includes speed/time and effectiveness/efficiency), quality (which includes waste, consistency and customer satisfaction), flexibility (which includes leadership and development) and cost.

**Research question 2**: What level of influence do the CSFs have on the firm's sustainability? An analytical investigation using ANOVA was carried out to understand this particular question as examined in chapter 5. The chapter summarises the ANOVA results between the three SME categories. The level of influence of CSFs on three categories is demonstrated on table 5.7.

**Research question 3**: To what extent do waste and development influence SMEs? The model testing of the presented framework included the influence of factors such as waste and development. A detailed account of this can be viewed in chapter 6. The findings show that more success is encountered with more factors involved. For Struggling SMEs, only two variables have a significant effect on waste and development. However, the number of effective variables increases to three for Surviving and to ten for Successful SMEs.

**Research question 4**: What are the characteristics of manufacturing SMEs' in the UK in terms of their success? The review of the literature along with the descriptive analysis presented in this study, identified the difference between influential factors for *Successful*, *Surviving* and *Struggling* SMEs, as presented in detail in chapters 6 and 7. The findings revealed differences between the performances of the categorised enterprises namely: Struggling, Surviving, and Successful SMEs. Moreover, it has been proved that the proposed framework is acceptable and assists with the successful growth of SMEs.

## 8.5 Limitations and Assumptions of the Study

In every study, there are limitations, however well the researcher considers all aspects of the subject, expending their best efforts and time. This research holds several limitations and assumptions. However, these limitations are not considered to have a significant effect on the research findings. Restrictions of this study include:

- The study was restricted to UK SMEs to reduce the cost of gathering data. The enterprises included in the study were those in the manufacturing sector specialising in wood, glass, metal, food and plastic. As the research focused on developing a PMS for manufacturing SMEs in developed countries, it needs to be customised to fit other economical environments (i.e. underdeveloped countries) and specific processes (e.g. retail).
- The collected data are considered cross-sectional rather than longitudinal with both dependent and independent variables being measured

simultaneously. This type of data collection is well accepted in similar research; however, it has the limitation of not being able to identify cause-and-effect relationships among studied variables. The collected data from respondents may not reflect PM practices of their enterprises over time. Also, the respondents' predisposition regarding any economic or social event or even their mental position at the time of study may have influenced their response to the self-reported questionnaires. However, the holistic data collection approach might have helped to detect any irregularities in the collected data, to minimise this risk.

- This study developed mixed methods: the holistic data collection, which was a quantitative approach and model validation by interviews, a qualitative approach. The limited resources made a quantitative approach more practical; however, the interviews provided a more detailed study of the research to complement and validate the quantitative work. The reliability test and data validation have proved that the study collected sufficient data for the analysis and to answer the research questions.
- The average net profit margin was used to classify the SMEs under study and determine their sustainability. It’s possible that SMEs did not regularly prepare financial records. To reduce the chance of collecting inaccurate data, the researcher collected a large number of financial data to examine the accuracy of this essential variable.

Besides the above limitations, there are two assumptions in this study. First, it is assumed that the SMEs have given accurate information. The owner/managers of these firms were assured that their information would be kept confidential, and their participation was voluntary. This would hopefully reduce the risk of inaccuracy of the collected data from SMEs, for example if owner/managers wanted to portray their data as better than it actually was. The second assumption relates to the SME approach towards sustainability of their firms. The directors of the SMEs, involved in this research, are the ones who define the enterprises' goals to run profitable firms.

Finally, this investigation has introduced a new design of PMS for manufacturing SMEs in a developing country, but requires more consideration. The presented ideas and study have been generated from in-depth research on 10 case studies. The total number of the questionnaires collected for the main study was 118. The researcher

does not attempt to claim that the findings can be generalised to wider economic groups, such as undeveloped counties; however, this research tries to reveal new opportunities and could be defined as an emergent method for these areas of study. The findings of this research have proven valuable to the case studies and the outcome of the model is useful to the SMEs' sustainability. The outcome of this investigation is a framework that will support the sustainability of manufacturing SMEs. The presented model has been validated by interviews, but the implementation of the framework by SMEs is beyond the scope this research.

## 8.6 Recommendations for Future Research

In conclusion, the design and implementation of an effective PMS requires a wide range of inputs from several dimensions. The dynamic nature of the key parameters in the success of SMEs allows for a PMS to leave space for flexible formulation of the KPIs as well as setting the key inputs to be measured.

The current study provides a platform from which to develop a dynamically adaptable PMS; it will serve as a generic paradigm to quantitatively compute and evaluate KPIs. Future research is expected to generate effective clarification for SMEs to enable them to plan based on the most efficient PMS for their contexts. The number of KPIs is usually few and they represent parameters usually useful for decision making about the reconfiguration of processes and layouts to improve KPIs. Usually, a few (perhaps one or two) KPIs suffice to report on the overall performance of the processes being monitored. The measure of waste and development of SMEs through the implementation of the developed PMS should be among the main measures to support success. However, further work on similar modelling will enable SMEs to switch between the use of a wide range of inputs, input data collection methods, PMSs, and finally performance measures or KPIs.

This study supported the achievement of a holistic model through an approach to identify and report the key requirements of the model for sustainability. The selection of the input variables may differ based on the SME's needs, and later work can develop a tool to collect the requested data holistically and support a dynamic

PMS, allowing choice of the factors for monitoring. Development of an online system would allow SME owner/managers to enter data (related to their performance) monthly or weekly or even daily, and get immediate real time feedback on performance.

# References

Abor, J. and Quartey, P. (2010) 'Issues in SME development in Ghana and South Africa', *International Research Journal of Finance and Economics*, 39(6), pp. 215-228.

Adams, C. A. and Frost, G. R. (2008) 'Integrating sustainability reporting into management practices', *Accounting Forum*, 32(4), pp. 288-302. doi:10.1016/j.accfor.2008.05.002.

Adams, C. A. and McNicholas, P. (2007) 'Making a difference: Sustainability reporting, accountability and organisational change', *Accounting, Auditing and Accountability Journal*, 20(3), pp. 382-402.

Ahmad, M. M. and Alaskari, O. (2014) 'Development of assessment methodology for improving performance in SME's', *International Journal of Productivity and Performance Management*, 63(4), pp. 477-498.

Ahmad, N. M. and Seet, P. S. (2009) 'Understanding business success through the lens of SME founder-owners in Australia and Malaysia', 1(1), pp. 72-87.

Ahmad, N. H., Wilson, C. and Kummerow, L. (2011) 'Assessing the Dimensionality of Business Success: The Perspectives of Malaysian SME Owner-Managers', *Journal of Asia-Pacific Business*, 12(3), pp. 207-224.

Ahmed, S. and Sun, H. (2012) 'Developing a Model for Managing Production Performance of Small and Medium Enterprises in Sweden', Doctor of Philosophy, Linne University.

Akpabot, S. and Khan, Z. (2015) 'Assessing the impact of performance measurement systems in northern Nigeria small businesses', *European Scientific Journal*, 11(4), pp. 263-279.

Al-Ansari, Y., Pervan, S. and Xu, J. (2013) 'Innovation and business performance of SMEs: the case of Dubai', *Education, Business and Society: Contemporary Middle Eastern Issues*, 6(3/4), pp. 162-180.

Aldrich, H. E. and Cliff, J. E. (2003) 'The pervasive effects of family on entrepreneurship: Toward a family embeddedness perspective', *Journal of business venturing*, 18(5), pp. 573-596.

References

Alfaro, J., Ortiz, A. and Poler, R. (2007) 'Performance measurement system for business processes', *Production Planning & Control*, 18(8), pp. 641-654.

Al-Matari, E. M., Al-Swidi, A. K. and Fadzil, F. H. B. (2014) 'The Measurements of Firm Performance's Dimensions', *Asian Journal of Finance & Accounting*, 6(1) pp. 24-49.

Almomani, M. A., Abdelhadi, A., Mumani, A., Momani, A. and Aladeemy, M. (2014) 'A proposed integrated model of lean assessment and analytical hierarchy process for a dynamic road map of lean implementation', *International Journal of Advanced Manufacturing Technology*, 72 (1-4), pp. 161-172.

Ambastha, A. and Momaya, K. S. (2005) 'Technology management and competitiveness: is there any relationship?', *International Journal of Technology Transfer and Commercialisation*, 4(4). doi: 10.1504/IJTTC.2005.006702.

Amir, A. M. (2011) 'The indirect effects of PMS design on Malaysian service firms' characteristics and performance', *Asian Review of Accounting*, 19(1), pp 31-49.

Amir, A. M., Auzair, S. M. and Ismail, Z. (2014) 'Integrated Performance Measurement System in Small and Medium Enterprises: The Role of Leadership and Decision-Making Style', *Asian Journal of Accounting and Governance*, 5, pp. 47-56.

Anderson, B., Henriksen, B. and Aarseth, W. (2006) 'Holistic performance management: an integrated framework', *International Journal of Productivity and Performance Management*, 55 (1/2), pp. 61-78.

Annual manufacturing report (2017). Available at: http://www.themanufacturer.com/wp-content/uploads/2017/01/Annual-Manufacturing-Report-2017-Final-Version.pdf (Accessed: 16 July 2019).

Antony, J. P. and Bhattacharyya, S. (2010) 'Measuring organizational performance and organizational excellence of SMEs – Part 2: an empirical study on SMEs in India', *Measuring Business Excellence*, 14(3), pp: 42-52.

Arasti, Z., Zandi, F. and Talebi, K. (2012) 'Exploring the effect of individual factors on business failure in Iranian new established small businesses', *International Business Research*, 5(4), pp. 2-11.

Argyropoulou, M., Sharma, M. K., Bhagwat, R., Lazarides, T., Koufopoulos, D.N. and Ioannou, G. (2010) *Measuring supply chain performance in SMEs*. Handbook on Business Information Systems, World Scientific Publishing Co. Pte. Ltd., Singapore, pp. 699-715.

References

Asadi, A., Alsubaey, M. and Makatsoris, C. (2015) 'A machine learning approach for predicting delays in construction logistics', International Journal of Advance Logistics, 4, pp. 113-115.

Asah, F., Fatoki, O. O. and Rungani, E. (2015) 'The impact of motivations, personal values and management skills on the performance of SMEs in South Africa', *African Journal of Economic and Management Studies*, 6(3), pp. 308-322.

Ates, A., Garengo, P., Cocca, P. and Bititci, U. (2013) 'The development of SME managerial practice for effective performance management', *Journal of Small Business and Enterprise Development*, 20(1), pp: 28-54.

Atkinson, A. A., Waterhouse, J. H. and Wells, R. B. (1997) 'A stakeholder approach to strategic performance measurement', *Sloan Management Review*, 38(3), pp. 25-38.

Avella, L., Vazquez-Bustelo, D. and Fernandez, E. (2011) 'Cumulative manufacturing capabilities: an extended model and new empirical evidence', *International Journal of Production Research*, 49(3), pp. 707-729.

Awwad, A. S., Al-Khattab, A. A. and Anchor, J. R. (2013) 'Competitive priorities and competitive advantage in Jordanian manufacturing', *Journal of Service Science and Management*, 6(1), pp. 69-79.

Azmat, F. and Samaratunge, R. (2013) 'Exploring customer loyalty at bottom of the pyramid in South Asia', *Social Responsibility Journal*, 9(3), pp. 379-394.

Azzone, G., Masella, C. and BerteleA´, U. (1991) 'Design of performance measures for time-based companies', *International Journal of Operations & Production Management*, 11(3), pp. 77-85.

Bager, T. E., Jensen, K. W., Nielsen, P. S. and Larsen, T. A. (2015) 'Enrolment of SME managers to growth-oriented training programs', *International Journal of Entrepreneurial Behavior & Research*, 21(4), pp. 578-599.

Bahri, M., St-Pierre, J. and Sakka, O. (2011) 'Economic value added: a useful tool for SME performance management', *International Journal of Productivity and Performance Management*, 60(6), pp. 603-621.

Bakås, O., Govaert, T. and Van Landeghem, H. (2011) 'Challenges and success factors for implementation of lean manufacturing in European SMEs', *MITIP*, Norwegian University of Science and Technology, Trondheim, Norway.

References

Bansal, P. (2005) 'Evolving sustainably: a longitudinal study of corporate sustainable development', *Strategic Management Journal*, 26(3), pp. 197-218.

Bansal, P. and Roth, K. (2000) 'Why Companies Go Green: A Model of Ecological Responsiveness', *Academy of Management Journal*, 43(4), pp. 717-736.

Baporikar, N., Nambira, G. and Gomxos, G. (2016) 'Exploring factors hindering SMEs' growth: evidence from Namibia', *Journal of Science and Technology Policy Management*, 7(2), pp. 190-211.

Baregheh, A., Rowley, J. and Sambrook, S. (2009) 'Towards a multidisciplinary definition of innovation', *Management Decision*, 47(8), pp. 1323-1339.

Barnabe, F. (2011) 'A system dynamics-based balanced scorecard to support strategic decision making', *International Journal of Productivity and Performance Management*, 60(5), pp. 446-473.

Barnes, M., Dickinson, T., Coulton, L., Dransfield, S., Field, J., Fisher, N., Saunders, I. and Shaw, D. (1998) 'A New Approach to Performance Measurement for Small to Medium Enterprises', *Performance Measurement – Theory and Practice (Conference Proceedings)*, 1, Cambridge University, Cambridge, pp. 86-92.

Bartunek, J. M. and Spreitzer, G. M. (2006) 'The Interdisciplinary Career of a Popular Construct Used in Management Empowerment in the Late 20th Century', *Journal of Management Inquiry*, 15(3), pp. 255-273.

Bassioni, H. A., Price, A. D. F. and Hassan, T. M. (2005) 'Building a conceptual framework for measuring business performance in construction: An empirical evaluation', *Construction Management and Economics*, 23(5), pp. 495-507.

Bayraktar, S. (2015) 'New regulations: challenge or opportunity for Turkish SMEs?', *Qualitative Research in Financial Markets*, 7(2), pp. 173-190.

Benavides, M. B. and Landeghem, V. H. (2015) 'Implementation of S-DBR in four manufacturing SMEs: a research case study', Production Planning & Control, 26(13), pp. 1110-1127.

Berko, O. D, Ashie, A. and Kodjo, K. E. (2016) 'The propensity to participate in formal training programmes: Evidence from small and medium-sized enterprises (SMEs) in Ghana', *World Journal of Entrepreneurship, Management and Sustainable Development*, 12(4), pp. 344-358.

References

Berns, M., Townend, A., Khayat, Z. and Balagopal, B. (2009) 'The Business of Sustainability: What It Means to Managers Now', *MIT Sloan Management Review*, 51(1), pp. 20-26.

Bhagwat, R. and Sharma, M. K. (2007) 'Performance measurement of supply chain management: A balance scorecard approach', *Computers and Industrial Engineering*, 53(1), pp. 43-62.

Bhandari, S. B. and Iyer, R. (2013) 'Predicting business failure using cash flow statement based measures', *Managerial Finance*, 39(7), pp. 667-676.

Bhasin, S. (2012) 'Prominent obstacles to lean', *International Journal of Productivity and Performance Management*, 61(4), pp. 403-425.

Bhimani, A. (1994) 'Monitoring performance measures in UK manufacturing companies', *Management Accounting*, 72(1), pp. 32-37.

Biggart, T. B., Burney, L. L., Flanagan, R. and Harden, J. W. (2010) 'Is a Balanced Scorecard Useful in a Competitive Retail Environment?', *Management Accounting Quarterly*, 12(1), pp. 1-12.

Bititci, U. (1994) 'Measuring Your Way to Profit', *Management Decision*, 32(6), pp. 16-24.

Bititci, U. S., Carrie, A. S. and McDevitt, L. (1997) 'Integrated performance measurement systems: a development guide', *International Journal of Operations and Production Management*, 17, pp. 522–534.

Bititci, U. S., Nudurupati, S. S., Turner, T. J. and Creighton, S. (2002) 'Web Enabled Performance Measurement Systems - Management Implications', *International Journal of Operations & Production Management*, 22(11), pp. 1273-1287.

Bititci, U. S., Trevor, T. and Begemann, C. (2000) 'Dynamics of performance measurement systems', *International Journal of Operations & Production Management*, 20(6), pp. 692-704.

Blackaby, D. (2018) 'The UK Economy and Brexit', chapter in: *Emerging Markets from a Multidisciplinary Perspective*, pp.37-45.

Blackburn, R. A., Hart, M. and Wainwright, T. (2013) 'Small business performance: business, strategy and owner-manager characteristics', *Journal of Small Business and Enterprise Development*, 20(1), pp. 8-27.

References

Blackford, M. G. (2003) *A history of small business in America*. Chapel Hill: University of North Carolina Press.

Blackstone, J. H. Jr., and Cox, J. F. (2005) *APICS: The association for operations management*. APICS Dictionary, 11th ed., 38.

Blaikie, N. (2000) *Designing Social Research*. Cambridge: Polity Press.

Blumberg, B., Cooper, D. R. and Schindler, S. (2008) *Business Research Methods*. 2nd European edn. London: McGraw-Hill Higher Education.

Blumberg, B. F. and Letterie, W. A. (2008) 'Business starters and credit rationing', *Small Business Economics*, 30(2), pp. 187-200.

Boiral, O. (2013) 'Sustainability reports as simulacra? A counter-account of A and A+ GRI reports', *Accounting, Auditing & Accountability Journal*, 26(7), pp. 1036-1071.

Bourne, M. (2001) *Implementation Issues*. Hand Book of Performance Measurement, GEE Publishing Ltd., London.

Box, M. (2007) 'The death of firms: exploring the effects of environment and birth cohort on firm survival in Sweden', *Small Business Economics*, 31(4), pp. 379-393.

Boyer, K. and Pagell, M. (2000) 'Measurement issues in empirical research: improving measures of operations strategy and advanced manufacturing technology', *Journal of Operations Management*, 18(3), pp. 361-374.

Braimah, N. (2008) 'An investigation into the use of construction delay and disruption analysis methodologies', Doctor of Philosophy, University of Wolverhampton, UK.

Brem, A., Kreusel, N. and Neusser, C. (2008) 'Performance measurement in SMEs: literature review and results from a German case study', *International Journal of Globalization and Small Business*, 2(4), pp. 411-27.

Bremser, W. G. and White, L. F. (2000) 'An experiential approach to learning about the balanced scorecard', *Journal of Accounting Education*, 18, pp. 241-255.

Bridge, S., O'Neill, K. and Cromie, S. (1998) 'Small Business Categories and Variations', *Understanding Enterprise, Entrepreneurship and Small Business*, Palgrave Macmillan, UK, pp. 101-135.

References

British Standards Institution (BSI) (2014) UK SME Landscape and Standardization Research. Available at: https://www.bsigroup.com/Global/BSI%20UK%20SME%20Landscape%20Report%20-%20Stage%201.pdf (Accessed: 2 August 2019).

Brown, M. (1996) *Keeping Score: Using the Right Metrics to Drive World Class Performance*. Quality Resources, New York, NY.

Browne, M. (1984) 'Asymptotically distribution-free methods for the analysis of covariance structures', *British Journal of Mathematical and Statistical Psychology*, 37(1), pp. 62-83.

Brouthers, K., Andriessen, F. and Nicolaes, I. (1998) 'Driving blind: strategic decision-making in small companies', *Long Range Planning*, 31(1), pp. 130-138.

Bryman, A. and Bell, E. (2007) *Business Research Methods*. 2nd edn. Oxford: Oxford University Press.

Bulak, M. E. and Turkyilmaz, A. (2014) 'Performance assessment of manufacturing SMEs: a frontier Approach', *Industrial Management & Data Systems*, 114(5), pp. 797-816.

Bulak, M. E., Turkyilmaz, A., Satir, M., Shoaib, M. and Shahbaz, M. (2016) 'Measuring the performance efficiency of Turkish electrical machinery manufacturing SMEs with frontier method', *Benchmarking: An International Journal*, 23(7), pp.2004- 2026.

Buonanno, G., Faverio, P., Pigni, F., Ravarini, A., Sciuto, D. and Tagliavini, M. (2005) 'Factors affecting ERP system adoption: A comparative analysis between SMES and large companies', *Journal of Enterprise Information Management*, 18(4), pp. 384-426.

Burns, P. and Dewhurst, J. (1996) *Small Business And Entrepreneurship*. 2nd Edn. Macmillan Press, London.

Business population estimates (BIS) (2015). Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/ (Accessed: 1 December 2018).

Cabral, I., Grilo, A. and Cruz-Machado, V. (2012) 'A decision-making model for lean, agile, resilient and green supply chain management', *International Journal Production Research*' 50(17), pp. 4830-4845.

References

Cantner, U., Meder, A. and Ter Wal, A. (2010) 'Innovator networks and regional knowledge base', *Technovation*, 30(9-10), pp. 496-507.

Caplice, C. and Sheffi, Y. (1995) 'A Review and Evaluation of Logistics Performance Measurement Systems', *The International Journal of Logistics Management*, 6(1), pp. 61-74.

Carless, S. A. (2004) 'Does psychological empowerment mediate the relationship between psychological climate and job satisfaction?', *Journal of Business and Psychology*, 18(4), pp. 405-425.

Carlucci, D., Marr, B. and Schiuma, G. (2004) 'The knowledge Value Chain: How Intellectual Capital Impacts of Business Performance', *International Journal of Technology Management*, 27(6), pp. 575-590.

Carneiro, A. (2008) 'When leadership means more innovation and development', *Business strategy series*, 9(4), pp. 176-184.

Carpinetti, L. C., Galda´mez, E. V. C. and Gerolamo, M. C. (2008) 'A measurement system for managing performance of industrial clusters. A conceptual model and research cases', *International Journal of Productivity and Performance Management*, 57(5), pp. 405-19.

Carter, S. and Jones-Evans, D. (2006) *Enterprise and Small Business: Principles, Practice and Policy*. Harlow: Pearson Education UK.

Carton, R. B. (2004) 'Measuring organizational performance: an exploratory study', Doctor of Philosophy, Athens, Georgia, USA.

Chan, F. T., Li, N., Chung, S. H. and Saadat, M. (2017) 'Management of Sustainable Manufacturing Systems-a Review on Mathematical Problems', *International Journal of Production Research*, 55 (4), pp. 1210-1225.

Chandler, G. and Hanks, S. (1993) 'Measuring the performance of emerging businesses: A validation study', *Journal of Business Venturing*, 8(5), pp. 391-408.

Chen, S. C. and Lee, A. H. I. (2010) 'Performance Measurement of SMEs' Employees by Fuzzy Multi-Criteria Decision Theory', *International Symposium on Computer*, pp: 110-113.

Chen, G., Gully, S. and Eden, D. (2001) 'Validation of a New General Self-Efficacy Scale', *Organizational Research Methods*, 4(1), pp. 62-83.

References

Chennell, A., Dransfield, S., Field, J., Fisher, N., Saunders, I. and Shaw, D. (2000) 'OPM: 'A system for organizational performance measurement', Conference Proceedings Performance Measurement-Past, Present and Future, Cranfield University, Cranfield, pp. 96-103.

Chi, T. (2015) 'Business Contingency, Strategy Formation, and Firm Performance: An Empirical Study of Chinese Apparel SMEs', *Administrative Sciences*, 5, pp: 27-45.

Chytas, P., Glykas, M. and Valiris, G. (2011) 'A proactive balanced scorecard', *International Journal of Information Management*, 31, pp. 460-468.

Clark, B. (2002) *Measuring performance: the marketing perspective*. Cambridge University Press, pp. 22-39.

Clarke, P. and O'Connor, R. (2011) 'The Meaning of Success for Software SMEs: An Holistic Scorecard Based Approach', 18th European Software Process Improvement Conference, CCIS, 172, Springer-Verlag.

Cleveland, G., Schroeder, R.G. and Anderson, J.C. (1989) 'A theory of production competence', *Decision Sciences*, 20(4), pp. 655-668.

Cocca, P. and Alberti, M., (2010) 'A framework to assess performance measurement systems in SMEs', *International Journal of Productivity and Performance Management*, 59(2), pp. 186-200.

Colbert, B. (2004) 'The Complex Resource-Based View: Implications for Theory and Practice in Strategic Human Resource Management', *Academy of Management Review*, 29(3), pp. 341-358.

Collett, N., Pandit, N.R. and Saarikko, J. (2014) 'Success and failure in turnaround attempts. An analysis of SMEs within the Finnish Restructuring of Enterprises Act', *Entrepreneurship and Regional Development*, 26(1-2), pp. 123-141.

Collier, P. (1995) *Improving Business Success Through Accurate Performance Measurement*. Worcester College of Higher Education, Worcester.

Collis, J. and Hussey, R. (2009) *Business Research: A practical guide for undergraduate and postgraduate students*. 3rd edn. London: Palgrave Macmillan.

Collis, D., Young, D. and Goold, M. (2003) 'The Size, Structure, and Performance of Corporate Headquarters', *Strategic Management Journal*, 28(4), pp. 383-405.

References

Corbett, C., Wassenhove, L.V. and Constance, B. (1993) 'Trade–offs? What trade-offs? Competence and competitiveness in manufacturing strategy', *California Management Review*, 35(4), pp. 107-122.

Correia, A., Kozak, M. and Ferradeira, J. (2013) 'From tourist motivations to tourist satisfaction', *International Journal of Culture, Tourism and Hospitality Research*, 7(4), pp. 411-424.

Creswell, J. W. (2006) *Qualitative Inquiry and Research Design: Choosing Among Five Tradition.*, 2nd edition. Newbury Park, CA: Sage.

Creswell, J. W. (2009) *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. Thousand Oaks, Cal.: Sage Publications.

Creswell, J. W. and Plano-Clark, V. L. (2011) *Designing and conducting mixed methods research*. 2nd edn. Thousand Oaks, CA: Sage

Creswell, J. W., Plano-Clark, V. L., Gutmann, M. L. and Hanson, W. E. (2003) *Advanced Mixed Methods Research Designs*. In A. Tashakkori, & C. Teddlie (Eds.), Handbook of mixed methods in social and behavioral research. Thousand Oaks, CA: Sage.

Crocker, L. and Algina, J. (2008) *Introduction To Classical And Modern Test Theory*. Ohio: Cengage Learning.

Crotty, M. (1998) *The Foundations of Social Research: Meaning and Perspective in the Research Process*. London: Sage.

Dangayach, G. S. and Deshmukh, S. G. (2000) 'Manufacturing strategy: experiences from select Indian organizations', *Journal of Manufacturing Systems*, 19(2), pp. 134-148.

Das, A., Handfield, R. B., Calantone, R. J. and Ghosh, S. (2000) 'A contingent view of quality management - the impact of international competition on quality', *Decision Sciences*, 31, pp. 649-690.

de Klerk, M. and de Villiers, C. (2012) 'The value relevance of corporate responsibility reporting: South African evidence', *Meditari Accountancy Research*, 20(1), pp. 21-38.

Deniz, M., Seçkin, Ş. and Cüreoğlu, M. (2013) 'Micro-Economic Competitiveness: A Research on Manufacturing Firms Operating in TRB1 region', *Procedia - Social and Behavioral Sciences*, 75, pp. 465-472.

References

Denzin, N. K. and Lincoln, Y. S. (2003) *Collecting and Interpreting Qualitative Materials*. Thousand Oaks, California, Sage.

Department for Business, Energy and Industrial Strategy (2018). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/746599/OFFICIAL_SENSITIVE_-_BPE_2018_-_statistical_release_FINAL_FINAL.pdf (Accessed: 23 July 2019).

Department of Innovation, Industry, Science and Research (DIISR) (2011). Australian Innovation System. Available at: http://www.innovation.gov.au/AISReport (Accessed: 16 July 2019).

DeVellis, R. F. (2003) *Scale Development, Theory and Applications: Applied social research methods*. 2nd edn. London: Sage Publications.

Díaz-Garrido, E., Martín-Peña, M. and Sánchez-López, J. (2011) Competitive priorities in operations: Development of an indicator of strategic position', *CIRP Journal of Manufacturing Science and Technology*, 4(1), pp. 118-125.

Dixon, J., Nanni, A. and Vollmann, T. (1990) 'The New Performance Challenge'. Measuring Operations for World-Class Competition, Dow Jones Irwin, Illinois.

Dobni, C. B. (2008) 'Measuring innovation culture in organizations: The development of a generalized innovation culture construct using exploratory factor analysis', *European Journal of Innovation Management*, 11(4), pp. 539-559.

Drury, C. (2004) Management and cost accounting. 6th edn, London: Thomson learning.

Duarte, S. and Cruz-Machado, V. (2013) 'Modelling lean and green: a review from business models', *International Journal of Lean Six Sigma*, 4(3), pp. 228-250.

Dües, C. M., Tan, K. H. and Lim, M. (2013) 'Green as the new Lean: how to use Lean practices as a catalyst to greening your supply chain', *Journal of Clean Production*, 40, pp. 93-100.

Easterby-Smith, M. T. and Lowe, R. A. (1991) *Management Research: an Introduction*. London: Sage.

Eccles, R. (1991) 'The Performance Measurement Manifesto', *Harvard Business Review*, pp. l3l-137.

References

Einwiller, S. A. and Boenigk, M. (2012) 'Examining the link between integrated communication management and communication effectiveness in medium-sized enterprises', *Journal of Marketing Communications*, 18(5), pp. 335-361.

Elkington, J. (1997) *Cannibals with forks – Triple bottom line of 21st century business*. Stoney Creek, CT: New Society Publishers.

ElMaraghy, H. and ElMaraghy, W. (2006) *Advances In Design*. London: Springer-Verlag London Limited.

Emmet, S. and Sood, V. (2010) *Green Supply Chains: An Action Manifesto*. Chichester: Wiley.

Enderle, G. (2004) 'Global competition and corporate responsibilities of small and medium-sized enterprises', *Business Ethics: A European Review*, 13(1), pp. 50-63.

Environmental Protection Agency (EPA) (2007) 'The Lean and Environment Toolkit', U.S. Environmental Protection Agency, Washington, DC.

Epstein, M. J. and Westbrook, R. A. (2001) 'Linking actions to profits in strategic decision making', *MIT Sloan Management Review*, 42(3), p. 39.

Eriksson, P. and Kovalainen, A. (2008) *Qualitative Methods in Business Research*. London: Sage.

European Commission (2016) SME Performance Review, Annual report on European SMEs 2015/2016. Available at: http://ec.europa.eu/growth/smes/business-friendly-environment/performance-review-2016_en (Accessed: 16 July 2019).

European Foundation (1991) *EFQM-The Business Excellence Model*. EFQM Publication, Brussels.

Eurostat (2016) Database management and research activities related to the production of principal European economic indicators (PEEIs). Available at: https://etendering.ted.europa.eu/cft/cft-display.html?cftId=1774 (Accessed: 10 July 2019).

Fatoki, O. (2014) 'Enhancing access to external finance for new micro- enterprises in South Africa', *Journal of Economics*, 5(1), pp. 1-6.

Favero, N., Meier, K. J. and O'Toole, L. J. (2016) 'Goals, trust, participation, and feedback: Linking internal management with performance outcomes', *Journal of Public Administration Research and Theory*, 26, pp. 327-343. doi:10.1093/jopart/muu044.

Federation Of Small Businesses (FSB) (2018) UK Small Business Statistics. Available at: https://www.fsb.org.uk/media-centre/small-business-statistics (Assessed: 16 July 2019).

Feindt, S., Jeffcoate, J. and Chappell, C. (2002) 'Identifying success factors for rapid growth in SME e-commerce', *Small Business Economics*, 19(1), pp. 51-62.

Field, A. (2005) *Discovering Statistics Using SPSS*. 2nd edn. London: Sage Publications.

Fiksel J. (2005) 'Sustainability and resilience: toward a systems approach', *Sustainability: Science, Practice, & Policy*, (2), pp. 14-21.

Fine, C. H. and Hax, A. C. (1985) 'Manufacturing strategy: a methodology and illustration', *Interfaces*, 15(6), pp. 28-46.

Fisher, R., Maritz, A. and Lobo, A. (2014) 'Evaluating entrepreneurs' perception of success: Development of a measurement scale', *International Journal of Entrepreneurial Behavior & Research*, 20(5), pp. 478-492.

Fitzgerald, L., Johnston, R., Brignall, J., Silvestro, R. and Voss, C. (1991) *Performance Measurement in Service Businesses*. The Chartered Institute of Management Accountants, London.

Fitzgerald, L. and Moon, P. (1996) *Performance Measurement in the Service Industries: Making it Work*. dMA, London.

Flapper, S. D. P., Fortuin, L. and Stoop, P. P. M. (1996) 'Towards consistent performance measurement systems', *International Journal of Operations & Production Management*, 16(7), pp. 27-37.

Forsman, H. and Temel, S. (2011) 'Innovation and business performance in small enterprises: an enterprise-level analysis', *International Journal of Innovation Management*, 15(3), pp. 641-665.

Fortuin L. (1988) 'Performance indicators - why, where and how?', *European Journal of Operation Research*, 34(1), pp. 1-9.

Francas, D., Löhndorf, N. and Minner, S. (2011) 'Machine and labor flexibility in manufacturing networks', *International Journal of Production Economics*, 131(1), pp. 165-174.

Frazer, L., Weaven, S. and Grace, D. (2012) 'Survival of the Fittest: The Performance of Franchised versus Independent Small Business during Economic

Uncertainty and Recovery', Griffith University, Australia. doi: https://assets.cdn.thewebconsole.com/S3WEB1401/images/Survival-of-the-Fittest_ARC-Linkage-Report_Oct-2012_Final.pdf.

Freel, M. S. (2000) 'Do small innovating firms outperform non-innovators?', *Small Business Economics*, 14(3), pp. 195-210.

Galeazzo, A., Furlan, A. and Vinelli, A. (2014) 'Lean and green in action: interdependencies and performance of pollution prevention projects', *Journal of Clean Production*, 85, pp. 191-200.

Gallani, S., Kajiwara, T. and Krishnan, R. (2015) 'Is Mandatory Non-financial Performance Measurement Beneficial?', Harvard Business School. Available at: http://www.hbs.edu/faculty/Publication%20Files/16-018_c6277204-f5ba-4facbef9-15791ece301c.pdf (Accessed: 06 December 2018).

Garengo, P. (2009) 'A performance measurement system for SMEs taking part in quality award programmes', *Total Quality Management& Business Excellence*, 20(1), pp. 91-105.

Garengo, P. and Biazzo, S. (2012) 'Unveiling strategy in SMEs through balanced scorecard implementation: A circular methodology', *Total Quality Management & Business Excellence*, 23(1), pp. 79-102.

Garengo, P., Biazzo, S. and Bernardi, G. (2007) 'Design and implementing a performance measurement system in SMEs: a bottom up approach', 14th International Annual EurOMA Conference: Managing Operations in Expanding Europe, 17-20 June, Ankara, Turkey.

Garengo, P., Biazzo, S. and Bititci, U.S. (2005) 'Performance measurement systems in SMEs: a review for a research agenda', *International Journal of Management Reviews*, 7(1), pp. 25-47.

Garengo, P. and Bitici, U. (2007) 'Towards a contingency approach to performance measurement: An empirical study in Scottish SMEs', *International Journal of Operations & Production Managemen*t, 27(8), pp. 802-825.

Gargeya, V. B. (2005) 'Plant level performance measurement: an exploratory case study of a pharmaceutical encapsulation company', *Technovation*, 25(1), pp. 1457-1467.

Garvin, D. A. (1984) 'What does "product quality' really mean?', *Sloan Management Review*, pp. 25-43.

References

Gay, B. and Weaver, S. (2011) 'Theory building and paradigms: A primer on the nuances of theory construction', *American International Journal of Contemporary Research*, 1(2), pp. 24-32.

Gerba, Y. T. and Viswanadham, P. (2016) 'Performance measurement of small scale enterprises: Review of theoretical and empirical literature', *International Journal of Accounting Research*, 2(3), pp. 531-535.
Gerwin, D. (1993) 'Manufacturing flexibility: a strategic perspective', *Management Science*, 39(4), pp. 395-410.

Ghalayini, A. Noble, J. and Crowe, T. (1997) 'An Integrated Dynamic Performance Measurement System for Improving Manufacturing Competitiveness', *International Journal of Production Economics*, 48, pp. 207-225.

Gherhes, C., Williams, N., Vorley, T. and Vasconcelos, A. C. (2016) 'Distinguishing micro-businesses from SMEs: a systematic review of growth constraints', *Journal of Small Business and Enterprise Development*, 23(4), pp. 939-963.

Ghobadian A. and Gallear D. (1997), 'TQM and Organisation Size', *International Journal of Operations and Production Management*, 17(2), pp. 121-163.

Gill, J. and Johnson P. (2002) *Research Methods for Managers*. 3rd edn. London: Sage Publications.

Glenn, B. (2009) 'Document analysis as a qualitative research method', *Qualitative Research Journal*, 9 (2), pp. 27-40.

Global Manufacturing (2017). Available at: https://www.manufacturingglobal.com/lean-manufacturing/uk-manufacturing-sees-increased-number-smes (Accessed: 2 July 2019).

Globerson, S. (1985) 'Issues in Developing a Performance Criteria System for an Organisation', *International Journal of Production Research*, 23(4), pp. 639- 646.

Gomes, C. F. and Yasin, M. M. (2011) 'A systematic benchmarking perspective on performance management of global small to medium-sized organizations: An implementation-based approach', *Benchmarking: An International Journal*, 18(4), pp. 543-562.

Goold, M. (1991) 'Strategic control in the decentralised firm', *Sloan Management Review*, 32(2), pp. 69-81.

Goold, M. and Quinn, J. J. (1990) 'The paradox of strategic controls', *Strategic Management Journal*, 11(1), pp. 43-57.

Govindan, K., Azevedo, S. G., Carvalho, H. and Cruz-Machado, V. (2015) 'Lean, green and resilient practices influence on supply chain performance: interpretive structural modelling approach', *International Journal of Environment Science Technology*, 12(1), pp. 15-34.

Gray, R., Adams, C. and Owen, D. (2014) *Accountability Social Responsibility and Sustainability*. Accounting for Society and the Environment, Pearson.

Grbich, C. (2012) *Qualitative Data Analysis: An introduction*. Thousand Oaks, Cal. Sage Publications.

Greatbanks, R. (2017) Performance measurement in SMEs: an operational perspective. Doctor of Philosophy, University of Manchester Institute of Science and Technology, Manchester.

Greenbank, P. (2001) 'Objective setting in the micro-business', *International Journal of Entrepreneurial Behaviour and Research*, 7(3), pp. 108-27.

Groover, M. P. (2005) *Automation, Production Systems and Computer Integrated Manufacturing*. Prentice Hall.

Guest, P. M. (2009) 'The impact of board size on firm performance: evidence from the UK', *The European Journal of Finance*, 15(4), pp. 385-404.

Gunasekaran, A., Patel, C. and Tirtiroglu, E. (2001) 'Performance measures and metrics in a supply chain environment', *International Journal of Operations and Production Management*, 21(1/2), pp. 7-87.

Gunawan, T., Jacob, J. and Duysters, G. (2016) 'Network ties and entrepreneurial orientation: Innovative performance of SMEs in a developing country', *International Entrepreneurship and Management Journal*, 12(2), pp. 575-599.

Guo, H. and Cao, Z. (2014) 'Strategic flexibility and SME performance in an emerging Economy A contingency perspective', *Journal of Organizational Change Management*, 27(2), pp. 273-298.

Guo, H., Zhao, J. and Tang, J. (2013) 'The role of top managers' human and social capital in business model innovation', *Chinese Management Studies*, 7(3), pp. 447-469.

Guthrie, J. and Parker, L. (1989) 'Corporate Social Reporting: A Rebuttal of Legitimacy Theory', *Accounting and Business Research*, 19(76), pp. 343-352.

References

Hajmohammad, S., Vachon, S., Klassen, R.D. and Gavronski, I. (2013) 'Lean management and supply management: their role in green practices and performance', *Journal of Clean Production*, 39, pp. 312-320.

Hair, J., Black, W., Babin, B., Anderson, R. and Tatham, R. (2010) *Multivariate Data Analysis*. 7th edn. Englewood Cliffs, NJ: Prentice-Hall.

Halabi, A. K., Barrett, R. and Dyt, R. (2010) 'Understanding financial information used to assess small firm performance: An Australian qualitative study', *Qualitative Research in Accounting and Management*, 7(2), pp. 163-179.

Ham, J. Y. (2009) 'Understanding performance measurement in the social housing sector in England; the case of housing associations'. Doctor of Philosophy, University of Birmingham, UK.

Hambrick, D. C. (2007) 'Upper echelons theory: An update', *Academy of Management Review*, 32(2), pp. 334-343.

Harrison, A. and Hoek, R. (2002) *Logistics Management and Strategy, Pearson Education*. Upper Saddle River, NJ.

Harrison, R. L. and Reilly, T. M. (2011) 'Mixed methods designs in marketing research', *Qualitative Market Research: An International Journal*, 14 (1), pp. 7-26.

Hart, S. and Milstein, M. (2003) 'Creating sustainable value', *Academy of Management Executive*, 17(2), pp. 56–67.

Hatch, M. J. and Cunliffe, A. L. (2006) *Organization Theory: Modern, Symbolic and Postmodern Perspectives*. Oxford: Oxford University Press.

Hayes, B., Perander, J., Smecko, T. and Trask, J. (1998) 'Measuring Perceptions of Workplace Safety: Development and Validation of the work safety scale', *Journal of Safety Research*, 29, pp. 145-161.

Hayes, R. H. and Pisano, G. P. (1994) 'Beyond world–class: the new manufacturing strategy, *Harvard Business Review*, 72(1), pp. 77-87.

Hayes, R. H. and Wheelwright, S. C. (1984) *Restoring Our Competitive Edge: Competing Through Manufacturing*. John Wiley, New York, NY.

Hayes, R. H., Wheelwright, S. C. and Clarke, K. B. (1988) *Dynamic Manufacturing: Creating the learning organisation*, The Free Press, New York.

References

Hegazy, M. and Hegazy, S. (2012) 'The development of key financial performance indicators for UK construction companies', *Accounting, Accountability & Performance*, 17(1), pp. 49-78.

Hendricks, K. B. and Singhal, V. R. (1996) 'Does implementing an effective TQM program actually improve operating performance? Empirical evidence from firms that have won quality awards', *Management Science*, 43(9), pp. 1257-1274.

Henri, J. (2004) 'Performance measurement and organizational effectiveness: bridging the gap', *Managerial Finance*, 30(6), pp. 93-123.

Henry, G. T. (1990) *Practical Sampling*. Thousand Oaks, Cal.: Sage Publications.

Hertzog, M. A. (2008) 'Considerations in determining sample size for pilot studies', *Research in Nursing & Health*, 31, pp. 180-191.

Hiebl M. R. W. (2014) 'A finance professional who understands the family: family firms' specific requirements for non-family chief financial officers', *Review of Management Science*, 8(4), pp. 465–494.

Hill, S. (1997) *The wait is over*. Manufacturing Systems, 15(6), II-X.

Hollander, E. D. (1967) *The Future of Small Busi*ness. Pager publisher, New York, USA.

Hon, B., (2004) Special issue on design and manufacture for sustainable development. Proceedings of the Institution of Mechanical Engineers, Part B: *Journal of Engineering Manufacture*, 218(9).

Hon, K. K. B. (2005) 'Performance and evaluation of manufacturing systems', *CIRP Annals - Manufacturing Technology*, 54(2), pp. 139-154.

Hong, P. and Jeong, J. (2006) 'Supply chain management practices of SMEs: from a business growth perspective', *Journal of Enterprise Information Management*, 19(3), pp. 292-302.

Hope, J. and Fraser, R. (2003) *Beyond Budgeting: How Managers Can Break Free from the Annual Performance Trap*. Harvard Business Press, Cambridge, MA.

Hourneaux, J. F., Carneiro-da-Cunha, J. A. and Corrêa, H. L. (2017) 'Performance measurement and management systems: Different usages in Brazilian manufacturing companies', *Managerial Auditing Journal*, 32(2), pp. 148-166.

References

Hudson, M (2001) ‘Introducing Integrated Performance Measurement into Small and Medium Sized Enterprises’, Doctor of Philosophy, University of Plymouth.

Hudson, M., Bourne, M., Lean, J. and Smart, P.A. (2000) ‘Only Just Managing – No Time to Measure’, *Performance Measurement* – Past, Present and Future (Conference Proceedings) Cranfield University, Cranfield, pp. 243-250.

Hudson, M., Lean, J. and Smart, P. A. (2001) ‘Improving control through effective performance measurement in SMEs’, *Production Planning and Control*, 12(8), pp. 804-813.

Hudson, M. and Smith D. (2000) ‘Running Before Walking: The Difficulties of Developing Strategic Performance Measurement Systems in SMEs’, *Operations Management* (EurOMA Conference Proceedings), Academia Press Scientific Publishers, Ghent, pp. 292-298.

Hudson, M., Smart, A. and Bourne, M. (2001), ‘Theory and practice in SME performance measurement systems’, *International Journal of Operations & Production Management*, 21(8), pp. 1096-115.

Husband, S. and Mandal, P. (1999) ‘A Conceptual Model for Quality Integrated Management in Small and Medium Size Enterprises’, *International Journal of Quality & Reliability Management*, 16, pp. 699-713.

Hussein, M., Gunasekaran, A. and Laitinen, E. K. (1998) ‘Management accounting system in Finish service firms’, *Technovation*, 18(1), pp. 57-67.

Hussey, J. and Hussey, R. (1997) *Business Research: A practical guide for undergraduate and postgraduate students*. London: Palgrave.

Hutchinson, K., Donnell, L.V., Gilmore, A. and Reid, A. (2015) ‘Loyalty card adoption in SME retailers: the impact upon marketing management’, *European Journal of Marketing*, 49(3/4), pp. 467-490.

Hvolby, H. H. and Thorstenson, A. (2000) ‘Performance Measurement in Small and Medium-Sized Enterprises’, 3rd International Conference on Stimulating Manufacturing Excellence in SMEs (Proceedings), Coventry University, Coventry, pp. 324-332.

Hyland, P., Mellor, R. and Sloan, T. (2007) ‘Performance measurement and continuous improvement: are they linked to manufacturing strategy?’, *International Journal of Technology Management*, 37(3/4), p. 237.

References

Hyun, j. H. and Ahn, B. H. (1992) 'A unifying framework for manufacturing flexibility', *Manufacturing Review*, 5(4), pp. 251-260.

Inman, A. R. and Simmering, M. (2006) *Performance Measurement*. 5th edn. Encyclopedia of Management.

Ireland, R. D., Hoskisson, R. E. and Hitt, M. A. (2009) *The management of strategy*. Mason, OH: South-Western Cengage Learning.

Isaac, S. and Michael, W. B. (1995) *Handbook in research and evaluation: Educational and Industrial Testing Service*. San Diego, CA.

Isaga, N., Masurel, E. and Van Montfort, K. (2015) 'Owner-manager motives and the growth of SMEs in developing countries: Evidence from the furniture industry in Tanzania', *Journal of Entrepreneurship in Emerging Economies*, 7(3), pp. 190-211.

Jamil, C. Z. M. and Mohamed, R. (2013) 'The Effect of Management Control System on Performance Measurement System at Small Medium Hotel in Malaysia', *International Journal of Trade, Economics and Finance*, 4(4), pp. 202-208.

Jarvis, R., Curran, J., Kitching, J. and Lightfoot, G. (2000) 'The use of quantitative and qualitative criteria in the measurement of performance in small firms', *Journal of Small Business and Enterprise Development*, 7(2), pp. 123-34.

Jayawarna, D., Macpherson, A. and Wilson, A. (2007) 'Training commitment and performance in manufacturing SMEs: Incidence, intensity and approaches', *Journal of Small Business and Enterprise Development*, 14(2), pp. 321-338.

Jayawarna, D., Rouse, J. and Kitching, J. (2011) 'Entrepreneur motivations and life course', *International Small Business Journal*, 31(1), pp. 34-56.

Jennings, P. L. and Beaver, G. (1997) 'The performance and competitive advantage of small firms: a management perspective', *International Small Business Journal*, 15(2), pp. 63-75.

Jitmaneeroj, B. (2016) 'Reform priorities for corporate sustainability: environmental, social, governance, or economic performance?', *Management Decision*, 54(6), pp. 1497-1521.

Johanson, G. A. and Brooks, G. P. (2009) 'Initial scale development: sample size for pilot studies', *Educational and Psychological Measurement*, 70(3), pp. 394 – 400.

Johnson, H. T. and Kaplan, R. S. (1987) *Relevance Lost - the rise and fall of Management Accounting*. Harvard Business School Press, Boston MA.

Jones, N. (2009) 'SME's Life Cycle-Steps to Failure or Success?' Available at: http://www.moyak.com/papers/small-medium-enterprises.pdf (Accessed: 18 December 2017).

Jones, S., Buerkle, M., Hall, A., Rupp, L. and Matt, G. (1993) 'Work Group Performance Measurement and Feedback', *Group and Organisation Management Journal,* 18(3), pp. 269-291.

Kadipasaoglu, S. N., Xiang, W., Hurley, S. F. and Khumawala, B. M. (2000) 'A Study on the Effect of the Extent and Location of Protective Capacity in Flow Systems', *International Journal of Production Economics,* 63(3), pp. 217-228.

Kaizen Institute (1985). Available at: https://uk.kaizen.com/what-is-kaizen.html#core_kaizen (Accessed: 17 December 2018).

Kanji, G. K. and Sa´, P. M. (2002) 'Kanji's business scorecard', *Total Quality Management*, 13(1), pp. 13-27.

Kaplan, R. (1983) 'Measuring Manufacturing Performance: A New Challenge for Managerial Accounting Research', *The Accounting Review*, 18(4), pp. 686-705.

Kaplan, R. and Norton, D. (1992) 'The Balanced Scorecard: Measures that Drive Performance', *Harvard Business Review,* pp. 7l-79.

Kaplan, S. and Norton, D. (1996) *The Balanced Scorecard: Translating Strategy into Action*. Harvard Business School Press, Boston, MA.

Kapoor, B. (2011) 'The Impact of globalization on human resource management', *Journal of International Management Studies*, 6(1), pp. 1-8.

Karim, N., Tarazi, M. and Reille, X. (2008) 'Islamic Microfinance: An Emerging Market', MicroCapital. Available at: https://www.microcapital.org/microcapital-paper-wrap-up-islamic-microfinance-an-emerging-market-niche-by-nimrah-karim-michael-tarazi-and-xavier-reille/ (Accessed: 19 July 2018).

Kathuria, R., Porth, S., Kathuria, N. and Kohli, T. (2010) 'Competitive priorities and strategic consensus in emerging economies: evidence from India', *International Journal of Operations & Production Management*, 30(8), pp. 879-896.

Katua, N. T. (2014) 'The role of SMEs in employment creation and economic growth in selected countries', *International Journal of Education and Research*, 2(12), pp. 461-472.

References

Kaur, S. P., Kumar, J. and Kumar, R. (2017) 'The Relationship Between Flexibility of Manufacturing System Components, Competitiveness of SMEs and Business Performance: A Study of Manufacturing SMEs in Northern India', *Global Journal of Flexible Systems Management*, 18(2), pp. 123–137.

Kaur, S. P., Kumar, J. and Kumar, R. (2016a) 'Impact of competitiveness on business performance: a case study of manufacturing SMEs in Northern India', *International Journal of Indian Culture and Business Management*, 13(2), pp. 205-225.

Kaur, S. P., Kumar, J. and Kumar, R. (2016b) 'Impact of flexibility of manufacturing system components on competitiveness of SMEs in Northern India', *Journal of Engineering, Project, and Production Management*, 6(1), pp. 63-76.

Kaur, J., Sidhu, R., Awasthi, A., Chauhan, S. and Goyal, S. (2018) 'A DEMATEL based approach for investigating barriers in green supply chain management in Canadian manufacturing firms', *International Journal of Production Research*, 56(1-2), pp. 312-332.

Kaynak, H. (2003) 'The relationship between total quality management practices and their effects of firm performance', *Journal of Operations Management*, 21, pp. 405-435.

Keegan, D., Eiler, R. and Jones, C. (1989) 'Are Your Performance Measures Obsolete?', *Management Accounting*, pp. 45-50.

Kennerley, M. and Neely, A. (2002) 'A framework of the factors affecting the evolution of performance measurement systems', *International Journal of Operations & Production Management*, 22(11), pp. 1222-1245.

Kennerley, M. and Neely, A. (2003) 'Measuring performance in a changing business environment', *International Journal of Operations & Production Management*, 23(2), pp. 213-29.

Keppel, G. and Zedeck, S. (1989) *Data Analysis for Research Designs: Analysis of Variance and Multiple Regression/Correlation Approaches*. New York: W. H. Freeman and Company.

Kim, B. (2013) 'Competitive priorities and supply chain strategy in the fashion industry', *Qualitative Market Research: An International Journal*, 16(2), pp. 214-242.

Kim, W. C. and Maubourgne, R. (2005) *Blue ocean strategy*. Harvard Business School Press, Boston, MA.

References

Klassen, R. D. and Menor, L. J. (2007) 'The process management triangle: An empirical investigation of process trade-offs', *Journal of Operations Management*, 25(5), pp. 1015-1036.

Klovienė, L. and Speziale, M. T., (2015) 'Is Performance Measurement System Going Towards Sustainability in SMEs?', *Procedia-Social and Behavioral Sciences*, 213(1), pp. 328-333.

Klynveld Peat Marwick Goerdeler (KPMG) (2013) The KPMG Survey of Corporate Responsibility Reporting 2013. Available at: https://assets.kpmg/content/dam/kpmg/pdf/2015/08/kpmg-survey-of-corporate-responsibility-reporting-2013.pdf (Accessed: 19 July 2018).

Koste, L. L. and Malhotra, M. K. (1999) 'A Theoretical Framework for Analyzing the Dimensions of Manufacturing Flexibility', Conceptual Note, *Journal of Operations Management*, 18, pp. 75-93.

Koste, L., Malhotra, M. and Sharma, S. (2004) 'Measuring dimensions of manufacturing flexibility', *Journal of Operations Management*, 22(2), pp. 171-196.

Kotey, B. (2014) 'Small business innovation in the hostile environment of Australia's drought stricken rural communities', *Australasian Journal of Regional Studies*, 20(2), pp. 325-351.

Krægpøth, T., Stentoft, J. and Jensen, J. K. (2017) 'Dynamic Supply Chain Design: A Delphi Study of Drivers and Barriers', *International Journal of Production Research*, pp. 1-11.

Krajewski, L. and Wei, J. (2001) 'The value of production schedule integration in supply chains', *Decision Sciences*, 32(4), pp. 601-634.

Krüger, J. and Rootman, C. (2010) 'How do small business managers influence employee satisfaction and commitment?', *Acta Commercii*, 10(1), pp. 59-72.

Kumar, M., Antony, J. and Douglas, A. (2009) 'Does size matter for Six Sigma implementation? Findings from the survey in UK SMEs', *The TQM Journal*, 21(6), pp. 623-635.

Kumar, M., Antony, J., Singh, R. K., Tiwari, M. K. and Perry, D. (2006) 'Implementing the lean sigma framework in an Indian SME: a case study', *Production Plan Control*, 17(4), pp. 407-423.

References

Kwasi, A. G. and Moses, A. (2008) 'Manufacturing strategy, competitive strategy and firm performance: An empirical study in a developing economy environment', *International Journal of Production Economics*, 111(2), pp. 575-592.

Laitinen, E. (1996) *Framework for Small Business Performance Measurement*. University of Vaasa, Vaasan yliopisto.

Laitinen, E. K. (2011) 'Effect of reorganization actions on the financial performance of small entrepreneurial distressed firms', *Journal of Accounting and Organizational Change,* 7(1), pp. 57-95.

Laitinen, K. (2002) 'A dynamic performance measurement system: evidence from small Finnish technology companies', *Scandinavian Journal of Management*, 18(1), pp. 65-99.

Lampadarios, E. (2016) 'Critical Success Factors for SMEs: An empirical study in the UK chemical distribution industry', *International Journal of Business and Management*, 11(7), pp. 67-82.

Larsson, C. (2017) 'Communicating performance measured: supporting continues improvement in manufacturing companies', Doctor of Philosophy, University of Skövde, Sweden.

Laukkanen, S., Sarpola, S. and Hallikainen, P. (2007) 'Enterprise size matters: Objectives and constraints of ERP adoption', *Journal of Enterprise Information Management*, 20(3), pp. 319-334.

Laukkanen, T., Nagy, G., Hirvonen, S., Reijonen, H. and Pasanen, M. (2013) 'The effect of strategic orientations on business performance in SMEs: A multigroup analysis comparing Hungary and Finland', *International Marketing Review*, 30(6), pp. 510-535.

Lea, R. and Parker, B. (1989) 'The JIT spiral of continuous improvement', *Industrial Management & Data Systems*, 89(4), pp. 10-13.

Lee, N. and Hooley, G. (2005) 'The evolution of 'classical mythology within marketing measure development', *European Journal of Marketing*, 39(3/4), pp. 365-386.

Lee, C. S. and Wong, K. Y. (2015) 'Development and validation of knowledge management performance measurement constructs for small and medium enterprises', *Journal of Knowledge Management*, 19(4), pp. 711-734.

References

Leitch, C. M., McMullan, C. and Harrison, R. T. (2013) 'The development of entrepreneurial leadership: The role of human, social and institutional capital', *British Journal of Management*, 24(3), pp. 347-366.

Leite, R., Brazdil, P. and Vanschoren, J. (2012) 'Selecting Classification Algorithms with Active Testing', 8th International Conference, MLDM 2012 Berlin, Germany, July 13-20.

Leong, G. K., Snyder, D. L. and Ward, P. T. (1990) 'Research in the process and content of manufacturing strategy, *Omega*, 18(2), pp. 109-122.

Li, H., Li, V., Skitmore, M., Wong, J. and Cheng, E. (2009) 'Competitiveness factors: a study of the real estate market in China', *Construction Management and Economics*, 27(6), pp. 567-579.

Liker, J. K. (1997) *Becoming Lean: Inside Stories of U.S*. Manufacturers. Portland, OR: Productivity Press.

Liker, J. K. (2004) *The Toyota way*. New York: McGraw Hill.

Ling, L., Qing, T. and Shen, P. (2014) 'Can training promote employee organizational commitment? The effect of employability and expectation value', *Nankai Business Review International*, 5(2), pp. 162-186.

Loewe, P. and Chen, G. (2007) Changing your company's approach to innovation', *Strategy and Leadership*, 35(6), pp. 18-26.

Lubatkin, M., Simsek, Z., Ling, Y. and Veiga, J. (2006) 'Ambidexterity and Performance in Small-to Medium-Sized Firms: The Pivotal Role of Top Management Team Behavioral Integration', *Journal of Management*, 32(5), pp. 646-672.

Lyons, P. and Mattare, M. (2011) 'How can very small SMEs make the time for training and development: Skill charting as an example of taking a scenistic approach', *Development and Learning Organisations*, 25(4), pp. 15-19.

Lynch, R. and Cross, K. (1991) *Measure Up! Yardsticks for Continuous Improvement*. Blackwell Publishing, London.

Mabey, C. and Ramirez, M. (2005) 'Does management development improve organizational productivity? A six-country analysis of European firms', *The International Journal of Human Resource Management*, 16(7), pp. 1067-1082.

References

Mabhungu, I. (2017) ‘A performance measurement framework to enhance the success and survival of retail Micro, Small and Medium enterprises’, Doctor of philosophy, University of South Africa, South Africa, 28th of July 2017.

Maduekwe, C. C. and Kamala, P. (2016) ‘Performance measurement by small and medium enterprises in Cape Metropolis, South Africa’, *Problems and Perspectives in Management*, 14(2), pp. 46-55.

Malayeff, J., Venkateswaran, V. and Arnheiter, E. A. (2012) ‘The continuing evolution of Lean Six Sigma’, *The TQM Journal*, 24(6), pp. 542-555

Maltz, A. C., Shenhar, A. J. and Reilly, R. R. (2003) ‘Beyond the balanced scorecard: refining the search for organizational success measures’, *Long Range Planning*, 36(2), pp. 187-204.

Margaret, H. (2008) ‘Composing qualitative research’, *Qualitative Market Research: An International Journal*, 11(4), pp. 439-443.

Maseko, N. and Manyani, O. (2011) ‘Accounting practices of SMEs in Zimbabwe: An investigative study of record keeping for performance measurement (A case study of Bindura)’, *Journal of Accounting and Taxation*, 3(8), pp. 171-181.

Maskell, B. (1989) ‘Performance Measures for World Class Manufacturing’, *Management Accounting*, pp. 32-33.

Masocha, R. and Charamba, M. (2014) ‘Challenges and Key Success Factors of African Descent Foreign-Owned SMEs in the Eastern Cape Province of South Africa: A Case of Selected Towns’, *Mediterranean Journal of Social Sciences*, 5(4), pp. 59-69.

Matanda, M. J. and Ndubisi, N. O. (2009) ‘Market orientation, supplier perceived value and business performance of SMEs in a Sub-Saharan African nation’, *Journal of Enterprise Information Management*, 22(4), pp. 384-407.

Mathur, A., Dangayach, G. S., Mittal, M. L. and Sharma, M. K. (2011) ‘Performance measurement in automated manufacturing’, *Measuring Business Excellence*, 15(1), pp. 77-91.

Matsoso, M. L. and Benedict, O. H. (2014) ‘Non-Financial Performance Measures in Small Medium Enterprises’ Supply Chain Management’, *Journal of Economics*, 5(3), pp. 247-257.

References

Matthias, T., Moacir, G. F., Mark, S. and Lawrence, D. F. (2013) 'Competitive priorities of small manufacturers in Brazil', *Industrial Management & Data Systems*, 113(6), pp. 856-874.

Mazzarol, T., Reboud, S. and Soutar, G. N. (2009) 'Strategic planning in growth oriented small firms', *International Journal of Entrepreneurial Behavior and Research*, 15(4), pp. 320-345.

McAdam, R. (2000) 'Quality models in an SME context: a critical perspective using a grounded approach', *International Journal of Quality and Reliability Management*, 17(3), pp. 305-323.

McAdam, R. and Bailie, B. (2002) 'Business Performance measure and alignment impact on strategy – The role of business improvement models', *International Journal of Operations & Production Management*, 22(9), pp. 972-966.

McAdam, R., Reid, R. and Mitchell, N. (2010) 'Longitudinal development of innovation implementation in family-based SMEs', *International Journal of Entrepreneurial Behavior & Research*, 16(5), pp. 437-456.

McBain, R., Ghobadian, A., Switzer, J., Wilton, P., Woodman, P. and Pearson, G. (2012) 'The Business Benefits of Management and Leadership Development', Chartered Management Institute and Penna. Available at: file:///C:/Users/empgaas/AppData/Local/Packages/Microsoft.MicrosoftEdge_8wekyb3d8bbwe/TempState/Downloads/Business-benefits-of-management-and-leadership-development-summary-report%20(1).pdf (Accessed: 17 July 2018).

McCann, M. and Barlow, A. (2015) 'Use and measurement of social media for SMEs', *Journal of Small Business and Enterprise Development*, 22(2), pp. 273-287.

McKenna, S. (2005) 'Organisational commitment in the small entrepreneurial business in Singapore', *Cross Cultural Management: An International Journal*, 12(2), pp.16-37.

Medori, D. (1998) *Integrated Performance Measure Framework*. Coventry University, Coventry.

Medori, D. and Steeple, D. (2000) 'A framework for auditing and enhancing performance measurement systems', *International Journal of Operations & Production Management*, 20(5), pp. 520-533.

Melnyk, S. A., Bititci, U., Platts, K., Tobias, J. and Andersen, B. (2014) 'Is performance measurement and management fit for the future?', *Management Accounting Research*, 25(2), pp. 173-186.

Merchant Savvy (2018) UK SME Data, Stats & Charts. Available at: https://www.merchantsavvy.co.uk/uk-sme-data-stats-charts/ (Accessed: 02/08/2019).

Messersmith, J. and Guthrie, J. (2010) 'High performance work systems in emergent organizations: Implications for firm performance', *Human Resource Management*, 49(2), pp. 241-264.

Meyer, C. (1994) 'How the Right Measures Help Teams Excel', *Harvard Business Review*, pp: 95-103.

Meyer, J. P. and Smith, C. A. (2000) 'HRM practices and organizational commitment: Test of a mediation model', *Canadian Journal of Administrative Sciences*, 17(4), pp. 319-331.

Miles, S. (2012) 'Stakeholder: Essentially contested or just confused?', *Journal of Business Ethics*, 108(3), pp. 285-298.

Mishra, K. E., Mishra, A. K. and Boynton, L. (2014) 'Driving Employee Engagement: The Expanded Role of Internal Communications', International Journal of Business Communication, 51(2), pp. 183-202.

Moshirvaziri, K. and Benli, O. S. (2008) 'Project management under risk control: a Monte Carlo simulation approach', Proceedings of the Thirty-Seventh Annual Meeting of the Western Decision Sciences Institute.

Mudavanhu, V., Bindu, S., Chigusiwa, L. and Muchabaiwa, L. (2011) 'Determinants of small and medium enterprises failure in Zimbabwe: A case study of Bindura', *International Journal of Economics Research*, 2(5), pp. 82-89.

Mumford, M. D., Bedell-Avers, K. E. and Hunter, S. T. (2008) 'Planning for innovation: A multi-level perspective', *Research in Multi-level Issues*, 7, pp. 107-154.

Mumford, M. D., Scott, G. M., Gaddis, B. and Strange, J. M. (2002) 'Leading creative people: Orchestrating expertise and relationships', *The Leadership Quarterly*, 13(6), pp. 705-750.

Myeda, N. E. and Pitt, M. (2012) 'Understanding the Performance Measurement System (PMS) for Facilities Management (FM) Industry in Malaysia', PMA 2012 Conference, Cambridge.

References

Naimy, V. Y. (2004) 'Financing problems faced by the Lebanese SMEs: An empirical study', *International Business and Economics Research Journal*, 3(1), pp. 27- 38.

Najmi, M., Rigas, J. and Fan, S. (2005) 'A framework to review performance measurement systems', *Business Process Management Journal*, 11 (2), pp. 109-122.

Nauhria, Y., Pandey, S. and Kulkarni, M. (2011) 'Competitive Priorities for Indian Car Manufacturing Industry (2011–2020) for Global Competitiveness', *Global Journal of Flexible Systems Management*, 12(3-4), pp.9-20.

Ndubisi, N. O. and Iftikhar, K. (2012) 'Relationship between entrepreneurship, innovation and performance: comparing small and medium-size enterprises', *Journal of Research in Marketing and Entrepreneurship*, 14(2), pp. 214-236.

Neely, A. (2007) *Measuring performance: the operations management perspective*. 2nd edn. Cambridge: Cambridge University Press.

Neely, A. (2005) 'The evolution of performance measurement research: Developments in the last decade and a research agenda for the next', *International Journal of Operations and Production Management*, 25(12), pp. 1264-1277.

Neely, A. and Adams, C. (2000) 'Perspectives on Performance: The Performanoe--P-rism', Cranfield School of Management, Cranfield.

Neely, A. Adams, C. and Kennerley, M. (2002) 'The Performance Prism: The Scorecard for Measuring and Managing Business Success', Financial Times/Prentice Hall, London.

Neely, A., Gregory, M. and Platts, K. (1995) 'Performance Measurement System Design: A Literature Review and Research Agenda', *International Journal of Operations and Production Management*, 15(4), pp. 80-116.

Neely, A. and Jarrar, Y. (2004) 'Extracting value from data-the performance planning value chain', *Business Process Management Journal*, 10(5), pp. 506-509.

Neely, A. and Mills, J. F. (1993) 'Manufacturing in the UK – Report on a Survey of performance measurement and strategy issue in UK manufacturing companies', Manufacturing engineering Group, London.

Neely, A., Mills, J., Gregory, M., Richards, H., Platts, K. and Bourne, M. (1996) *Getting the Measure of Y our Business*. Works Management, Cambridge.

References

Neely, A., Richards, H., Mills, I., Platts, K. and Bourne, M. (1997) 'Designing Performance Measures; A Structured Approach', *International Journal of Operations and Production Management*, 17(11), pp. 1131-1152.

Ng, F. A., Harrison, J. and Akroyd, C. (2013) 'A revenue management perspective of management accounting practice in small businesses', *Meditari Accountancy Research*, 21(2), pp. 92-116.

Nieman, G. and Nieuwenhuizen, C. (2009) *Entrepreneurship: A South African Perspective*. 2nd edn. Pretoria: Van Schaik.

Noci G. (1995) 'Accounting and Non-Accounting Based Measures of Quality-Based Performances in Small Firms', *International Journal of Operations and Production Management*, 15(7).

Nordin, N., Deros, B., Wahab, D. and Rahman, M. (2012) 'A framework for organisational change management in lean manufacturing implementation', *International Journal of Services and Operations Management*, 12(1), p. 101.

Nouara, A. (2015) 'Development of Performance Measurement Model for Oil Operations: A Study of Libyan Oil Companies', Doctor of Philosophy, Brunel University London, United Kingdom, April 2015.

Ntalianis, F., Dyer, L. and Vandenberghe, C. (2015) 'Owner-employee relations in small firms', *Journal of Managerial Psychology*, 30(7), pp. 832-846.

Nudurupati, S. S., Bititci, U. S., Kumar, V. and Chan, F. T. (2011) 'State of the art literature review on performance measurement', *Computers and Industrial Engineering*, 60(2), pp. 279-290.

Nunnally, J. C. and Bernstein, I. H. (1994) *Psychometric Theory*. 3rd edn. New York: McGrawHill.

Nyamwanza, L., Paketh, L., Mhaka, C., Makaza, F. and Moyo, N. (2015) 'An Evaluation of the Policies Instituted by the Government of Zimbabwe in Promoting Survival and Growth of SMEs: The Case of Glen View Area 8 SMEs', *International Journal of Novel Reserach in Marketing Management and Economics*, 2(2), pp. 35-44.

Oakland, J. S. (2003) *Total Quality Management: Text with Cases*. Routledge.

Olawale, F. and Garwe, D. (2010) 'Obstacles to the growth of new SMEs in South Africa: A principal component analysis approach', *African Journal of Business Management*, 4(5), pp. 729-738.

Oliver, C. (1991) ‘Strategic Responses to Institutional Processes’, *The Academy of Management Review*, 16(1), p.145.

Office for National Statistics, (2016). Available at: https://www.ons.gov.uk/businessindustryandtrade/business/activitysizeandlocation/bulletins/businessdemography/2016 (Assessed: 16 July 2019).

Otley, D. (2001) ‘Accounting performance measurement: a review of its purposes and practices’, *International Journal of Business Performance Management*, 3(2), pp. 245-260.

Padachi, K. and Lukea Bhiwajee, S. (2016) ‘Barriers to employee training in small and medium sized enterprises: Insights and evidences from Mauritius’, *European Journal of Training and Development*, 40(4), pp. 232-247.

Pakdil, F. and Leonard, K. M. (2014) ‘Criteria for a lean organisation: development of a lean assessment tool’, *International Journal of Production Research*, 52(15), pp. 4587-4607.

Pallant, J. (2010) *SPSS Survival Manual*. 4th edn. London: McGraw Hill Education.

Pallant, J. (2011) *SPSS Survival Manual: A step by step guide to data analysis using SPSS*. 4th edn. Milton Keynes: Open University Press.

Panayides, P. (2006) ‘Enhancing innovation capability through relationship management and implications for performance’, *European Journal of Innovation Management*, 9(4), pp. 466-483.

Panda, D. K. (2014) ‘Managerial networks and strategic orientation in SMEs Experience from a transition economy’, *Journal of Strategy and Management*, 7(4), pp. 376-397.

Panizzolo, R., Garengo, P., Sharma, M. K. and Gore, A. (2012) ‘Lean manufacturing in developing countries: evidence from Indian SMEs’, *Production Plan Control*, 23(10-11), pp. 769-788.

Pansiri, J. and Temtime, Z. T. (2010) ‘Linking firm and managers' characteristics to perceived critical success factors for innovative entrepreneurial support’, *Journal of Small Business and Enterprise Development*, 17(1), pp. 45-59.

Parker, S. (2009) *The Economics Of Entrepreneurship*. Cheltenham: Edward Elgar. doi: 10.1017/9781316756706.

References

Parnell, J. A., Long, Z. and Lester, D. (2015) 'Competitive strategy, capabilities and uncertainty in small and medium sized enterprises (SMEs) in China and the United States', *Management Decision*, 53(2), pp. 402-431.

Parthiban, P. and Goh, M. (2011) 'An integrated model for performance management of manufacturing units', *Benchmarking: An International Journal*, 18(2), pp. 261-281.

Pekkola, S., Saunila, M. and Rantanen, H. (2016) 'Performance measurement system implementation in a turbulent operating environment', *International Journal of Productivity and Performance Management*, 65(7), pp. 947-958.

Peng, D.X., Schroeder, R.G. and Shah, R. (2008) 'Linking routines to operations capabilities: A new perspective', *Journal of Operations Management*, 26(6), pp. 730-748.

Polyhart, R. E. (2006) 'Staffing in the 21st century: New challenges and strategic opportunities', *Journal of Management*, 32, pp. 868-897.

Porter, M. E. (1996) 'Competitive advantage, agglomeration economies, and regional policy', *International Regional Science Review*, 19(1-2), pp. 85-90.

Powel, T. (1995) 'Total quality management as competitive advantage: A review and empirical study', *Strategic Management Journal*, 16(1), pp. 15-37.

Powell, D. (2012) 'Investigating ERP Support for Lean Production', Doctor of Philosophy, August 2012, Norwegian University of Science and Technology.

Pradhan, S. and Chaudhury, S. (2012) 'A survey on employee performance management and its implication to their retention in OCL India Ltd', Asian Journal of Research in Social Science & Humanities, 2(4), pp. 2249-731.

Quesada, H. and Gazo, R. (2007) 'Methodology for determining key internal business processes based on critical success factors: A case study in furniture industry', *Business Process Management Journal*, 13(1), pp. 5-20.

Rajagopal, C. A. (2010) 'Supply chain management and financial performance: literature review and future directions', *Journal of Transnational Management*, 15(4), pp. 322-349.

Ramasesh, R. and Jayakumar, M. (1991) 'Measurement of manufacturing flexibility: A value based approach', *Journal of Operations Management*, 10(4), pp. 446-468.

References

Rampersad, H. K. (2005) 'Total performance scorecard: the way to personal integrity and organizational effectiveness', *Measuring Business Excellence*, 9(3), pp. 21-35.

Ramukumba, T. (2014) 'Overcoming SMEs Challenges through Critical Success Factors: A Case of SMEs in the Western Cape Province', *South Africa, Economic and Business Review*, 16(1), pp. 19-39.

Rantakyrö, L. (2004) 'Still searching the best way...: a multiple-case study in small industrial organizations', Luleå, Luleå University of Technology.

Rappaport, A. (1998) *Creating Shareholder Value: The New Standard for Business Performance*. The Free Press, New York, NY.

Raymond, L., St-Pierre, J. and Marchand, M. (2009) 'A taxonomic approach to studying the performance of manufacturing SMEs', *International Journal of Business Performance Management*, 11(4), pp. 277-91.

Rehman, M. A. A. and Shrivastava, R. L. (2013) 'Development and validation of performance measures for green manufacturing (GM) practices in medium and small scale industries in Vidharbha region, India', *International Journal of Society Systems Science*, 5(1), pp. 62-81.

Richbell, S. M., Watts, H. D. and Wardle, P. (2006) 'Owner-managers and business planning in the small firm', *International Small Business Journal*, 24(5), pp. 496-514.

Roach, D. C. (2011) 'The impact of product management on SME performance', *Journal of Small Business and Enterprise Development*, 18(4), pp. 695-714.

Robb, A. M. and Fairlie, R. W. (2009) 'Determinants of business success: an examination of Asian-owned businesses in the USA', *Journal of Population Economics*, 22(4), pp. 827-858.

Robu, M. (2013) 'The dynamic and importance of SMEs in economy', *The USV Annals of Economics and Public Administration*, 13(17), pp. 84-89.

Rockart, J. F. (1979) 'Chief executives define their own data needs', *Harvard Business Review*, 57(2), pp. 81-93.

Rosenbusch, N., Brinckmann, J. and Bausch, A. (2011) 'Is innovation always beneficial?', A meta-analysis of the relationship between innovation and performance in SMEs', *Journal of Business Venturing*, 26, pp. 441-457.

References

Rowley, J. (2012) ‘Conducting research interviews’, *Management Research Review*, 35(3/4), pp. 260-271.

Rubin, H. J. and Rubin, I. S. (2011) *Qualitative Interviewing: The art of hearing data*. Thousand Oaks, Cal.: Sage Publications.

Rusjan, B. (2006) ‘The impact of manufacturing focus on manufacturing and business unit performance: an empirical investigation’, *Economic and Business Revie*w, 8(1), pp. 5-18.

Salem, A. H. and Deif, A. M. (2014) ‘An integrated approach to assess manufacturing greenness level’, *Procedia CIRP*, 17, pp. 541-546.

Samkin, G. (2012) ‘Changes in sustainability reporting by an African defence contractor: a longitudinal analysis’, *Meditari Accountancy Research*, 20(2), pp.134-166.

Sangwan, K. S. (2011) ‘Quantitative and qualitative benefits of green manufacturing: an empirical study of Indian small and medium enterprises. In: Glocalized Solutions for Sustainability in Manufacturing’, Springer, Berlin Heidelberg, pp. 371-376.

Sapienza, H. J. and Grimm, C. M. (1997) ‘Founder characteristics, start-up process, and strategy/structure variables as predictors of shortline railroad performance’, *Entrepreneurship Theory and Practice*, 23(1), pp. 5-24.

Sarasvathy, S. D., Menon, A. R. and Kuechle, G. (2013) Failing firms and successful entrepreneurs: Serial entrepreneurship as a temporal portfolio’, *Small Business Economics*, 40(2), pp. 417-434.

Sarkis, J. and Zhu, Q. (2017) ‘Environmental sustainability and production: taking the road less travelled’, *International Journal of Production Research*, 56(1-2), pp. 743-759.

Saunders, M., Lewis, P. and Thornhill, A. (2009) *Research Methods for Business Students*. 5th edition. Harlow, Essex: Prentice Hall.

Saunila, M. (2016) ‘Performance measurement approach for innovation capability in SMEs’, *International Journal of Productivity and Performance Management*, 65(2), pp. 162-176.

Schein, E. H. (1996) ‘Culture: The missing concept in organization studies’, *Administrative Science Quarterly*, 41, pp. 229-240.

References

Schjoedt, L. (2009) 'Entrepreneurial job characteristics: an examination of their effect on entrepreneurial satisfaction', *Entrepreneurship Theory and Practice*, 33(3), pp. 619-644.

Schlosser, F. (2013) 'Identifying and Differentiating Key Employees from Owners and Other Employees in SMEs', *Journal of Small Business Management*, 53(1), pp. 37-53.

Schmenner, R. and Vollmann, T. (1994) 'Performance Measures; Gaps, False Alarms and the Usual Suspects', *International Journal of Operations and Production Management*, 14(12).

Schroeder, R. G., Linderman, K., Liedtke, C. and Choo, A. S. (2008) 'Six Sigma: Definition and underlying theory', *Journal of Operations Management*, 26, pp. 536-554.

Schuller, B. J. and Lidbom, M. (2009) 'The Enlargement of the EU since 2000 - Economic Aspects and Challenges', The 11th Annual SNEE European Integration Conference, May 26-29, 2009, Mölle, Sweden.

Searcy, C. (2011) 'Updating corporate sustainability performance measurement system', *Measuring Business Excellence*, 15(2), pp. 44-56.

Sedehi, A. (2015) 'Evaluating the impacts of enterprise resource planning on organizational performance for small to medium enterprises in manufacturing', Doctor of Philosophy, Georgia Institute of Technology, USA May 2015.

Sekaran, U. (2000) *Research Methods for Business: A skill-building approach*. 3rd edn. New York: John Wiley and Sons.

Senik, Z. C., Scott-Ladd, B., Entrekin, L. and Adham, K. A. (2011) 'Networking and internationalization of SMEs in emerging economies', Journal of International Entrepreneurship, 9, pp. 259-281.

Sezen, B. and Çankaya, S. Y. (2013) 'Effects of green manufacturing and eco-innovation on sustainability performance', Procedia-Social Behavioral Sciences, 99, pp. 154-163.

Shah, R. and Ward, P. T. (2003) 'Lean manufacturing: context, practice bundles, and performance', *Journal of Operations Management*, 21(2), pp. 129-149.

Sharma, M. K. and Bhagwat, R. (2006) 'Performance measurements in the implementation of information systems in small and medium-sized enterprises: a framework and empirical analysis', *Measuring Business Excellence*, 10(4), pp. 8-21.

Sharma, S. and Starik, M. (2009) ‘Research in corporate sustainability: The evolving theory and practice of organizations in the natural environment’, *Canadian Journal of Administrative Sciences* / Revue Canadienne des Sciences de l'Administration, 21(3), pp. 288-289.

Shaw, E. and Conway, S. (2000) *Networking and the small firm*. in Carter, S. and Jones-Evans, D. (Eds), Enterprise and Small Business, Financial Times/Prentice-Hall, Harlow.

Shi, M. and Yu, W. (2013) ‘Supply chain management and financial performance: literature review and future directions’, *International Journal of Operations and Production Management*, 33(10), pp. 1283-1317.

Shirokova, G., Vega, G. and Sokolova, L. (2013) ‘Performance of Russian SMEs: exploration, exploitation and strategic entrepreneurship’, *Critical Perspectives on International Business*, 9(1), pp. 173-203.

Simons, R. (2000) *Performance Measurement and Control Systems for Implementing Strate*gy. Upper Saddle River, Prentice Hall.

Simpson, M., Tuck, N. and Bellamy, S. (2004) ‘Small business success factors: the role of education and training’, *Education and Training*, 46(8/9), pp. 481-491.

Simpson, M., Padmore, J. and Newman, N. (2012) ‘Towards a new model of success and performance in SMEs’, *International Journal of Entrepreneurial Behaviour and Research*, 18(3), pp. 264-285.

Singh, R. K., Garg, S. K. and Deshmukh, S. G. (2008) ‘Strategy development by SMEs for competitiveness: a review’, *Benchmarking: An International Journal*, 15(5), pp. 525-547.

Sink, S. and Tuttle, T. (1989) *Planning and Measurement in your Organisation of the Future*. Industrial Engineering & Management Press, Norcross.

Slack, N., Chambers, S. and Johnston, R. (2007) *Operations Management*. New York : Financial Times Prentice Hall.

Slack, N. and Lewis, M. (2008) *Operations Strategy*. Prentice Hall, Harlow.

Slack, N. Chambers, S., Harland, C., Harrison, A. and Johnston, R. (1998) *Operations Management*. Pitman Publishing, London.

References

Small Business Administration (SBA) (2012). Available at: https://www.sba.gov/content/small-business-gdp-update-2002-2010 (Assessed: 16 July 2019).

Sorooshian, S., Aziz, N. F., Ahmad, A., Jubidin, S. N. and Mustapha, N. M. (2016) 'Review on Performance Measurement Systems', *Mediterranean Journal of Social Sciences*, 7(1), pp. 123-132.

Srimai, S., Radford, J. and Wright, C. (2011) 'Evolutionary paths of performance measurement: an overview of its recent development', *International Journal of Productivity and Performance Management*, 60(7), pp. 662-687.

Stanton, N. A., Salmon, M., Walker, G. H., Baber, C. and Jenkins, D. P. (2005) *Human Factors Methods: A practical guide for engineering and design*. London: Ashgate.

Statistics of U.S. Businesses (SUSB) (2016). Available at: https://www.sba.gov/sites/default/files/advocacy/United_States.pdf (Assessed: 16 July 2019).

Stefana, R. M. (2012) 'A Comparison of Data Classification Methods', Procedia *Economics and Finance*, 3, pp. 420-425.

Stephen Town, J. (2000), 'Performance or measurement?', *Performance Measurement and Metrics*, 1(1), pp. 43-54.

Stewart, G. B. (1991) *The Quest for Value: The EVA Management Guide*. Harper Business, New York, NY.

Stokes, D. and Wilson, N. (2006) *Small Business Management and Entrepreneurship*. 5th edn. London: Thomson.

St-Pierre, J. and Delisle, S. (2006) 'An expert diagnosis system for the benchmarking of SMEs' performance', *Benchmarking: An International Journal*, 13(1/2), pp. 106-119.

Subramony, M. (2009) 'A meta-analytic investigation of the relationship between HRM bundles and firm performance', Human Resource Management, 48, pp. 745-768.

Sureshchandar, G. S. and Leisten, R. (2005) 'Holistic scorecard: strategic performance measurement and management in software industry', *Measuring Business Excellence*, 9(2), pp. 12-29.

References

Sushil, P. (2010) 'Flexible strategy game-card', *Global Journal of Flexible Systems Management*, 11(1/2), pp. iii-iiv.

Suwignjo, P., Bititci, U. S. and Carrie, A. S. (2000) 'Quantitative models for performance measurement system', *International Journal of Production Economics*, 64(1-3), pp. 231-241.

Tabachnick, B. G. and Fidell, L. S. (2007) *Using Multivariate Statistics*. 5th edn. New York: Pearson Education.

Taipale-Erävala, K., Heilmann, P. and Lampela, H. (2014) 'Survival Competence in Russian SMEs in a Changing Business Environment', *Journal of East-West Business*, 20(1), pp. 25-43.

Talib, H. H. A., Ali, K. A. M. and Idris, F. (2014) 'Critical success factors of quality management practices among SMEs in the food processing industry in Malaysia', *Journal of Small Business and Enterprise Development*, 21(1), pp. 152-176.

Tan, C. S. L. (2007) Sources Of Competitive Advantage For Emerging Fast Growth Small-To-Medium Enterprises: The Role Of Business Orientation, Marketing Capabilities, Customer Value, And Firm Performance', School of Management Business Portfolio RMIT University.

Tan, C. S. L., Smyrnios, K. X. and Xiong, L. (2014) What drives learning orientation in fast growth SMEs?', *International Journal of Entrepreneurial Behaviour and Research*, 20(4), pp. 324-350.

Tan, K. H., Shi, L., Tseng, M .L. and Cui, W. J., (2014) Managing the indirect effects of environmental regulation and performance measurement', *Industrial Engineering and Management Systems*, 13(2), pp. 148-153.

Tang, D., Wang, Q. and Ullah, I. (2017) 'Optimisation of Product Configuration in Consideration of Customer Satisfaction and Low Carbon', International Journal of Production Research, 55(12), pp. 3349-3373.

Tangen, S. (2004) 'Evaluation and Revision of Performance Measurement Systems', Doctoral thesis, Woxe´n Centrum, Department of Production Engineering Royal Institute of Technology Stockholm.

Taschner, A. (2016) 'Improving SME logistics performance through benchmarking', *Benchmarking: An International Journal*, 23(7), pp. 1780-1797.

References

Taticchi, P. and Balachandran, K. R. (2008) 'Forward performance measurement and management integrated frameworks', *International Journal of Accounting and Information Management*, 16(2), pp. 140-154.

Taticchi, P., Balachandran, K. and Tonelli, F. (2012) 'Performance measurement and management systems: state of the art, guidelines for design and challenges', *Measuring Business Excellence*, 16(2), pp. 41-54.

Taticchi, P., Tonelli, F. and Cagnazzo, L. (2010) 'Performance measurement and management: a literature review and a research agenda', *Measuring Business Excellence*, 14(1), pp. 4-18.

Taylor, A. and Taylor, M. (2013) 'Factors influencing effective implementation of performance measurement systems in small and medium-sized enterprises and large firms: a perspective from Contingency Theory', International Journal of Production Research, 52(3), pp. 847-866.

Tenhunen, J., Rantanen, H. and Ukko, J. (2001) 'SME-oriented implementation of a performance Measurement system, Department of Industrial Engineering and Management', Lappeenranta University of Technology, Saimaankatu 11, FIN-15140 Lahti, Finland.

Teo, S. T. T., Le Clerc, M. and Galang, M. C. (2011) 'Human capital enhancing HRM systems and frontline employees in Australian manufacturing SMEs', *International Journal of Human Resource Management*, 22(12), pp. 2522-2538.

Thakkar, J., Kanda, A. and Deshmukh, S. G. (2009) 'Supply chain performance measurement framework for small and medium scale enterprises', *An International Journal*, 16(5), pp. 702-723.

Thanki, S., Govindan, K. and Thakkar, J. (2016) 'An investigation on lean-green implementation practices in Indian SMEs using analytical hierarchy process (AHP) approach', *Journal of Cleaner Production*, 135, pp. 284-298.

The blue book (2013). Available at: https://webarchive.nationalarchives.gov.uk/20160107055223/http://www.ons.gov.uk (Assessed: 16 July 2019).

The manufacturer (2019). Available at: https://www.themanufacturer.com/uk-manufacturing-statistics/ (Assessed: 16 July 2019).

Timans, W., Antony, J., Ahaus, K. and Solingen, R. V. (2012) 'Implementation of Lean Six Sigma in small- and medium-sized manufacturing enterprises in the Netherlands', *Journal of Operational Research Society*, 63, pp. 339-353.

Tiwari, R., Buse, S. and Herstatt, C. (2007) 'Mobile Services in Banking Sector: The Role of Innovative Business Solutions in Generating Competitive Advantage', The 8th International Research Conference on Quality, Innovation and Knowledge Management, 12-14 Feb. 2007, New Delhi.

Tomas, G. and Hult, M. (2012) 'A focus on international competitiveness', *Journal of the Academy of Marketing Science*, 40, pp. 195-201.

Tracey, M., Vonderembse, M. A. and Lim, J. S. (1999) 'Manufacturing technology and strategy formulation: keys to enhancing competitiveness and improving performance', *Journal of Operations Management*, 17(4), pp. 411-28.

Tracy, B. (2007) *Eat that frog!: 21 great Ways to Stop Procrastinating and Get More Done in Less Tim*. 2nd edn. Berrett-Koehler Publishers.

Tucker, M. and Pitt, M. (2009) 'Customer performance measurement in facilities management: A strategic approach', *International Journal of Productivity and Performance Management*, 58(5), pp. 407-422.

Ukko, J., Karhu, J. and Rantanen, H. (2007), 'How to communicate measurement information successfully in small and medium-sized enterprises: A regression model', *International Journal of Information Quality*, 1, pp. 41-59.

Ukko, J., Pekkola, S. and Rantanen, H. (2009) 'A framework to support performance measurement at the operative level of an organisation', *International Journal of Business Performance Management*, 11(4), p. 313.

Upton, D. (1994) 'The management of manufacturing flexibility', *California Management Review*, 36(1), pp. 72-89.

Valaei, N. and Rezaei, S. (2017) 'Does Web 2.0 utilisation lead to knowledge quality, improvisational creativity, compositional creativity, and innovation in small and medium-sized enterprises? A sense-making perspective', *Technology Analysis and Strategic Management*, 29(4), pp. 381-394.

Valaei, N., Rezaei, S. and Ismail, W. K. W. (2017) 'Examining learning strategies, creativity, and innovation at SMEs using fuzzy set Qualitative Comparative Analysis and PLS path modeling', *Journal of Business Research*, 70, pp. 224-233.

Van Aken, E., Letens, G., Coleman, G., Farris, J. and Van Goubergen, D. (2005) Assessing maturity and effectiveness of enterprise performance measurement systems', *International Journal of Productivity and Performance Management*, 54(5/6), pp. 400-418.

Van Looy, A. and Shafagatova, A. (2016) 'Business process performance measurement: a structured literature review of indicators, measures and metrics', *SpringerPlus*, 5(1797), doi: 10.1186/s40064-016-3498-1.

Verrier, B., Rose, B., Caillaud, E. and Remita, H. (2014) 'Combining organizational performance with sustainable development issues: the lean and green project benchmarking repository', *Journal of Clean Production*, 85, pp. 83-93.

Vinodh, S. and Balaji, S. R. (2011) 'Fuzzy logic based leanness assessment and its decision support system', *International Journal of Production Research*, 49(13), pp. 4027-4041.

Visagie, R. (2012) *An ethics of accountability within a qualitative framework*. Unisa.

Wach, D., Stephan, U. and Gorgievski, M. (2016) 'More than money: Developing an integrative multi-factorial measure of entrepreneurial success', *International Small Business Journal*, 34(8), pp. 1098-1121.

Waddock, S. (2008) 'Building a New Institutional Infrastructure for Corporate Responsibility', Academy of Management Perspectives, 22(3), pp. 87-108.

Waggoner, D., Neely, A. and Kennerly, M. (1999) 'The Forces that Shape Organisational Performance Measurement Systems: An Interdisciplinary Review', *International Journal of Production Economics*, 60, pp. 53-60.

Walker, E., Loughton, K. and Brown, A. (1999) 'The relevance of non-financial measures of success for micro business owners', Proceedings of the 1999 International Council for Small Business Conference Naples.

Walker, E. and Brown, A. (2004) 'What success factors are important to small business owners?', *International Small Business Journal*, 22(6), pp. 577-594.

Wang, C. and Ang, B. L. (2004) 'Determinants of Venture Performance in Singapore', *Journal of Small Business Management*, 42(4), pp. 347-363.

Wang, X. and Chan, H. (2013) 'A hierarchical fuzzy TOPSIS approach to assess improvement areas when implementing green supply chain initiatives', *International Journal of Production Research*, 51(10), pp. 3117-3130.

Ward, P. T., McCreery, J. K., Ritzman, L. P. and Sharma, D. (1998) 'Competitive priorities in operations management', *Decision Sciences*, 29(4), pp. 1035-1046.

References

Ward, M. and Rhodes, C. (2014) 'Small businesses and the UK economy', *Economic Policy and Statistics*, Note: SN/EP/6078. Available at: https://researchbriefings.files.parliament.uk/documents/SN06078/SN06078.pdf (Accessed: 18 December 2019).

Watson, K., Nicholas, S. H., Watson, K., Hogarth-scott, S. and Wilson, N. (1998) 'Small business start-ups: implications', *International Journal of Entrepreneurial Behaviour & Research*, 4(3), pp. 217-238.

Watts, T. and McNair-Connolly, C. J. (2012) 'New performance measurement and management control systems', *Journal of Applied Accounting Research*, 13(3), pp. 226-241.

Waweru, N. and Spraakman, G. (2012) 'The use of performance measures: case studies from the microfinance sector in Kenya', *Qualitative Research in Accounting and Management*, 9(1), pp. 44-65.

Wettstein, T. and Kueng, P. (2002) 'A maturity model for performance measurement systems', *Management Information Systems*. Available at: https://pdfs.semanticscholar.org/1cc1/5619b86ad2a1fd10481e29b45b28c6eeafd7.pdf?_ga=2.45598435.672650771.1584031744-1896453770.1583686407 (Accessed: 18 December 2019).

Wheelen, T. L. and Hunger, D. J. (2002) *Strategic Management and Business Policy*. 8th edn. New Jersey: Prentice Hall.

White, G. (1996) 'A Survey and Taxonomy of Strategy-Related Performance Measures for Manufacturing', *International Journal of Operations and Production Management*, 16(3), pp. 42-61.

White, S. (2015) 'Business Population Estimates for the UK and Regions 2015', UK Department for Business Innovation and Skills, Sheffield, UK. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/467443/bpe_2015_statistical_release.pdf (Accessed 13 April 2016).

Wild, A. M. (2010) 'Learning the wrong lessons from history: Underestimating strategic change in business turnarounds', *Business History*, 52(4), pp. 617-650.

Williams, B. R. and O'Donovan, G. (2015) 'The accountants' perspective on sustainable business practices in SMEs', *Social Responsibility Journal*, 11(3), pp. 641-656.

Williamson, D., Lynch-Wood, G. and Ramsay, J. (2006) 'Drivers of environmental behaviour in manufacturing SMEs and the implications for CSR', *Journal of Business Ethics*, 67, pp. 317-330.

Womack, J. and Jones, D. (2003) *Lean Thinking: Banish Waste and Create Wealth in Your Corporation*. 7th edn. Simon & Schuster.

Womack, J. P., Jones, D. T. and Ross, D. (1990) *The Machine that Changed the World*. New York, NY: Macmillan.

Wong, W. P., Ignatius, J. and Soh, K. L. (2014) 'What is the leanness level of your organisation in lean transformation implementation? an integrated lean index using ANP approach', *Production Planning & Control*, 25(4), pp. 273-287.

Wood, C. H., Ritzman, L. P. and Sharma, D. (1990) 'Intended and achieved competitive priorities: measures, frequencies, and financial impact, in Ettlie, J., Burstein, E. and Fiegenbaum, M.C. (Eds), Manufacturing Strategy, Kluwer, Academic Publishers, Boston, MA, pp. 225-232.

World Commission on Environment and Development (WCED) (1987) *Our common future*. Oxford: Oxford University Press.

Wu, D. (2009) 'Measuring Performance in Small and Medium Enterprises in the Information & Communication Technology Industries', Doctorate of Philosophy, RMIT University, Australia, February.

Wu, N., Bacon, N. and Hoque, K. (2013) 'The adoption of high performance work practices in small businesses: the influence of markets, business characteristics and HR expertise', *The International Journal of Human Resource Management*, 25(8), pp. 1149-1169.

Wu, L., Subramanian, N., Abdulrahman, M. D., Liu, C., Lai, K. H. and Pawar, K. S. (2015) 'The impact of integrated practices of lean, green, and social management systems on firm sustainability performance-evidence from Chinese fashion auto-parts suppliers', *Sustainability*, 7(4), pp. 3838-3858.

Wu, X., Qiao, F. and Poon, K. (2014) 'Cloud Manufacturing Application in Semiconductor Industry', Proceedings of the Winter Simulation Conference, pp. 2376-2383.

Yadav, N. and Sagar, M. (2013) 'Performance measurement and management frameworks: Research trends of the last two decades', *Business Process Management Journal*, 19(6), pp. 947-971.

References

Yin, R. K. (2012) *Case Study Research: Design and methods*. 4th edn. London, Sage.

Zeglat, D., AlRawabdeh, W., AlMadi, F. and Shrafat, F. (2012) 'Performance Measurement Systems: stages of development leading to success', *International Journal of Contemporary Research in Business*, 4(7), pp. 440-448.

Zeng, S. X., Xie, X. M. and Tam, C. M. (2010) 'Relationship between cooperation networks and innovation performance of SMEs', *Technovation*, 30, pp. 181-194.

Zerfass, A. and Winkler, L. (2016) 'Corporate Communication in SMEs: Unveiling an Ignored Field of Practice', *The Management Game of Communication*, 1, pp. 265-286.

Zhang, Q., Vonderembse, M. A. and Lim, J. S. (2003) Manufacturing flexibility: defining and analyzing relationships among competence, capability, and customer satisfaction', *Journal of Operations Management*, 21(2), pp. 173-191.

Zhao, W. and Wang, L. (2015) 'How knowledge affects resource acquisition: Entrepreneurs' knowledge, intra-industry ties and extra-industry ties', *Journal of Entrepreneurship in Emerging Economies*, 7(2), pp. 115-128.

Zhu, Q., Sarkis, J. and Geng, Y. (2005) 'Green Supply Chain Management in China: Pressures, Practices and Performance', *International Journal of Operations & Production Management*, 25(5), pp. 449-468.

Zikmund, W. G. (2003) *Business Research Met*hods. 7th edn. Cincinnati, OH: Thomson/South-Western.

Zikmund, W., Babin, B., Carr, J. and Griffin, M. (2012). *Business Research Methods*. New York: Cengage Learning.

# Appendices

# Appendix A

# UK SMEs

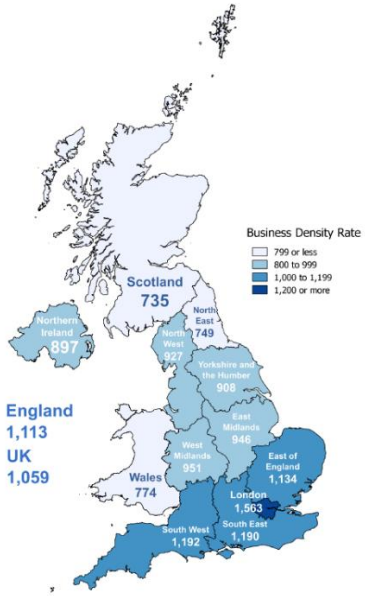



Figure 1: Number of businesses in the UK private sector per 10,000 adults, UK region and country, start of 2018 (BIS, Business population estimates, 2018).

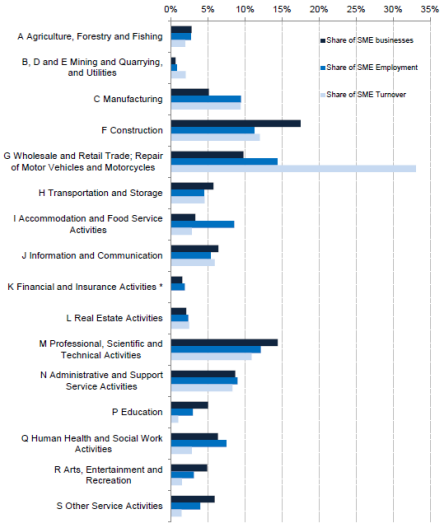



Figure 2: Share of SME numbers, SME employment and SME turnover by industrial sector, start of 2018 (BIS, Business population estimates, 2018).

# Appendix B

# Questionnaire Map

The following table details the questionnaire map that presents the metrics definitions and related references.

| | Questions | Metrics | References |
|---|---|---|---|
| 1 | Device or Tool or Machinery working | Resource Utilization | Benavides and Landeghem (2015), Gupta, Ko, and Min (2002), Kadipasaoglu et al. (2000) |
| 2 | Vehicle working | | |
| 3 | Staff working | | |
| 4 | Scheduled downtime | Down Time Hours | Kaur et al. (2017), Ahmad and Alaskari (2014), Lee and Wong (2015) |
| 5 | Unscheduled downtime | | |
| 6 | Total shutdown | | |
| 7 | Forecast production | Forecasting | Garengo and Bernardi (2007), Roach (2011), Hilmola et al. (2015), Bulak et al. (2015), Chi (2015), Benavides and Landeghem (2015), Bulak et al. (2016), Krægpøth, Stentoft, and Jensen (2017) |
| 8 | Actual production | Production Capacity (15+16) | Umble, and Murakami (2006), Corbett and Csillag (2001), Hudson (2001), KPI Institute, Hilmola et al. (2015), Chi (2015), Sedehi (2015), Benavides and Landeghem (2015), Ipinnaiye et al. (2016) |
| 9 | Potential production in months of no demand | Volume Flexibility | Hilmola et al. (2015), Benavides and Landeghem (2015), Sedehi (2015) |
| 10 | Total dispatched | Delivery Speed | Neely (2005), Sanchez (2001), Pyzdek (2010), Hilmola et al. (2015), Sedehi (2015) |
| 11 | Total shipments | | |
| 12 | Complaints | Customer Complaints | Bai (2009), Kim (2009), Ahmad and Alaskari (2014), Sedehi (2015) |
| 13 | High quality products | Product Quality (Performance and Conformance) | Hilmola et al. (2015), Bulak et al. (2016) |
| 14 | Average quality products | | |
| 15 | Good products | Defect Free Products (13+14) | Hon 2005, Hudson 2001, Pawar 1999, Pyzdek 2010, Matsoso and Benedict (2014), Sedehi (2015), Bulak et al. (2016) |
| 16 | Failed quality control | Waste Product | Hon 2005, Hudson 2001, Pawar 1999, Pyzdek 2010, Sedehi (2015), Bulak et al. (2016) |
| 17 | Production lost due to shutdown | Waste Time | Pyzdek 2010, Sedehi (2015) |
| 18 | Number of Employees | Potential Labour Force | Lee and Wong (2015), Bulak et al. (2016), Ipinnaiye et al. (2016) |
| 19 | Defect free on time shipments | On-time Delivery | Amrina 2011, Davidson 2013, Hon 2005, Uwizeyemungu 2010, Wei 2008, Matsoso and Benedict (2014), Sedehi (2015), Chi (2015) |
| 20 | Different employee expertise | Expertise Flexibility | Bulak et al.(2016), Kaur et al. (2017), Larsson et al. (2017) |
| 21 | Monthly sales | Volume Sales | Atwater and Chakravorty (2002), Gupta, Ko, and Min (2002), Benavides and Landeghem (2015) |
| 22 | Monthly Variable costs | Operation Cost | Hon 2005, KPI Institute 2013, Sedehi (2015) |
| 23 | Monthly Fixed costs and overheads | | |
| 24 | The employees were appreciated for their work | Employee appraisals | Ates et al. (2013), Garavan et al. (2016) |
| 25 | Organisation compared operations with other organisations | Competitiveness | Kwasi and Moses (2008), Karim et al. (2008), Nauhria et al. (2011), Joshi et al. (2013), Kaur et al. (2017) |
| 26 | The managers encouraged initiatives | Knowledge acquisition | Lee and Wong (2015), Hutchinson and Quintas, (2008), Jones and Crompton (2009) |
| 27 | The managers gave positive feedback | Feedback Activities | Della Torre and Solari (2013), Gilman and Edwards (2008), Garavan et al. (2016) |
| 28 | The managers pass employees' ideas to the upper levels of the organisation | Supports leadership development | McAdam and Keogh (2004), Adams et al. (2006), Crossan and Apaydin (2010), Lee and Wong (2015), Garavan et al. (2016), Saunila (2017) |
| 29 | The managers participate in ideation and development | Focus of attention | Jr et al. (2017), Franco-Santos et al. (2007) |
| 30 | Transferring tacit knowledge was practised | Knowledge Transfer | Hutchinson and Quintas, (2008), Jones and Crompton (2009), Lee and Wong (2015) |
| 31 | Employee had to learn something | Employee Training | Lee and Lan (2011), Lee and Wong (2015) |

| | | | |
|---|---|---|---|
| 32 | Employee volunteered to learn something | Motivation | Ates et al. (2013), Tan, Smyrnios and Xiong (2014), Saunila (2017) |
| 33 | Organisation had to seek new action | Development | McAdam and Keogh (2004), Carayannis and Provance (2008), Skarzynski and Gibson (2008), Saunila (2017) |
| 34 | Organisation encouraged new action | Encourage Development | Breunig et al. (2014), Davila et al. (2009), Saunila (2017), Garengo and Bernardi (2007), Ates et al. (2013) |
| 35 | Organisation tolerated mistakes in new actions | Tolerance for Mistakes | Wong (2005), Radzeviciene (2008), Omerzel et al. (2011), Lee and Wong (2015) |
| 36 | Employee was encouraged to contact external contact to learn something | Knowledge Creation | Wong (2005), Valmohammadi (2010), Lee and Wong (2015) |
| 37 | Organisation developed actions together with stakeholders or customers | Knowledge providers | Chen et al., (2006), Desouza and Awazu, (2006), Yip et al. (2012), Alvarez and Busenitz (2001), Sheehan et al. (2005), Zhang et al. (2006), Lee and Wong (2015), Garengo and Bernardi (2007), Chi (2015), Saunila (2017) |
| 38 | New action required special know-how of employee | Development Changes | Wong and Chan (2014), Zach et al. (2014), Saunila (2017), Larsson et al. (2017) |
| 39 | Taking new action was understood easily by employee | Development Communication | Adams et al. (2006), Garengo and Bernardi (2007), Saunila (2017) |

# Appendix C

# Ethical Approval

Applicant: Mrs Atefeh Sayad Saravi

Project Title: Interviews for PhD project in performance measurement system

Reference: 16888-LR-Jul/2019- 19912-2

Dear Mrs Atefeh Sayad Saravi

The Research Ethics Committee has considered the above application recently submitted by you.

The Chair, acting under delegated authority has agreed that there is no objection on ethical grounds to the proposed study. Approval is given on the understanding that the conditions of approval set out below are followed:

- The agreed protocol must be followed. Any changes to the protocol will require prior approval from the Committee by way of an application for an amendment.

Please note that:

- Research Participant Information Sheets and (where relevant) flyers, posters, and consent forms should include a clear statement that research ethics approval has been obtained from the relevant Research Ethics Committee.
- The Research Participant Information Sheets should include a clear statement that queries should be directed, in the first instance, to the Supervisor (where relevant), or the researcher. Complaints, on the other hand, should be directed, in the first instance, to the Chair of the relevant Research Ethics Committee.
- Approval to proceed with the study is granted subject to receipt by the Committee of satisfactory responses to any conditions that may appear above, in addition to any subsequent changes to the protocol.
- The Research Ethics Committee reserves the right to sample and review documentation, including raw data, relevant to the study.
- You may not undertake any research activity if you are not a registered student of Brunel University or if you cease to become registered, including abeyance or temporary withdrawal. As a deregistered student you would not be insured to undertake research activity. Research activity includes the recruitment of participants, undertaking consent procedures and collection of data. Breach of this requirement constitutes research misconduct and is a disciplinary offence.

Professor Hua Zhao

Chair of the College of Engineering, Design and Physical Sciences Research Ethics Committee

Brunel University London

# Appendix D

# Questionnaire Part I and Part II

Dear Participants,

I am conducting a research on identifying the key factors that influence the performance of Small to Medium Size Enterprises in the UK. We hope the results of this study could help in building a good understanding of the key factors that affect the viability and sustainability of SMEs during the economic, commercial and legislative volatility. You will find attached two questionnaires which I hope you could complete to the best of your knowledge and at your convenience.

This study is part of my PhD research programme, undertaken at the College of Engineering, Design and Physical Sciences in Brunel University. This project has been supervised by Dr Ali Mousavi. Your participation is entirely voluntary and you may withdraw at any stage. The information you provide will be anonymised and destroyed upon completion of the study. The questionnaire will be used for the sole purpose of this academic research. All information supplied from questionnaires will be kept **strictly confidential** and only aggregated data will be reported in the study. In addition, the information provided by you will not be used by any third party or entity.

Please complete both separate questionnaires. The first one is needed to be complete just once, in order to gather general information about your firm. You can find this questions in this word file, which is in the next page, and it takes maximum 5 minutes. The second part of the questionnaire is an excel file that it takes between 30 to 45 minutes. The second part includes the questions related for performance measurements factors.

A summary of the findings will be provided to you after the project is completed (upon request). In addition, we will be delighted to discuss our findings with you if this could be beneficial to your organisation. Thanking you for your kind cooperation and support for this research. Should you require any clarification, please do not hesitate to contact:

Yours Faithfully,

Atefeh Sayad Saravi

Mobile: 07888 763594

Email: atefeh.sayadsaravi@brunel.ac.uk

Appendix D

Name of the company: ……..

Name of the participant: ……

**Section I (Company Profile):** Select the most appropriate option that describes your company:

1. Please estimate the number of employees in the firm:

☐1-5 ☐6-9 ☐10-49 ☐50-100 ☐101-250 ☐251 or more

2. What is the type of your firm?

☐Manufacture ☐Service ☐R & D ☐whole sales ☐Retailer ☐Others

If other please name it here:

3. How many years has your firm been in business?

☐Less than 3 years ☐3-5 years ☐6-10 years ☐11-20 years ☐More than 20 years

4. Your job position in the firm:

☐Owner manager or Director ☐Manager ☐Supervisor ☐Employee

5. Is the company private or publicly held?

☐Private ☐Public

6. Has your company been invested by venture capital companies?

☐Yes ☐No

**Section II (Financial Profile):** to choose the right answer please click on the check boxes.

| GBP | £0 to £20,000 | £20,001 to £40,000 | £40,001 to £60,000 | £60,001 to £80,000 | £80,001 to £100,000 | Over £100,001 |
|---|---|---|---|---|---|---|
| Variable costs (per year) | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Fixed costs and overheads (per year) | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

| GBP | £0 to £20,000 | £20,001 to £50,000 | £50,001 to £100,000 | £100,001 to £200,000 | £200,001 to £300,000 | Over £300,001 |
|---|---|---|---|---|---|---|
| Annual Sales | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Annual Turnover | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

Appendix D

| Profit Margin = (net profit/sale) X 100 | Less than 0% | 0%-4% | 5%-8% | 9%-12% | 13%-16% | More than 16% |
|---|---|---|---|---|---|---|
| Past three years of operation (average) | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

1. Where do you gain the financial resource in case if needed (i.e. adding new production line), please choose two main resources?

☐Bank ☐Self-cash reserves ☐Government grants and loan

☐Cooperation Partner ☐Relatives and Friends ☐Retained earnings

2. What options do you think is the biggest threat to your company's sustainability?

☐Low profit ☐Bad debt ☐No enough collateral

☐Country economical changes ☐Others

If other reasons please list them below:

3. Do you think Bank is the most significant issue you hope to gain financial resource support?

☐Yes ☐No

4. Are your fixed and variable costs increasing beyond inflation rate?

☐Yes ☐No

If fixed and variable costs are increasing beyond inflation rate, please explain the reasons below:

5. In your experience, which two costs increased fast in the last six months?

☐Material ☐Labour cost ☐Machines ☐Marketing

☐Plant rent ☐Transportation cost ☐Customer service

☐Energy cost ☐New product development ☐Others

6. Which ways do you apply to control and reduce the cost, please choose two?

☐Reduce the waste of inferior quality product

☐Increase the workload

☐Extend the life of the machine

☐Change to cheap plant

☐Change to less cost ways of marketing

☐Reduce the training cost

Appendix D

☐Reduce the new product development

☐Looking for low cost transportation channel

☐Others

Following if a sample of Excel sheet that includes the questions filled out by SMEs:

| **Related factors** | **Data by different units** |
|---|---|
| Resource utilization based on duration (hours) | Device 1 or Tool 1 or Machinery 1 working hours |
| | Device 2 or Tool 2 or Machinery 2 working hours |
| | Device 3 or Tool 3 or Machinery 3 working hours |
| | Device 4 or Tool 4 or Machinery 4 working hours |
| | Vehicle 1 working hours |
| | Vehicle 2 working hours |
| | Vehicle 3 working hours |
| | Staff 1 working hours |
| | Staff 2 working hours |
| | Staff 3 working hours |
| | Staff 4 working hours |
| | Scheduled downtime hours |
| | Unscheduled downtime hours |
| | Total shutdown hours |
| | |
| Number of products, number of customer satisfaction and employment for consistency, waste and effectiveness | Number of good products |
| | Number of failed quality control |
| | Number of forecast productions |
| | Number of Actual productions |
| | Number of total dispatched |
| | Number of high-quality products |
| | Number of average quality products |
| | Number of potential productions in months of no demand |
| | Number of productions lost due to shutdown |
| | Number of defect free on time shipments |
| | Number of total shipments |
| | Number of Complaints |
| | Number of Employees |
| | Number of Different employee expertise |
| | |
| Number of events for leadership and development (your estimation) | The managers encouraged initiatives |
| | The managers gave positive feedback |
| | The managers pass employees' ideas to the upper levels of the organisation |
| | The managers participate in ideation and development |
| | Transferring tacit knowledge was practised |
| | The employees were appreciated for their work |
| | Employee had to learn something |
| | Employee volunteered to learn something |
| | Organisation had to seek new action |
| | Organisation encouraged new action |
| | Organisation tolerated mistakes in new actions |
| | Employee was encouraged to contact external contact to learn something |
| | Organisation compared operations with other organisations |
| | Organisation developed actions together with stakeholders or customers |
| | New action required special know-how of employee |
| | Taking new action was understood easily by employee |

# Appendix E

# Analysis and Results

The following table shows the Reliability Test in SPSS by Cornbach Alpha for collected data for each SMEs. Speed/time: Hours; Effectiveness/Efficiency and Consistency/Waste: number of products; Cost: specific range; Leadership and Development: number of events.

| Type of Classified Factors | A | B | C | D | E | F | G | H | I | J |
|---|---|---|---|---|---|---|---|---|---|---|
| Speed/Time | 0.869 | 0.713 | 0.895 | 0.779 | 0.953 | 0.746 | 0.710 | 0.929 | 0.912 | 0.926 |
| Effectiveness/ efficiency | 0.814 | 0.695 | 0.776 | 0.576 | 0.759 | 0.788 | 0.759 | 0.649 | 0.852 | 0.791 |
| Consistency and waste | 0.692 | 0.718 | 0.701 | 0.625 | 0.694 | 0.666 | 0.600 | 0.693 | 0.661 | 0.678 |
| Cost | 0.750 | 0.886 | 0.750 | - | - | - | - | 0.750 | 0.750 | 0.703 |
| Leadership and Development | 0.763 | - | - | 0.705 | 0.714 | 0.701 | 0.704 | 0.708 | 0.731 | 0.720 |

The following tables are the samples of results for ANOVA test. The complete set of results for this test is available upon the request by researchers.

Descriptive data of SMEs clustering for EE1.

| EE1 | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean | | Minimum | Maximum |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound | | |
| *Straggling* | 36 | .9120 | .62069 | .10345 | .7020 | 1.1220 | -.50 | 2.00 |
| *Survival* | 36 | 1.1628 | .25629 | .04271 | 1.0761 | 1.2495 | .81 | 2.00 |
| *Successful* | 36 | 1.1104 | .13331 | .02222 | 1.0653 | 1.1555 | .99 | 1.67 |
| Total | 108 | 1.0617 | .40631 | .03910 | .9842 | 1.1392 | -.50 | 2.00 |

Appendix E

EE1 ANOVA test comparing the mean of *Successful*, *Survival*, and *Struggling* SMEs.

| EE1 | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | 1.260 | 2 | .630 | 4.032 | .021 |
| Within Groups | 16.405 | 105 | .156 | | |
| Total | 17.665 | 107 | | | |

EE1 multiple comparisons, Tukey HSD (Speed/Time). (*. The mean difference is significant at the 0.05 level.)

| (I) SME | (J) SME | Mean Difference (I-J) | Std. Error | Sig. | 95% Confidence Interval | |
|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound |
| *Straggling* | *Survival* | -.25076* | .09317 | .022 | -.4723 | -.0293 |
| | *Successful* | -.19838 | .09317 | .089 | -.4199 | .0231 |
| *Survival* | *Straggling* | .25076* | .09317 | .022 | .0293 | .4723 |
| | *Successful* | .05238 | .09317 | .840 | -.1691 | .2739 |
| *Successful* | *Straggling* | .19838 | .09317 | .089 | -.0231 | .4199 |
| | *Survival* | -.05238 | .09317 | .840 | -.2739 | .1691 |

Descriptive data of SMEs clustering for LD16.

| LD16 | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean | | Minimum | Maximum |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound | | |
| *Straggling* | 36 | .2500 | .43916 | .07319 | .1014 | .3986 | .00 | 1.00 |
| *Survival* | 36 | .2917 | .43712 | .07285 | .1438 | .4396 | .00 | 1.00 |
| *Successful* | 36 | .2222 | .36732 | .06122 | .0979 | .3465 | .00 | 1.00 |
| Total | 108 | .2546 | .41296 | .03974 | .1759 | .3334 | .00 | 1.00 |

LD16 ANOVA test comparing the mean of *Successful*, *Survival*, and *Struggling* SMEs.

| LD16 | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | .088 | 2 | .044 | .254 | .776 |
| Within Groups | 18.160 | 105 | .173 | | |
| Total | 18.248 | 107 | | | |

LD16 multiple comparisons, Tukey HSD (Speed/Time). (*. The mean difference is significant at the 0.05 level.)

| (I) SME | (J) SME | Mean Difference (I-J) | Std. Error | Sig. | 95% Confidence Interval | |
|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound |
| *Straggling* | *Survival* | -.04167 | .09802 | .905 | -.2747 | .1914 |
| | *Successful* | .02778 | .09802 | .957 | -.2053 | .2608 |
| *Survival* | *Straggling* | .04167 | .09802 | .905 | -.1914 | .2747 |
| | *Successful* | .06944 | .09802 | .759 | -.1636 | .3025 |
| *Successful* | *Straggling* | -.02778 | .09802 | .957 | -.2608 | .2053 |
| | *Survival* | -.06944 | .09802 | .759 | -.3025 | .1636 |

Appendix E

# Paired-Samples T-Test

This test has been considered for the dependent variables' comparison.

**CW5 (Waste by Product loss):**

Paired samples statistics.

| CW5 | | Mean | N | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| Pair 1 | *Struggling* | .7431 | 36 | .10384 | .01731 |
| | *Surviving* | .8769 | 36 | .11479 | .01913 |
| Pair 2 | *Surviving* | .8769 | 36 | .11479 | .01913 |
| | *Successful* | .9458 | 36 | .06148 | .01025 |
| Pair 3 | *Struggling* | .7431 | 36 | .10384 | .01731 |
| | *Successful* | .9458 | 36 | .06148 | .01025 |

Paired samples correlations.

| CW5 | | N | Correlation | Sig. |
|---|---|---|---|---|
| Pair 1 | *Struggling & Surviving* | 36 | .098 | .570 |
| Pair 2 | *Surviving & Successful* | 36 | -.203 | .234 |
| Pair 3 | *Struggling & Successful* | 36 | -.659 | .000 |

Paired samples test.

| CW5 | | Paired Differences | | | | | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|---|
| | | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference | | | | |
| | | | | | Lower | Upper | | | |
| Pair 1 | *Struggling - Surviving* | -.13389 | .14705 | .02451 | -.18364 | -.08413 | -5.463 | 35 | .000 |
| Pair 2 | *Surviving - Successful* | -.06889 | .14081 | .02347 | -.11653 | -.02125 | -2.935 | 35 | .006 |
| Pair 3 | *Struggling - Successful* | -.20278 | .15157 | .02526 | -.25406 | -.15149 | -8.027 | 35 | .000 |

**CW6 (Waste by Time loss):**

Paired samples statistics.

| CW6 | | Mean | N | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| Pair 1 | *Struggling* | .8911 | 36 | .16475 | .02746 |
| | *Surviving* | .9364 | 36 | .11564 | .01927 |
| Pair 2 | *Surviving* | .9364 | 36 | .11564 | .01927 |
| | *Successful* | .9703 | 36 | .05730 | .00955 |
| Pair 3 | *Struggling* | .8911 | 36 | .16475 | .02746 |
| | *Successful* | .9703 | 36 | .05730 | .00955 |

Appendix E

Paired samples correlations.

| CW6 | | N | Correlation | Sig. |
|---|---|---|---|---|
| Pair 1 | *Struggling & Surviving* | 36 | .718 | .000 |
| Pair 2 | *Surviving & Successful* | 36 | .722 | .000 |
| Pair 3 | *Struggling & Successful* | 36 | .698 | .000 |

Paired samples test.

| CW6 | | Paired Differences | | | | | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|---|
| | | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference Lower | Upper | | | |
| Pair 1 | *Struggling - Surviving* | -.04528 | .11468 | .01911 | -.08408 | -.00648 | -2.369 | 35 | .023 |
| Pair 2 | *Surviving - Successful* | -.03389 | .08422 | .01404 | -.06238 | -.00539 | -2.414 | 35 | .021 |
| Pair 3 | *Struggling - Successful* | -.07917 | .13131 | .02188 | -.12360 | -.03474 | -3.617 | 35 | .001 |

**LD10 (Development):**

Paired samples statistics.

| LD10 | | Mean | N | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| Pair 1 | *Struggling* | .3611 | 36 | .43916 | .07319 |
| | *Surviving* | .4537 | 36 | .42279 | .07046 |
| Pair 2 | *Surviving* | .4537 | 36 | .42279 | .07046 |
| | *Successful* | .4028 | 36 | .36974 | .06162 |
| Pair 3 | *Struggling* | .3611 | 36 | .43916 | .07319 |
| | *Successful* | .4028 | 36 | .36974 | .06162 |

Paired samples correlations.

| LD10 | | N | Correlation | Sig. |
|---|---|---|---|---|
| Pair 1 | *Struggling & Surviving* | 36 | .563 | .000 |
| Pair 2 | *Surviving & Successful* | 36 | -.116 | .501 |
| Pair 3 | *Struggling & Successful* | 36 | -.227 | .182 |

Paired samples test.

| LD10 | | Paired Differences | | | | | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|---|
| | | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference Lower | Upper | | | |
| Pair 1 | *Struggling - Surviving* | -.09259 | .40325 | .06721 | -.22903 | .04385 | -1.378 | 35 | .177 |
| Pair 2 | *Surviving - Successful* | .05093 | .59304 | .09884 | -.14973 | .25158 | .515 | 35 | .610 |
| Pair 3 | *Struggling - Successful* | -.04167 | .63512 | .10585 | -.25656 | .17323 | -.394 | 35 | .696 |

Appendix E

## LD11 (Encourage Development):

Paired samples statistics.

| LD11 | | Mean | N | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| Pair 1 | *Struggling* | .1389 | 36 | .35074 | .05846 |
| | *Surviving* | .2778 | 36 | .38627 | .06438 |
| Pair 2 | *Surviving* | .2778 | 36 | .38627 | .06438 |
| | *Successful* | .3704 | 36 | .38237 | .06373 |
| Pair 3 | *Struggling* | .1389 | 36 | .35074 | .05846 |
| | *Successful* | .3704 | 36 | .38237 | .06373 |

Paired samples correlations.

| LD11 | | N | Correlation | Sig. |
|---|---|---|---|---|
| Pair 1 | *Struggling* & *Surviving* | 36 | .023 | .892 |
| Pair 2 | *Surviving* & *Successful* | 36 | .412 | .013 |
| Pair 3 | *Struggling* & *Successful* | 36 | .174 | .311 |

Paired samples test.

| | | Paired Differences | | | | | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 95% Confidence Interval of the Difference | | | | |
| LD11 | | Mean | Std. Deviation | Std. Error Mean | Lower | Upper | | | |
| Pair 1 | *Struggling - Surviving* | -.13889 | .51563 | .08594 | -.31335 | .03557 | -1.616 | 35 | .115 |
| Pair 2 | *Surviving - Successful* | -.09259 | .41680 | .06947 | -.23362 | .04843 | -1.333 | 35 | .191 |
| Pair 3 | *Struggling - Successful* | -.23148 | .47187 | .07865 | -.39114 | -.07182 | -2.943 | 35 | .006 |

# Appendix F

# Histogram

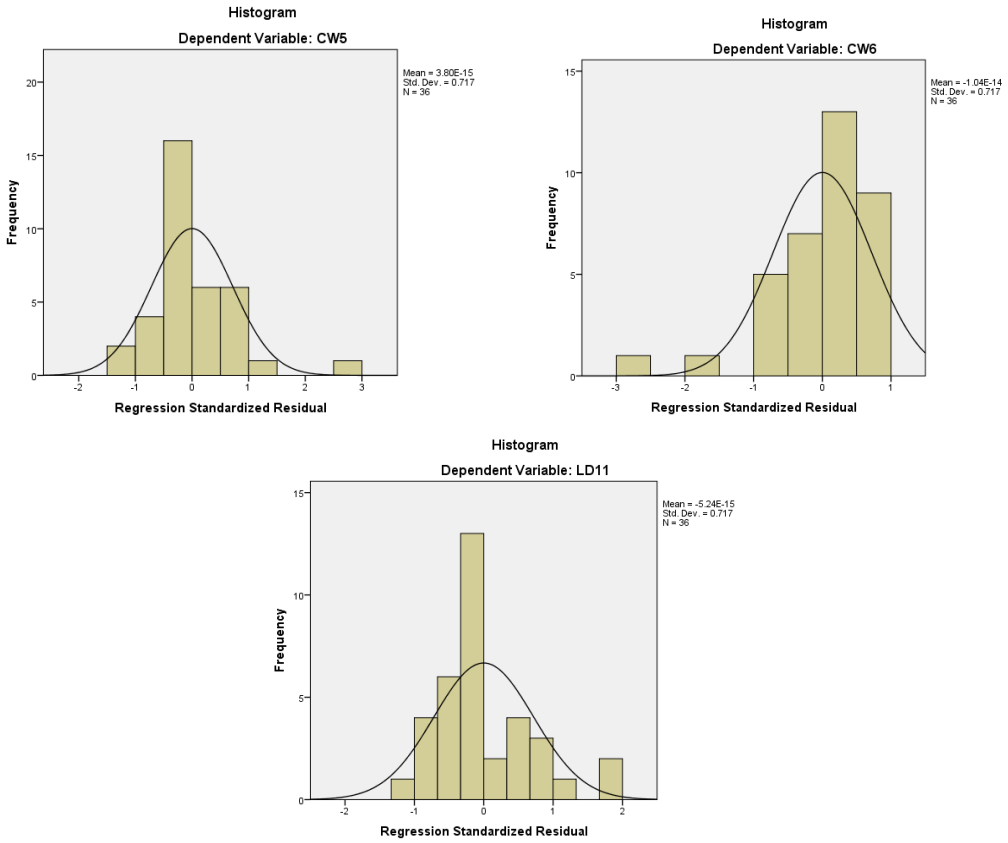



Figure 4: Histogram for each dependent variable for *struggling* group. CW5: Waste by Product Loss; CW6: Waste by Time Loss; LD11: Encourage Development.

Appendix F

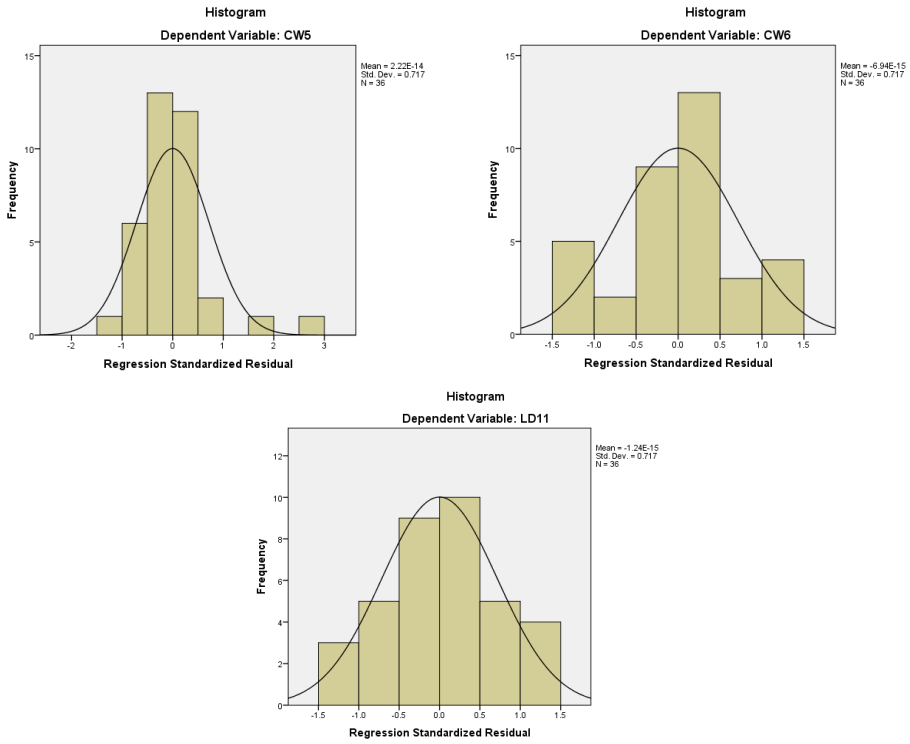



Figure 5: Histogram for each dependent variable for Surviving group. CW5: Waste by Product Loss; CW6: Waste by Time Loss; LD11: Encourage Development.

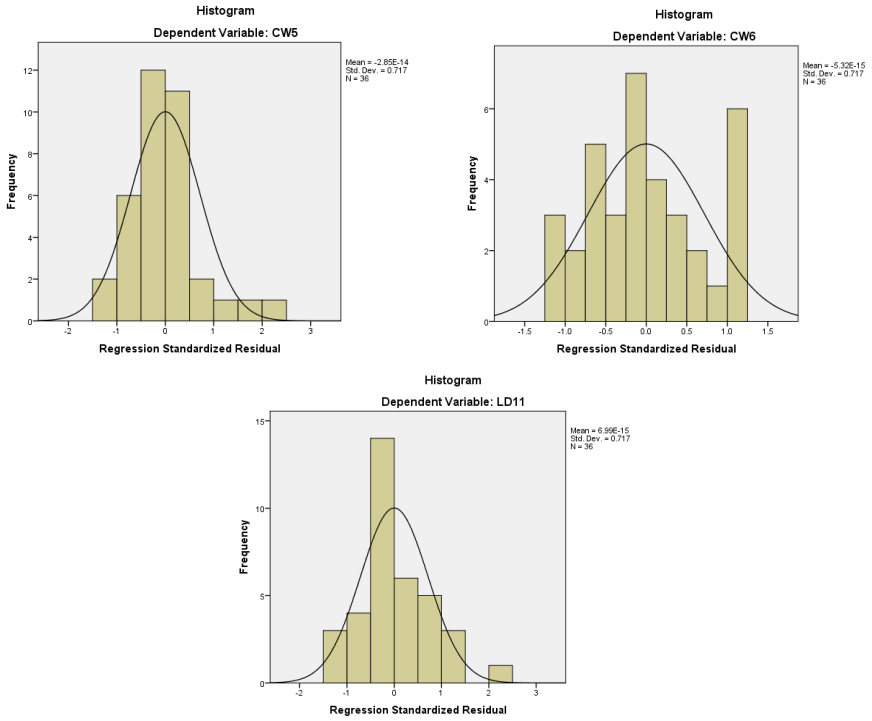



Figure 6: Histogram for each dependent variable for *Successful* group. CW5: Waste by Product Loss; CW6: Waste by Time Loss; LD11: Encourage Development.

# Appendix G

# Interviews Cover Letter

Dear Sir

This interview is part of my PhD Thesis at Brunel University London. It is designed to understand the Small and Medium Enterprise's performance in developed countries such as UK.

Your participation is voluntary, will contribute in survey success and it is appreciated.

This interview will take approximately 45 minutes to 1 hour of your valuable time and the provided information will be confidential and used only for this research purpose.

If you have any concern, please do not hesitate to contact me:

Atefeh Sayad Saravi

Brunel University, London

School of Engineering and Design

Atefeh.SayadSaravi@brunel.ac.uk

# Appendix H

# Interview Questions

In order to validate findings of the study, semi-structured interviews are conducted. The interviews have been conducted with three managers of SME's in UK. The managers were selected from different companies. The followings are the designed questions that are asked during the interviews:

Current position: …… Work experience: …….

1. Do you think the relationships within the framework in Figure 1 are reasonable?

Yes…….

No…….

2. Tell me your opinion about the effect of waste on company's sustainability.

3. Tell me your opinion about relationship between waste and Resource Stability & Reliability:

Negative…….

Positive…….

Not effected…….

4. Tell me your opinion about relationship between waste and Forecasting Production:

Negative…….

Positive…….

Not effected…….

5. Tell me your opinion about relationship between waste and Delivery Speed:

Negative…….

Positive…….

Not effected…….

6. Tell me your opinion about relationship between waste and Expertise Flexibility:

Negative…….

Positive…….

Not effected…….

7. Tell me your opinion about relationship between waste and Customer Satisfaction Rate:

Negative…….

Positive…….

Not effected…….

8. Tell me your opinion about relationship between waste and Leadership Supports development:

Negative…….

Positive…….

Not effected…….

9. Tell me your opinion about the effect of development on company's sustainability.

10. Tell me your opinion about relationship between development and Forecasting Production:

Negative…….

Positive…….

Not effected…….

11. Tell me your opinion about relationship between development and Delivery Speed:

Negative…….

Positive…….

Not effected…….

12. Tell me your opinion about relationship between development and Expertise Flexibility:

Negative…….

Appendix H

Positive…….

Not effected…….

13. Tell me your opinion about relationship between development and Customer Satisfaction Rate:

Negative…….

Positive…….

Not effected…….

14. Tell me your opinion about relationship between development and Employee appraisals:

Negative…….

Positive…….

Not effected…….

# Appendix I

# List of publications

Sayad Saravi, A. and DeCoster, R. (2014) 'Sustainable Performance Management and Measures across the Healthcare Supply Chain', ResCon14, Brunel University, 23-26 June 2014.

Sayad Saravi, A. and Mousavi, A. (2016) 'Development of a holistically performance measurement system in manufacturing SME's', British Academy of Management (BAM) Doctoral Symposium Poster Presentations, Monday 8th September 2014.

Sayad Saravi, A. and Mousavi, A. (2017) 'Evaluating the impact of waste and development on organizational performance for small to medium enterprises in manufacturing', PGR Symposium Brunel University June 2019.

Sayad Saravi, A., Mousavi, A. and DeCoster, R. (2019) 'Evaluating the impact of waste and development on organizational performance for small to medium enterprises in manufacturing', *International Journal of Mechanical and Production Engineering (IJMPE)*, 7(1), pp. 20-23.

Sayad Saravi, A., Mousavi, A. and DeCoster, R. (2020) 'Investigation on the impact of waste and development for small to medium enterprises in manufacturing', Journal of Small Business and Enterprise Development (Under preparation).