SUSTAINABLE OPERATIONS MANAGEMENT PRACTICES, FIRM CHARACTERISTICS, PERFORMANCE AND COMPETITIVE ADVANTAGE OF MANUFACTURING FIRMS IN KENYA

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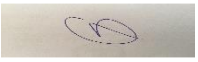
A RESEARCH THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF DOCTOR OF PHILOSOPHY IN BUSINESS ADMINISTRATION, SCHOOL OF BUSINESS, UNIVERSITY OF NAIROBI

2021

DECLARATION

This research thesis is my original work and has not been submitted in any institution of learning for an award of any kind.

Signed  **Date: 30/08/2021**

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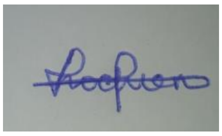
Signed  **Date: 01/09/2021**

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DEDICATION

This research is dedicated to my family for the immense support and encouragement they gave me throughout this research and in life. Thank you for being there for me!

ACKNOWLEDGEMENT

This research thesis was a culmination of many months of painstaking research and study. However, I got valuable support from well-meaning Kenyans.

To Dr. Stephen Odock and Prof. Gituro Wainaina, I am so grateful for your patience, love and guidance throughout the entire period of my research. Your constructive criticism, technical and even material assistance saw me accomplish this work successfully.

This work further reflects the lessons and experiences provided to me through my affiliation with the University of Nairobi. To my lecturers, thanks so much for without you my work would not have been achieved.

Not to be forgotten are, Mr. Bellah Chepkulei, Mrs. Amina Ndinya, Miss Mercy Mwithiga and my dear family members. Their motivation and support are unparalleled.

To the many whom I cannot mention your names individually, I recognize your support and I say, THANK YOU.

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ABBREVIATIONS AND ACRONYMS

CA	Cost advantage
DA	Differentiation advantage
DF	Degree of freedom
DS	Distribution
ECS	Environmental cost saving
ED	Education
EIR	Environmental impact reduction
EL	End-of-life
EP	Employment
GDP	Gross Domestic Product
GSCM	Green Supply Chain Management
HS	Health and safety
ILO	International Labor Organization
KAM	Kenya Association of Manufacturers
KNBS	Kenya National Bureau of Statistics
MP	Manufacturing process
MU	Material use
NACOSTI	National Council for Science, Technology and Innovation
NRBV	Natural Resource Based View
OE	Operations efficiency
OST	Open System Theory
PD	Productivity
PDD	Product design and development
PF	Profitability
PU	Product use
RBV	Resource Based View
SD	Standard deviation
SM	Sustainable manufacturing
SOMPs	Sustainable Operation Management Practices
TBL	Triple Bottom Line
TPF	Theory of performance frontier
WB	Well-being,

ABSTRACT

Sustainable operations management practices (SOMPs) are strategies, actions and techniques that support operational policies in achieving environmental, social and economic objectives. Company's operations management decisions form part of the key contributors to the anthropogenic impact on the ecosystem. Therefore, SOMPs potentially play a critical role in contribution of solutions for challenges faced by humanity. Despite its importance, it has not yet fused into the mainstream of operations management research and there are concerns on whether implementation of sustainable practices will actually afford a firm competitive advantage. It is for this reason that this study proposed to examine the effect of sustainable operations management practices (SOMPs), firm characteristics and performance on competitive advantage of manufacturing firms in Kenya. To achieve the objective, four hypotheses were formulated; SOMPs have no significant influence on firm competitive advantage, Firm characteristics have no significant moderating effect on the relationship, Organizational performance has no significant mediating effect on the relationship, Joint effect of SOMPs, firm characteristics and organizational performance on firm competitive advantage is not significant. A review of studies revealed that few attempts have taken a simultaneous approach to describe the three elements of sustainability. In explaining the link between environmental management and firm competitiveness, little is known about the mediating and moderating influence of organization performance and firm characteristics on the link between the two variables. Further, the assessment of the probable direct relation between environmental consciousness and firm competitiveness in writing has resulted in mixed outcomes. Whereas various studies have found a positive connection, some do not make out a positive relationship. The study adopted positivist philosophy to the development of knowledge and used a cross sectional survey research design. The study population consisted of all manufacturing firms registered with the KAM (903). Slovin's formula was used to calculate the size of the sample (277), but to cater for non – response, a sample of 300 was used. Primary data was collected using a designed questionnaire. Validity and reliability were also tested and finally data was analyzed using covariance-based structural equation modeling. There were three anchoring theories: TPF, NRBV and OST. The findings were in consistent with arguments of the various theories hence the study extended to conceptual and empirical research in the area related to SOMPs. From the objectives, the results showed that SOMPs have significant influence on the firm's competitive advantage. Based on the second objective, only one variable (age) was found to have a significant moderating influence on the relationship between SOMPs and competitive advantage. Thirdly, the findings showed that organizational performance has a significant mediating effect on the relationship between the two variables. Lastly, the findings showed that all the relationships for the joint effect were not significant except for the mediating effects of organizational performance between the two variables. The main conclusion was that SOMPs lead to minimized operating costs, enhanced satisfaction of employees and environmental improvements leading to competitive advantage. The study recommends implementation of SOMPs by manufacturing firms since it comes with possible advantages such as unceasing improvement on capital productivity, business performance enhancement in addition to competitive edge. The findings are relevant to the advancement of environmental policy and practice. This study also adds to knowledge in the less explored field of SOMPs by providing theoretical underpinning, conceptual and methodological references that can be used by academicians for pursuing future studies.

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

Numerous resources remain inadequate and semi renewable while the ecosystem's ability in absorption of contaminants is constrained. Human consumption of natural resources is unsustainable, leading to major environmental challenges. Climate change, resource exhaustion and pollution, impact greatly on the ecosystem (Kleindorfer, 2010). Manufacturing firms have been connected to negative environmental impact due to the rising mindfulness of environmental challenges caused by their operations (Galdeano, Ce´spedes, & Martı´nez, 2008). Therefore, they have to embrace technologies that utilize alternative energy sources and minimize pollution by implementing sustainable operations management practices (SOMPs) (Meadows, Randers, & Meadows, 2004). The SOMPs can be defined as environmental initiatives taken to care for the environment, improve life and for economic gains (Abdul-Rashid, Sakundarini, Ghazilla, & Thurasamy, 2017). Integrating SOMPs can lead to outstanding organizational performance and competitive advantage (Thierry, Salomon, Van Nunen, & Van Wassenhove, 1995). Successful implementation of SOMPs requires resources and capability and has the possibility of improving several dimensions of organizational performance (Moldan, Janouskova, & Hak, 2012).

This study was grounded on various theories; Theory of performance frontiers (TPF), Open system Theory (OST) and Natural Resource Based View (NRBV). The TPF states that unique operating practices such as SOMPs give a firm more competitive advantage than the asset frontier (Schmenner & Swink, 1998). The OST confirms the interdependence between the environment and the organization. The organization takes care of the environment by adoption of SOMPs leading to competitive advantage (Ashmos & Huber 1987). The NRBV argue that, by employing SOMPs which require tacit skills that are hard to observe and copy, a firm can gain a competitive edge (Hart & Dowell, 2011).

Manufacturing remains an important pillar of the government's employment creation strategy. It contributes to revenue and is a source of tradable goods (World Bank, 2014). The Kenyan government has identified it as one of its big four-agenda for growth and employment creation. It is among the sectors selected to aid in the attainment of a sustainable annual Gross Domestic Product (GDP) growth (Vision 2030, 2008). It's input to GDP has over the years stagnated at around 10 percent and stood at 8.4 percent in 2017 (Kenya National Bureau of Statistics, KNBS, 2018). Manufacturing activities consume considerable amounts of resources which are non-renewable and are energy intensive, emits toxic wastes leading to negative environmental challenges including acid rain, global warming, poisoning of biosphere and climatic change in addition to raising concerns regarding depletion of natural resources (International Energy Agency, 2009).

In spite of the current efforts, sustainable efforts are yet to merge into the mainstream of operations management research (Gavronski, Paiva, Teixeira, & de Andrade, 2013). Company's operations decisions forms part of the key contributors to the anthropogenic impact on ecosystem. If appropriately addressed, SOMPs have likelihood of becoming crucial to competitive advantage and a solution to the problems experienced. This is because distribution and manufacturing constitutes a vast section of human activity (Gonzaléz, Perera, & Correa, 2003). Sustainability calls for SOMPs because of the central position of companies in the world economy (Esty & Winston, 2009).

1.1.1 Sustainable Operations Management Practices

Sustainability is the capability for the achievement of environmental, economic and social dimension in the current time, without any compromise on the ability to maintain the same in the future (Brundtland, 1987). Sustainable operations management is the quest for social, economic and environment objectives within and beyond firms operations (Krajnc & Glavič, 2005). In the past, variations in climate were mainly connected to natural processes, but currently the changes are largely attributed to anthropogenic causes of manufacturing firms. Companies should not only be concerned about their operations in business, but also for establishing good environmental behavior by adopting SOMPs (Ashby, Leat, & Hudson-Smith, 2012). Sustainable practices are environmentally friendly practices which aim at reducing environmental footprint (International Trade Administration, 2007).

Sustainable operations management practices are environmental initiatives taken to care for the environment, improve life and for economic gains (Abdul-Rashid, Sakundarini, Raja Ghazilla, & Thurasamy, 2017). Some researchers have attempted to identify and classify the various SOMPs as eco-design, sustainable buildings, green production, ecological supply chains, corporate social responsibility and reverse logistics (Abdul-Rashid et al., 2017; Bennett, Nunes, & Shaw, 2013; Drake & Spinler, 2013). To capture the whole product life cycle from when the operations cycle commences, this study adopted a significant set of indicators which include: sustainable product design and development; sustainable material use; sustainable manufacturing process; sustainable distribution; sustainable product use; and sustainable end-of-life.

Designing a product constitute a vital stage that determines the behavior of the product in the later stages of the life cycle. Sustainable product design and development aims at decreasing or eradicating harmful substances, minimizing wastes, improving resource recovery, preservation and efficiency, designing for reuse/remanufacturing, while adding to the sustainability aspects (Lee, Lye, & Khoo, 2001; Duflou et al., 2012). In material sourcing, a manufacturer should make use of swiftly renewable or recycled materials and make sure that the materials are not likely to cause any harm to ecosystem (Blus, 2008). Sustainable material use involves assortment of materials which are of low energy content and impact, not hazardous, recyclable and recycled materials and non-exhaustible supplies. It also entails weight and volume reduction and the use of replenishable (Brezet, 1997).

Manufacturing processes should be developed in such a way that they encourage energy reduction and resource utilization, reduction of air emissions, liquid, solid and gaseous wastes (Jorgensen et al., 2007). Sustainable manufacturing process includes production techniques optimization and alternatives, waste reduction, use of low/clean energy, few/ clean production processes (Singhal, 2013). Sustainable distribution ensures that there is efficient product transportation from the manufacturers to the final user. It is also in relation to product specifics, like packaging, transportation mode and logistics operations. This comprises of efficient mode of transport, distribution system and logistics, less/clean packaging and optimizing the weight/volume of the product (Brezet, 1997).

From the viewpoint of the environment, the use phase leads to the most adverse effects in products using energy as well as consumables (Singhal, 2013). Sustainable product use consist of reduction of the environmental impact; few/clean consumables, consumption of low/clean energy, no energy/auxiliary material use, uses of the least harmful source of energy and energy sources which are renewable (Van Hemel, 1995). Sustainable end-of-life practices intend to restore components/materials in the last stage of a product through remanufacturing, reuse and recycling so as to maintain its worth after it has been used (Smith & Ball, 2012). This entails optimizing the end-of-life system, material and product recycling as well as clean incineration. Its purpose is to ensure reuse of products valuable components as well as proper waste management (Brezet, 1997).

1.1.2 Firm Characteristics

These are demographic and managerial variables of a firm's internal environment, which play a crucial part in the attainment of competitive edge (Zou & Stan, 1998). This study used size, age of the firm and managerial capabilities as internal characteristics, which influenced the relationship between SOMPs and firm's competitive advantage (Kogan & Tian, 2012). Bowen (2002) asserts that firm's resources enhance its exploration of costly and risky environmental investments. Firm size impacts on its proficiency to obtain resources and employ SOMPs, leading to competitive advantage. This is because SOMPs require long-term investment, enough resources and firm's commitment (Hart, 1995).

The age of the firm can be linked to the learning curve, older firms have more experience than new comers (Kisengo & Kombo, 2014). The more the years of existence of the firm, the higher the possibility of accumulating properties and competencies that may amount to overall improvement and competitive advantage (Birley & Westhead, 1990). Good managerial competences make it possible for organizations to enhance their efficiency and effectiveness in the selection and implementation of SOMPs for production and delivery of quality, which helps in achievement of competitive advantage (Mahoney, 1995).

1.1.3 Firm Performance

These days, the metrics of organization performance are moving from balance score cards and being economic centered measurements towards the sustainability ones (TBL approach) (Jovane et al., 2008). Successful implementation of SOMPs has the capability of improving several dimensions of organizational performance including environmental, economic as well as social (Moldan, Janouskova, & Hak, 2012). Environmental performance is reliant on the utilization of effectual as well as cleaner sustainable energy resources, waste minimization and the usage of non-hazardous substances (Yusuf et al., 2013). It can be categorized into two; environmental impact reduction, dealing with the minimization of air emission, solid wastes, waste water, improvement of organization's environmental condition and reduction in the use of hazardous resources (Alvarez & Barney, 2001). The second category is environmental cost saving which deals with improving economic performance, like decline in the cost for energy intake, cost for materials procured, fee for waste ejection and treatment. While also trying to get rid of the undesirable economic performance including, rise in operational cost, investment, cost of purchasing environmentally conscious materials and training cost (Melnyk, Sroufe, & Calantone, 2002).

Economic performance echoes the long-term capability and financial sustainability of the firm as measured with regard to long term operating effectiveness, productivity, efficiency and return on investment (Rezaee, 2017). It is determined based on economic growth, life improvement and protecting the environment. In order to assess it, one considers economic outcomes which reflect financial benefits of the organization which is connected to industrial costs reduction (Eltayeb, Zailani, & Ramayah, 2011) and operational outcomes which relates to the fact that SOMPs leads to improved operational efficiency, hence increasing long-term profitability potential (Rothenberg, 2007). Economic sustainability is attained through unceasing improvement on capital productivity through supply chain optimization, improving employee's productivity and enhancing their effectiveness. (Rezaee, 2017).

Social performance entails firm's achievement in maintaining and enhancing the quality of life (Yusuf et al., 2013). It makes sure that industries are making good profits and that their activities cause no social degradation (Tsai, Chou, & Hsu, 2009). Social consciousness will be compensated through workforce fulfillment, improved research and development plus reputation enrichment (Pfeffer, 1998). Past studies have looked at the social dimensions of sustainability through examination of numerous social aspects that encompass community concerns, environment, philanthropy, staff relations and well-being, human rights as well as diversity, learning and ethical inclusions, training and improvement plus healthy and safety (Chabowski, Mena, & Gonzalez-Padron, 2011; Carter & Jennings, 2002). By being able to adhere to social compliance expectations, manufacturers escape fines and tainted public image resulting from lack of compliance hence gain a competitive edge. (Rezaee, 2017).

1.1.4 Competitive Advantage

Competitive advantage refers to a condition which puts a firm in a superior position, acquired through provision of greater value to the clients. An entity is said to have attained competitive advantage when it has adopted a unique strategy of value creation not implemented by rival entities (Barney, 1991). Competitive advantage has been explained as a factor, which makes it possible for a company to serve its consumers more effectively than the competitors, thereby creating enhanced customer value and attainment of superior performance (Ma, 1999). It is the capability of offering a product with distinctive qualities, for which customers have the preparedness to pay premium price (Boon-itt, 2009). A rising number of manufacturing organizations have come to the realization that achievement of high quality and low-cost are basic priority for improvement of competitive advantage (Boon-itt, 2009). It is made up of two types: low cost and differentiation (Porter, 1985). Competitive advantage results from a firm having the capacity to deliver similar benefits at a lower cost compared to its rival firms (cost advantage). It can also result from the firm delivering benefits that surpasses those of the competitors (differentiation advantage) (Ranko et al., 2008).

As stated by Pearce and Robinson (2011), differentiation seeks to build competitive advantage on the basis of features and performance and it allows for premium prices. The strategy is established around numerous features including quality of the product, technology and innovativeness, customer service, design feature, reputation, dependability, durability and brand image (Moses, 2010). Organizations that attain success in cost leadership carry out critical value chain activities at less cost as compared to their rivals and often have the following: skills for development of commodities for efficient production, increased level of experience engineering of manufacturing process, large scale as well as efficient supply chain, vigorous quest of cost reductions, minimized operations time, tight cost control and efficiency, high capacity utilization and technological advantages (Wang, Lin, & Chu, 2011).

1.1.5 Manufacturing Firms in Kenya

The Kenyan manufacturing sector is divided into 14 sub-sectors, 13 of which deal with processing and addition of value while the remaining one is under service and consultancy (Kenya Association of Manufacturers, KAM, 2018). It's input to GDP has over the years stagnated at around 10 percent and stood at 8.4 percent in 2017 (Kenya National Bureau of Statistics, KNBS, 2018). An estimated 18 percent of Kenyan manufactured goods are exported of which 6.1 percent are traded to the East African Community while 12 percent to the rest of world (KNBS, 2013). This sector recorded a slow employment growth rate of 0.8 percent (303,300 people) of 2.66 million-wage employment in 2017 up from 1.8 percent (300,800 people) of 2.55 million wage employment in 2016. This accounted for 11.4 per cent of the total formal employment (KNBS 2018). The operations of the manufacturing sector play a critical role in an economy. However, without positive inventiveness, they contribute to resource over-exploitation, huge chunk of wastes and excessive consumption of energy (Hassine et al., 2015).

Manufacturing firms in Kenya have been linked to environmental problems. They usually face diverse challenges like environmental regulations compliance, sustainable energy consumption and managing waste both solid and liquid (Mwaguni & Munga, 1997). Earlier on, industrial pollution loads showed biological oxygen demand (BOD) at levels which were high. Solid wastes, nitrogen compounds and suspended matters from industries are commonly not sorted and are dumped at various sites. Some of these industrial wastes are hazardous and toxic to both human and animal's health (Mwaguni & Munga, 1997). The implication is, the need for development and implementation of environmental inventiveness hence adoption of SOMPs.

1.2 Research Problem

Company's operations management decisions form part of the key contributors to the anthropogenic impact on the ecosystem. Therefore, SOMPs potentially play a critical role in contribution of solutions for challenges faced by humanity. Despite its importance and ongoing efforts, it has not yet fused into the mainstream of operations management research as studies in the area of SOMPs are limited (Gavronski, Paiva, Teixeira, & de Andrade, 2013) and there are concerns on whether implementation of sustainable practices will actually afford a firm competitive advantage. The assessment of the probable direct relation between SOMPs and firm's competitive advantage in literature has brought varied results. Whereas various studies have established a positive connection (Bennett, Nunes, & Shaw, 2013; Drake & Spinler, 2013), Wagner (2005) identified a relatively weak positive link, while Watson, Klingenberg, Polito, and Geurts (2004) did not identify any link. Hence, a study to help resolve the inconsistencies was necessary.

Manufacturing activities are connected to negative environmental challenges like pollution, climatic change and depletion of natural resources (International Energy Agency, 2009). Manufacturing firms in Kenya are exposed to various challenges like environmental regulations compliance, sustainable energy consumption and managing waste both solid and liquid (Mwaguni & Munga, 1997). The Government of Kenya has identified manufacturing as one of its big four-agenda. However, its advancement has been sluggish in some previous years, which is attributed to adverse weather conditions, high production costs and competition.). It clearly shows that a solution is needed to address these problems.

Some studies (Drake & Spinler, 2013; Esty & Charnovitz, 2013) have explored the relationship between SOMPs and competitive advantage and reveal some knowledge gaps. First, sustainability rests on three constituent categories based upon TBL (environmental, economic and social). However, previous studies (Esty & Charnovitz, 2013; Longoni & Cagliano, 2015) paid attention on some of the aspects of sustainability (environmental and social) but they did not incorporate the three dimensions of sustainability. Although this point is often not considered, the three are tangled and they reinforce each other, hence need to be addressed in connection with one another (Svensson & Wagner, 2012a). In the operationalization of SOMPs, some researchers (Abdul-Rashid et al., 2017; Drake & Spinler, 2013) used few indicators (product design, manufacturing process, supply chain and end-of-life management) which did not take into consideration product life cycle as a whole. The SOMPs incorporate all aspects of operations within and beyond the firm in order to obtain maximum possible benefits (Hill, 2007).

Successful implementation of SOMPs requires resources and capability and has the possibility of improving several dimensions of organizational performance (Moldan, Janouskova, & Hak, 2012). However, little is known about the moderating and mediating effect of firm characteristics and organizational performance on the relationship between SOMPs and competitive advantage. Business models may be incomplete if they fail to specify mediating and moderating variables. Therefore, they may be unable to give solution to actual business problems (Namazi & Namazi, 2016). Most of the studies reviewed are limited to other countries and developed economies (US, Malaysia, UK, India). African countries face major environmental challenges (International Labour Organization, ILO, 2012) hence clear understanding and sufficient knowledge will facilitate implementation and problem-solving process. Previous studies done in Kenya covered green manufacturing and green supply chain management (GSCM). For example, Odock, Awino, Njihia, and Iraki (2016) did a study on the effect of GSCM practices on performance of ISO 14001 certified manufacturing firms. Mwaura et al. (2016) examined green distribution practices and its impact on competitiveness of food manufacturing firms. These studies were on some of the facets of SOMPs. However, a study which considers all the facets of SOMPs will be important.

In methodology, Mwaura, Letting, Ithinji, and Orwa (2016) used regression analysis while Adebambo, Ashari, and Nordin (2015) used partial least squares structural equation modeling (PLS-SEM). This study used covariance based structural equation modeling (CB-SEM), as it allows for more sophisticated and comprehensive analyses as compared to the first-generation methods (Hair et al., 2010). By using SEM, interrelationships among numerous latent variables can be explored in a manner that minimizes error in the model as variables with weak measurement are dropped (Hair, Hult, Ringle, & Sarstedt, 2016). Thomas, Fugate, Robinson, and Tasçioglu (2016) did a behavioral experimental research, which is prone to human error and environmental influence. This study adopted cross sectional survey to avoid the shortcomings. It is apparent that more research was necessary to take care of the knowledge gaps. This research aimed at addressing the gaps by posing the following questions; what is the effect of SOMPs on firm's competitive advantage? What is the moderating and mediating role of firm characteristic and organizational performance respectively on the relationship?

1.3 Research Objectives

The general objective was to establish the effect of SOMPs on competitive advantage of manufacturing firms in Kenya. The specific objectives were to:

i. Determine the relationship between sustainable operations management practices and competitive advantage.
ii. Examine the moderating effect of firm characteristics on the relationship between sustainable operations management practices and competitive advantage.
iii. Establish the mediating influence of organizational performance on the relationship between sustainable operations management practices and competitive advantage.
iv. Determine the joint effect of sustainable operations management practices, firm characteristics, environmental, economic and social performance on firm competitive advantage.

1.4 Value of the Study

The findings can help manufacturing firms become more enlightened on the significance of integrating sustainable operations management practices in their business processes in terms of the benefits accrued. Sustainable operations management concept awareness also has the capability of assisting companies in having successful operations and enable new products development. The findings of this research act as a critical reference to the firms as they work towards the enhancement of their overall performance and gaining competitive edge.

The study contributes to knowledge by extending the sustainable operations management perspective research in manufacturing. It further brings theoretical underpinning, conceptual and methodological references that can be used by academicians for pursuing future studies in the less explored sustainable operations management research field. Using TPF, NRBV and OST, this study provides scholars with findings that can help them know the relationship among the variables. The study also gives room for further research on SOMPs in other sectors.

It also presents the legislative commission with critical material for the review of the sustainable practices, employment measures in 2020 to capitalize on the innovation effect and the progressive participation of companies' legislative processes. The research can also enable the government in identifying gaps in their present policies, hence assist them in making new and better ones. The government may also realize their part in providing the essential inducements to assist in proper implementation of SOMPs.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This part gives the theoretical foundation by looking at theories that support the link between SOMPs and competitive advantage. This is followed by a focus on existing literature on SOMPs and competitive advantage. Next is the summary of past-related studies and research gaps. It concludes by looking at the conceptual framework and research hypothesis.

2.2 Theoretical Review

The relationship among SOMPs, firm performance, firm characteristics and competitive advantages is grounded on three major theories: TPF, NRBV and OST. TPF explains the importance of assets and operating practices on competitive advantage, whereas NRBV and OST state that firm's competitive advantage can be achieved through its association with the natural environment, and firms must manage their interdependence with the environment for success, growth and survival (Ashmos & Huber, 1987).

2.2.1 Theory of Performance Frontiers

It was advanced by Schmenner and Swink (1998). A performance frontier is described as the highest level of performance a manufacturing unit can achieve using a set of operating choices. As competition forces firms to embrace physical assets and advanced manufacturing systems, technological trade-offs considerations become important (Schmenner & Swink, 1998). This theory argues that the operating frontiers of firms denote distinctive resources which are more vital than the asset frontiers in competitive advantage achievement; this is because they are specific to a particular firm, rare and hard to mimic (Vastag, 2000). However, resources alone are also not sufficient for creation of competitive advantage, as they require capabilities to be leveraged (Eisenhardt & Martin, 2000).

Intangible assets like know-how or culture of being sustainable through the implementation of SOMPs are important resource which gives an organization a mileage from its competitors. This is because it requires time for them to acquire these resources and by the time they catch up, the organization will have moved on to a different level, hence improves on its performance leading to competitive advantage. An organization will try its best to maintain its competitive advantage but after some time competitors will begin to acquire the resources and end up catching up (Vanderkaay, 2000). Therefore, the theory shows how the firm can achieve maximum performance through its operating frontier by implementing SOMPs which amounts to achievement of competitive advantage. This is the key anchoring theory for this study.

2.2.2 Natural Resource Based View

It was advanced by Harts (1995). It states that an organization can achieve competitive edge on the basis of its association to the natural environment (Hart & Dowell, 2011). The NRBV is made up of three interrelated strategies: product stewardship, pollution prevention and sustainable development strategy (Hart, 1995). Pollution prevention strategies like SOMPs depend upon tacit skills developed and sharpened through workforce engagement, making it hard to observe and quickly copy, hence improves an organization performance and gives it a competitive advantage (Willig, 1994). However, having resources alone is not enough.

Capabilities are required to put resources to use as possessing them alone does not guarantee performance nor competitive advantage (Eisenhardt & Martin, 2000).

Product stewardship offers an organization a chance to attain competitive advantage by enabling communication across departments, functions as well as organizational boundaries so as to coordinate SOMPs among all parties (Schmidheiny, 1992). Sustainable development alludes to technological cooperation, working with state and business in the building of relevant infrastructure, nurture human resources and explore means for achieving competitiveness (Schmidheiny, 1992). Firms need to work in harmony with all stakeholders like suppliers, by ensuring that they implement SOMPs hence supply them with sustainable resources, giving them a competitive advantage (Hart & Ahuja, 1996). An organization will try its best to avoid imitation but in the long run competitors will end up catching up (Vanderkaay, 2000).

2.2.3 Open System Theory

It was developed by Von Bertanlanffy (1956). The theory recognizes that organizations are not closed systems, just like any other system, they derive their input from the environment converted into output that is released to the environment. They are also affected by customer demands, competition and government regulations (Cummings & Worley, 2014). OST confirms the interdependence between the environment and the organization where they both need one another for success, growth and survival. An organization cannot be autonomous with respect to critical resources. To be competitive they need to take care of this reliance for sustainable development (Wathne & Heide, 2004). The theory is only concerned with the external factors, which determines the firm's performance and competitiveness, neglecting the fact that internal factors such as resources, efficiency, competence and know-how are crucial and cannot be ignored.

As an organization acquires resources for their survival, this may lead to adoption or diffusion of other partner's sustainable practices resulting to competitive advantage (Sarkis, Gonzalez-Torre, & Adenso-Diaz, 2010). Through sustainable operations, an organization meets customer demands, adhere to environmental policies and try to be innovative enough to serve the ever-changing taste, preferences and concerns of the customer. This differentiates it and gives it a competitive advantage. Organizations that have a good relationship with their environment are better placed to gain resources that provide them with the much-needed competitive edge (Barringer & Harrison, 2000). However, Rumelt (1991) indicated that the significant elements of profitability and performance are particular to a given firm.

2.3 Empirical Review

The present section evaluates literature findings connected to SOMPs, firm characteristics, organization performance and competitive advantage of manufacturing firms in Kenya. Objectives, methodology, findings and the research gaps of the reviewed studies are summarized as shown in Table 2.1.

2.3.1 Sustainable Operations Management Practices and Competitive Advantage

The SOMPs can develop to be an essential competitive edge, due to the fact that the continued existence and competitiveness of organizations are dependent on their practices as well as capabilities for adapting to the external environment, attributable to variation in customer preferences, government regulations, technology as well as competitors (Machuca, Jiménez, & Garrido-Vega, 2011). The SOMPs have emerged as a new competitive requirement as efforts for minimizing environmental, economical, as well as social effects lead to minimized operating costs, enhanced satisfaction of employees and environmental improvements through product marketing leading to competitive advantage (Shahbazpour & Seidel, 2006).

The link between SOMPs and competitive advantage has been studied by various authors who found a positive link. For example; Bennett, Nunes, and Shaw (2013) did a study on how a strategy of sustainable operations can develop a firm's competitive advantage with an objective of addressing strategies for sustainable operations when aiming at increasing profitability. It was primarily a qualitative case study. This study was on operation's strategy and did not look at the mediating impact of organization performance on the association and it was a case study, which may limit generalization. Drake and Spinler (2013) did a study on sustainable operations management, with a view to establishing the drivers underlying sustainability and how an operations management lens contributes to it. It employed qualitative research design. The study did not consider TBL approach and it ignored the whole product life cycle.

While the above studies suggest that environmental consciousness can help firms improve their competitive advantage others have questioned the confidence of environmental advocates (Wagner, 2005; Watson, Klingenberg, Polito, & Geurts, 2004) hence the relationship represent a perplexing issue in literature. Therefor this study has the goal of providing clarity on the relationship. There are limited studies which are specifically on SOMPs, hence this study was a survey which aimed to contribute to scarce empirical evidence. It employed the TBL approach covering the whole product life cycle. It posits that implementation of SOMPs leads to competitive advantage.

2.3.2 Sustainable Operations Management Practices, Firm Characteristics and Competitive Advantage

Firm characteristics capture the exceptional organizational attributes which influence the variation in tactics and performance outcomes among variety of companies (Rumelt, 1998). The RBV characteristically provides enlightenment for the firm characteristics on the performance outcome and competitiveness within an industry (Wernerfelt, 1984; Peteraf, 1993). Firm's size, age and managerial capabilities were considered as the internal characteristics, which influenced the relationship between SOMPs and firm competitive advantage (Kogan & Tian, 2012). Larger organizations have more resources, skills and capabilities as compared to smaller firms which struggle to garner them, enabling them to easily transfer information, try costly and risky environmental investments such as SOMPs, which gives them a competitive advantage (Ismail & King, 2014). Moreover, small firms have little likelihood of hiring specialists with wide ranging experience to directly handle SOMPs issues, as seen from NRBV. These tacit skills could result in competitive advantage (Leonidou et al., 2017). This study, therefore proposed that the bigger the firm, the greater the competitive advantage due to the implementation of SOMPs.

The years of existence of the firm can be linked to the learning curve. The more the years of existence of the firm, the higher the possibility of accumulating capabilities and resources, which enable them to implement SOMPs that may lead to overall improvement and competitive advantage (Birley & Westhead, 1990). Due to the experience and reputation of older firms, they have the likelihood of attracting first class vendors who may have implemented SOMPs, which may diffuse in the organization or they may give them innovative ideas on how to improve their competitive advantage. Young entities may only account for a small part of the supplier's output, meaning their capability of integrating suppliers into their SOMPs may not be feasible, hence hindering achievement of superior performance (Koufteros, Cheng, & Lai, 2007). Competitive advantage is attained through a combination of green information, knowledge as well as resources (Schoenherr & Wagner, 2016). This study, therefore posit that the link between SOMPs and competitive advantage of the firm increases with age.

Managerial capability can be explained as the company's skills, experience and knowledge enabling it to handle hard and complicated roles in management. According to RBV, management competences are fundamental to the process of recognition, development, implementation as well as deployment of resources into valuable activities of the firm like SOMPs for achievement of competitive advantage (Mahoney, 1995). Hence, the study argues that the managerial capabilities positively moderate the link between SOMPs and firm competitive advantage.

Limited studies focused their attention on the effect of firm characteristics on the link between SOMPs and firm competitive advantage. They include: Kannadhasan and Nandagopal (2009), who investigated the effect of firm size in regulating the association between strategy and performance. This was a survey, which found a substantial link among strategy, firm size and performance. The study's focus was only on the size of the firm. Majumdar (1997), explored the effect an entity's size and age has on the level of output and gains. The results showed that, firms that have existed for longer are likely to experience low profit but high productivity levels, while in the contrary larger firms are more profitable but not as productive. It was a survey whose focus was on firm's size and age only and in both studies, the context was India. Waweru (2008), investigated the effect of competitive strategy and on performance in large private sector firms in Kenya. This was a survey which revealed that top management characteristics have no significant impact on organizational performance.

Mutuku (2012), explored the factors influencing relationship between top management team diversity and performance of Commercial Banks in Kenya. The findings indicated that academic qualification, diversity in tenure and performance have a negative association. In the same vein, on a study on leadership and Small Firm performance: The moderating effects of demographic characteristics, Flanigan, Bishop, Brachle, and Winn (2017) found out that demographic characteristics had no moderating effects on firm performance. In all these studies, the concepts were different from the current study. The context of this study was Kenya and it looked at the moderating effects of firm size, age and managerial capabilities. This study holds that the link between SOMPs and firm competitive advantage is moderated by firm size, age and managerial capabilities.

2.3.3 Sustainable Operations Management Practices, Organizational Performance and Competitive Advantage

By improving efficiency of production to reduce scraps, defects and emissions, a firm lowers its operating costs by reducing the cost of raw material and waste stream, hence achieving improved performance of the environment (Yang et al., 2010). Improvement of environmental performance of business organizations by adopting SOMPs is attributable to competitive improvement and enhanced financial performance (Crittenden et al., 2011). Organizations that emphasize on enhancement of SOMPs with regard to the reduction of adverse outputs from manufacturing process will ultimately enhance their economic performance (Wagner, 2005). The SOMPs leads to unceasing improvement on capital productivity through enhanced customer relationships, employees' productivity, effectiveness, business performance enhancement in addition to competitive edge (Rezaee, 2017). Managers are called upon to stop being only shareholders' agents but also being builders of stakeholder relations (Kennelly, 1995).

Social activities present opportunities for a company, allowing it to meet its needs and those of its stakeholders, achieve social performance, while still pursuing profit goals. Entities are likely to gain from SOMPs through innovation and growth, productivity as well as efficiency gains from reduced health and safety risk, absenteeism and turnover (Grant et al., 2008). Manufacturers are coming to the realization that, minimization of adverse environmental and social impact leads to reduction of operating costs and improvement in staff satisfaction, hence achievement of competitive advantage (Hart, 1995). The relationship is grounded on NRBV, OST and TPF theory.

The relationship between SOMPs, organization performance and competitive advantage has been looked at by several authors. For example; Adebambo, Ashari, and Nordin (2015) conducted a study on how sustainable manufacturing (SM) practices impact on firm performance. The objective entailed finding out how SM practices influence organizations' performance. The study utilized a quantitative methodology carried out in a cross-sectional design. Data was analyzed using PLS-SEM. The findings showed a positive affiliation between SM practices and performance of the environment. The concept was sustainable manufacturing practices, while this study looked at the whole concept of SOMPs. Esty and Charnovitz (2013) looked at environmental sustainability and competitiveness. In order to determine whether customary operations strategy configuration models are adapted to include social and environmental issues, It used qualitative approach. The study revealed that environmental sustainability usually associates with greater economic performance as well as competitiveness.

The study was on environmental sustainability which is just one aspect of sustainability. A study on how sustainability activities (environmental and social) affect sourcing behavior by Thomas, Fugate, Robinson, and Tasçioglu (2016) aimed at understanding if environmental and social activities of suppliers' impact upon the buying decision and defines supplier choice. The study adopted behavioral experimental design. It established that social and environmental practices enable organizations to differentiate themselves giving them a competitive advantage. The study examined only two dimensions of TBL approach. It is a behavioral experimental research, which is prone to human error and environmental influence.

Abdul-Rashid et al. (2017) studied SM activities and their impact on sustainability performance. A questionnaire survey was conducted and the outcomes showed that SM process significantly influences sustainability performance. The focus was on SM operations, which is one of the facets of SOMPs. The indicators used did not cover the product life cycle as a whole. The studies reviewed were limited to other countries and developed economies (Malaysia and US). African countries face major environmental challenges hence the need for a research in this area to help in solving the various problems. The target area of this study was an African country (Kenya). Literature is also scanty on the mediating effects of social performance on the link between SOMPs and firm competitive advantage. The study proposed that social performance mediate the relationship between SOMPs and competitive advantage of a firm.

2.3.4 Sustainable Operations Management Practices, Firm Characteristics, Organizational Performance and Competitive Advantage

By making sustainable enhancement to manufacturing activities, firms come to the realization of operational expense savings (Schäpke et al., 2017). Improvement of environmental performance by adopting sustainability measures is attributable to competitiveness and enhanced financial performance (Porter & Van der Linde, 1995a, b). Sustainability is majorly perceived as an important success factor within the long run strategy of a business and enterprises that adopt it are believed to attain differentiation competitive edge over the rivals (Crittenden et al., 2011). Enhancement of environmental performance with regard to the reduction of adverse outputs from manufacturing process will ultimately enhance economic performance as Wagner (2005) illustrated.

Social responsibility may allow a firm to evade strict regulations, which will lead to cost reduction, meeting the different desires of its various stakeholders while still operating profitably (Hart, 1995). Reduction of environmental and social impact leads to improved employee satisfaction and reduced operating costs plus improvement in the environment through product marketing resulting to competitive advantage. Large organizations have more resources and capabilities, which allow them to be very productive and preserve their competitive advantage. Sustainable practices require long-term investment, enough resources to implement and firms' commitment, hence most firms do not implement them early enough (Hart, 1995). The relationship is grounded on NRBV, OST and TPF.

The connection between the above variables has been studied by various authors. In a qualitative study on environmental sustainability and competitiveness. Esty and Charnovitz (2013) found out that environmental sustainability often relates to superior economic advancement as well as competitiveness. A study on how sustainability activities (environmental and social) affect sourcing behavior by Thomas, Fugate, Robinson, and Tasçioglu (2016) found out that these practices enable organizations to stand out from competitors giving them a competitive advantage.

Kannadhasan and Nandagopal (2009) scrutinized the role played by firm size on the performance and strategy relationship. The study was a survey, which established existence of statistically significant association among strategy, size and performance. Waweru (2008), investigated the effect of competitive strategy and on performance in large private sector firms in Kenya. It was a survey, revealed that top management characteristics have no significant impact on organizational performance. These studies partly touched on the sustainability dimensions but not all the three dimensions. To take care of the gap this work employed the TBL approach. On the same note, little is known about the mediating effect of organization performance on the association between SOMPs and firm competitive advantage, which is one of the objectives of this study. The study posits that, there exists an association between SOMPs, organizational performance, firm characteristics and competitive advantage.

2.4 Summary of Empirical Review

Assessment of the various studies showed that research on the area of SOMPs as a whole is limited. In expounding the link between SOMPs and firm competitive advantage, mixed outcomes have been noted: TBL approach is neglected, while little is known in connection to the mediating influence of organization performance. Table 2.1 presents the summary of the studies.

Table 2. 1 Summary of Empirical Review

Author(s)	Study focus	Objectives	Methodology	Key Findings	Knowledge Gap	Focus of Current Study
Abdul et al.(2017)	The link between sustainable manufacturing activities and firm performance	Examination of the link between sustainable manufacturing activities and sustainability performance	A survey of 443 ISO 14001 certified manufacturers	Sustainable manufacturing impacts on all elements of sustainability performance leading to competitive advantage	Focus was on sustainable manufacturing practices which is just a component of SOMPs	Focus was on SOMPs
Thomas et al. (2016)	Effect of sustainability activities (environmental and social) on sourcing behavior	Determine if sustainability activities (environmental and social) impact on buying decision and selection of suppliers	Experimental design with two scenario-based behavioral experiments	Environmental and social sustainable practices give organizations opportunity to differentiate themselves leading to competitive advantage	Only looked at social and environmental dimensions	Focus was on TBL approach and cross-sectional research design was adopted

Author(s)	Study focus	Objectives	Methodology	Key Findings	Knowledge Gap	Focus of Current Study
Adebambo et al. (2015)	Influence of sustainable environmental manufacturing on performance	Determine the impact of sustainable environmental manufacturing practices on firm performance	Quantitative approach	Sustainable manufacturing practices significantly influence environmental performance	Looked only at environmental dimension of sustainability	TBL approach was incorporated
Ahenkan and Osei-Kojo (2014)	Sustainable development achievement in Africa	Assessing sustainable development achievement in Africa	Qualitative approach	African countries have significantly made progress towards sustainable development but they face challenges	It was a desk top research which utilized only secondary data	Primary data was used for this study
Bennett et al. (2013)	Competitive advantage through sustainable operation	Address the strategies for sustainable operations when aiming at increasing profitability	Qualitative case studies	Sustainable operations strategies lead to a good environmental performance, avoidance of reputational risk and competition	Manufacturing in corporate strategy theory is not sufficient.	Sufficient theories were used.
Drake and Spinler (2013)	How sustainability leads to efficiency and competitive advantage	Establish drivers underlying sustainability as a management issue	Qualitative approach	Sustainable operations management makes it possible for achievement of efficiency and competitiveness	Did not look at any of aspects of sustainability, had few indicators.	TBL approach was used
Esty and Charnovitz (2013)	Relationship between environmental sustainability and competitiveness	Determine whether established operations strategy configuration models include environmental and social priorities	Qualitative approach	Environmental sustainability leads to superior economic performance and competitiveness	One theory is not enough to explain the link between the variables	Actual data was collected and sufficient theories were used.
Daramola & Ibem (2010).	Urban environmental problems in Nigeria	To examine urban environmental problems implications for sustainable development	Qualitative and observation approach	There are different environmental problems, mostly due to cultural, geologic and climatic factors	Limited to Nigeria, it was a desktop research.	This study was on Kenya and primary data was used

Author(s)	Study focus	Objectives	Methodology	Key Findings	Knowledge Gap	Focus of Current Study
Kannadhasan and Nandagopal (2009)	Firm size as a moderator in the link between business strategy and performance	To establish the effect of firm size on the link between business strategy and performance	Cluster analysis was done for hypotheses, testing the study employed two-way ANOVA and multiple regression	Significant relationship exist between strategy, size and performance	The study was on strategies and not practices. It was limited to India	This study was on Kenya and it looked at SOMPs
Majumdar (1997)	Effect of Size and Age on Performance of the firm	To examines the the effect of an entities size and age on level of performance	Two regressions were estimated, results were obtained using the heteroscedastic-consistent covariance matrix estimation	Firms that have existed for longer are likely to experience low profit but high productivity levels, while in the contrary larger firm are more profitable but not as productive.	The study was on productivity and profitability and it was limited to India	This study was on Kenya and it was on firm competitive advantage

2.5 Conceptual Framework

The conceptual framework shows the various relationships of the study, which are: the relationship between SOMPs and competitive advantage; the moderating effect of firm characteristics on the relationship between SOMPs and competitive advantage; the influence of organization performance on the relationship between SOMPs and competitive advantage and lastly the joint effect of SOMPs, firm characteristics, organization performance on competitive advantage. It is as shown in Figure 2.1 below

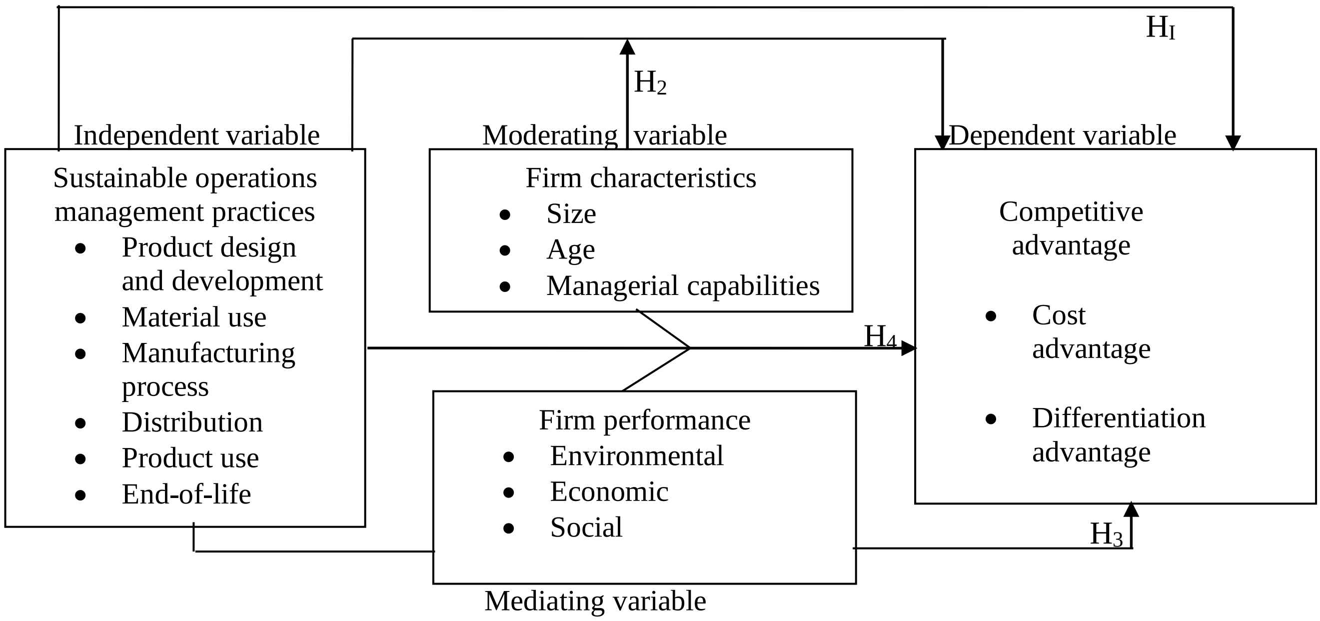


Figure 2.1 Conceptual Framework

2.6 Study Hypotheses

On the basis of the objectives of this study and the conceptual framework, the hypotheses were formulated as follows:

H_1: Sustainable operations management practices have no significant influence on firm competitive advantage.

H_2: Firm characteristics have no significant moderating effect on the relationship between SOMPs and firm competitive advantage.

H_3: Organizational performance has no significant mediating effect on the relationship between SOMPs and firm competitive advantage.

H_4: Joint effect of SOMPs, firm characteristics and organizational performance on firm competitive advantage is not significant.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the methodology used to study the effect of SOMPs, organizational performance and firm characteristics on firm competitive advantage. It includes research philosophy, design, study population, sample and sampling technique, data collection, study's hypotheses, operationalization of study variables, reliability and validity, and data analysis.

3.2 Research Philosophy

It is a basis for the foundation of knowledge which provides assumptions and inclinations of a study. Social science research is underpinned by three key philosophies; positivism, interpretivism and realism. Positivism focuses on collection of facts (Easterby-Smith, Thorpe, & Lowe, 2002). Interpretivists typically put emphasis on meaning and employs variety of ways so as to reflect diverse aspects of an issue. The emphasis is on qualitative analysis and it is not possible to establish causal relationships between social phenomena (Brymann, 2001). Realism admits that reality exist despite observation and science. It is concerned with what kind of things exist and their behavior (Blaikie, 2007).

The study adopted a positivist philosophy. This is because the philosophy makes consideration of reality in an objective way such that facts remain real and the person conducting the study is detached making him or her an objective observer of the research issue, thus minimizing bias. It aims at explaining events through the demonstrations of causativeness. It encompasses collection and analysis of "facts" in the field with the reality being represented through objects perceived as "real". It also involves the use of existing theories to develop hypothesis to be tested (Easterby-Smith et al., 2002). A methodology which is highly structured is utilized under the positivist approach (Gill & Johnson, 2002) giving much focus on quantifiable observation leading to statistical analysis.

3.3 Research Design

Cross sectional survey design was used for this study, it is suitable when the main goal is to find out whether substantial relationships amongst variables are in existence at any point in the course of time and where data was gathered at a point in time across various firms. It aims at exploring, describing and explaining the concerns in SOMPs to attain contextual evidence, clarify issues and advance responses to queries. Surveys are popular and highly economical because they permit huge volumes of data to be collected from an ample population (Cooper, Schindler, & Sun, 2013).

The data collected using this method can give probable explanations for certain relations among different variables and to advance models of these relations. Zutshi and Sohal (2004) successfully used cross sectional survey design while studying environmental management systems adoption and maintenance. It was also employed by Zhu and Sarkis (2004) when studying the link between operational practices and performance of firms.

3.4 Population of the Study

It consisted of all manufacturing firms in Kenya, where the focus was on manufacturing firms registered with KAM. This is because these firms are perceived to be large and have been in existence for some time, hence have accumulated enough resources to enable them implement SOMPs. The SOMPs require long-term investment, enough resources to implement and firm commitment, hence majority of firms do not implement them early (Hart, 1995).

The KAM members are categorized into 14 sectors, 13 of which deal with processing and value addition while the remaining one is under service and consultancy. The study targeted 903 manufacturing firms under the 13 sectors, which deal with processing and value addition (KAM, 9th February, 2018). This is because the study involved the actual operations.

3.5 Sampling Design

The study population was first stratified into 13 sectors in relation the nature of raw materials enterprises import or the products they produce. Then Slovin's formula (1960) was adopted to compute the sample size. The formula is most suitable when nothing is known about the population behavior and it was successfully used by Sugandi (2014) when developing a model of environmental conservation.

Slovin's formula

$$n = \frac{N}{1 + Ne^2}$$

Where: n= size of the sample; N= size of the population; e= desired margin of error

The study used a 95 percent confidence level, therefore:

$$n = \frac{903}{1 + 903(0.05)^2} = 277$$

However, to cater for non-responses 300 firms were surveyed and Table 3.1 shows this information.

Table 3. 1 Sample of the Study

Sector	Number of Firms	Proportionate Sample
Pharmaceutical and Medical Equipment	30	10
Metals and Allied	96	32
Textiles and Apparels	73	24
Energy, Electrical and Electronics	58	19
Paper and Board	82	27
Plastic and Rubber	90	30
Chemicals and Allied	90	30
Food and Beverages	234	78
Building, Mining and Construction	39	13
Motor Vehicles and Accessories	59	20
Leather and Footwear	9	3
Timber, Wood and Furniture	30	10
Fresh Produce	13	4
Total	903	300

3.6 Data Collection

Primary data was utilized and it was gathered using a designed questionnaire by way of 'drop and pick later' method. There were five divisions of the questionnaire. Section A sought data on characteristics of the participants; sections B, C and D aimed at obtaining data and information relating to SOMPs adopted by the firms, organization performance and competitive advantage of the manufacturing firms, respectively. One questionnaire was handed in to each manufacturing firm to be completed by the operations manager, director or equivalent.

3.7 Operationalization of Study Variables

Latent constructs were operationalized using indicators and measured using a 5- point Likert scale as shown in Table 3.2. Likert scale is appropriate when belief, value and opinion are being gathered or when addressing sensitive topics for which the respondent may not respond to if asked directly (Chimi & Russel, 2009).

Table 3. 2 Operationalization and Measurement of Study Variables

Variable	Sub Construct	Indicators	Informing Literature	Measurement	Questionnaire Item
Firm characteristics (moderating variable)		Age (Length of operation)	Kogan and Tian (2012); Kisengo and Kombo (2014)	Ordinal scale	Section A Question 7
		Size (Staff size)	Kogan and Tian (2012): Kisengo and Kombo (2014)	Ordinal scale	Section A Question 8
	Managerial capabilities	Level of education	Okonda et al. (2015); Clulow et al. (2007)	Ordinal scale	Section A Question 9
		Number of years working in the manufacturing industry	Okonda et al. (2015); Clulow et al. (2007)	Ordinal scale	Section A Question 10
SOMPs (independent variable)	Sustainable product design and development	Decrease or eradication of harmful substances, minimization of wastes, improvement of resource recovery, preservation and efficiency, designing for reuse/remanufacturing, while adding to the sustainability aspects	Lee et al. (2001); Duflou et al. (2012)	Ordinal scale	Section B Question 11
	Sustainable material use	Assortment of low energy content and impact materials, non-hazardous, recyclable and recycled materials and non-exhaustible supplies, reduction of weight and volume, use of replenishable	Brezet (1997)	Ordinal scale	Section B Question 11
	Sustainable manufacturing process	Production techniques optimization and alternatives, waste reduction, use of low/clean energy, few/ clean production processes	Singhal (2013)	Ordinal scale	Section B Question 11
	Sustainable distribution	Use of efficient mode of transport, distribution system and logistics, less/clean packaging and optimization of weight/volume of the product	Brezet (1997)	Ordinal scale	Section B Question 11

Variable	Sub Construct	Indicators	Informing Literature	Measurement	Questionnaire Item
	Sustainable product use	Reduction of the environmental impact; few/clean consumables, consumption of low/clean energy, no energy and auxiliary material use, uses of the least harmful source of energy and energy sources which are renewable	Van Hemel (1995)	Ordinal scale	Section A Question 11
	Sustainable end-of-life	Optimizing the end of life system, material and product recycling as well as clean incineration	Brezet (1997)	Ordinal scale	Section B Question 11
Organizational performance (mediating variable)	Environmental performance	Environmental impact reduction- Minimization of air emission, solid wastes, waste water, improvement of organization's environmental condition and reduction in the use of hazardous resources Environmental cost saving - Reduction in the cost for energy intake, cost for materials procured, fee for waste ejection and treatment. Reduction in the cost of operations, investment and training	Alvarez and Barney (2001); Melnyk et al. (2002)	Ordinal scale	Section C Question 12
	Economic performance	Profitability - gross profit, net profit, return on assets	Gnanasooriyar (2014); Rezaee (2017); Rothenberg (2007)	Ordinal scale	Section C Question 13
		Productivity - increased output, increased revenue, low levels of inventory, low operation cost, low number of employees and working hours	Syverson (2011); Rezaee (2017); Rothenberg (2007)	Ordinal scale	Section C Question 13
		Operations efficiency and effectiveness - decreased equipment failure, decreased setup and adjustment time, decreased stoppages and idling, increased speed of production, decreased process defects, increase yield	Nakajima (1988); Rezaee (2017); Rothenberg (2007)	Ordinal scale	Section C Question 13

Variable		Indicators	Informing Literature	Measurement	Questionnaire Item
	Social performance	Health and safety - advance in healthy status, rise in life expectancy, rise in health life years	Gavronski (2012); Chabowski et al. (2011)	Ordinal scale	Section C Question 14
		Employment - retention and recruitment of staff, good staff relation, employees productivity levels	Galant and Cadez (2017); Gavronski (2012); Chabowski et al. (2011)	Ordinal scale	Section C Question 14
		Education - human capital development, training and improvement of employees, availability of education funding for sustainability courses	Galant and Cadez (2017); Gavronski (2012); Chabowski et al. (2011)	Ordinal scale	Section C Question 14
		Well- being - improved employee satisfaction, conducive working environment, decent wages for the employees, improved welfare programme, improved community relation and involvement, improved employee motivation	Gavronski (2012); Chabowski et al. (2011); Carter and Jennings (2002); Galant and Cadez (2017).	Ordinal scale	Section C Question 14
Competitive Advantage (dependent variable)	Cost advantage	Skills for development of commodities for efficient production, increased level of experience engineering of manufacturing process, large scale as well as efficient supply chain, vigorous quest of cost reductions, minimized operations time, tight cost control and efficiency, high capacity utilization and technological advantages	Porter (1985); Wang et al. (2011)	Ordinal scale	Section D Question 15
	Differentiation advantage	Quality products, technology and innovativeness, customer service, design feature, reputation, dependability, durability and brand image	Porter (1985); Moses (2010)	Ordinal scale	Section D Question 15

3.9 Reliability and Validity Tests

Validity can be defined as the degree to which a research instruments measures what it us supposed to. Consequently, an instrument that accurately measures a specified variable or constructs is said to be valid. The concept validity can be divided into face, criterion and content validity. Face validity is subjective and entails examining the concept and determining whether at its surface (face) it looks valid or not. Thus, face validity denotes the extent a test appears as having the ability of measuring what it purports to. Concurrent validity is defined as the extent to which scores on a test have a relationship with scores of another test, which is already established, test conducted simultaneously, or other valid criterion available concurrently. When the researcher is expecting future performance on the basis of the scored derived presently by the measure, correlate scores attained with the performance; the latter performance can be said to be criterion while the present score is the prediction criterion (Muijs, 2011; Jackson, 2015).

Validity concepts calls for good knowledge of models with association of the variable and the measure of relationship between the measure and the factors. Content validity is concerned with content of items and whether the instrument actually measures the constructs in the study. Lastly, construct validity is utilized in measuring the degree to which an instrument correctly measures a theoretical construct it is meant to measure. The process through which the interpretations concerning a construct are validated can be defined as construct validation (Muijs, 2011).

Research need to have measurements that can be relied upon. Measurements are perceived as being reliable to the degree they can be replicated and that any random influence with tendency of varying measurements from time to time or from one scenario to the other is a source of measurement error. Reliability denotes the extent a test constantly measures what it is intended to. Errors of measurement with bearing on reliability are random errors and errors of measurement with bearing on validity are systematic or constant errors. Thus, reliability denotes the degree to which test scores are not affected by measurement errors. Jackson (2015) defines reliability as the measure of stability or internal consistency of an instrument in measuring of different concepts. As per assertion of Creswell (2002), there are different forms of reliability as per the number of times an instrument is administered and the number of respondents who take part.

Test-retest reliability is among the major forms of reliability and denotes the extent the scores show consistency in the course of time. It seeks to determine the variation in scores that emanated from testing session after session due to the measurement errors. This form of reliability is attained where the instrument is administered to same group of participants at two varied occasions and yet look at the correlation between them (Pallant, 2010). A high correlation value implies the instrument is reliable while a lower score is indicative of lower level of reliability. On the other hand, alternate form reliability denotes the degree the scores from a given sample are consistent over an administration of two instruments of varied versions of the instrument while assessing same concept but being administered twice at different intervals. The form of reliability is more often adopted where there is likelihood of test takers recalling responses made in the initial session as well as when alternate form is there.

The attained coefficient is referred to as "coefficient of stability" or "coefficient of equivalence". Alternate forms as well as test-retest reliability combines the two concepts. Internal consistency reliability entails determining the correlation among all items making up the constructs for ensuring that the items are measuring same construct. It ensures that all the items on the test are related. Rationale equivalence reliability is not determined using correlation; rather, internal consistency is estimated through determination of how all items on a test relate to the rest of items as well as the total test. Finally, the inter-rater reliability entails looking at whether scores from a given sample are consistent when two or more observers record the behavior of participants simultaneously while adopting same instrument (Muijs, 2011; Creswell, 2002).

The two concepts (validity and reliability) are related. While an instrument can be reliable and not valid, lacks of validity implies the instrument is not reliable. Thus, for an instrument to be reliable, it must be valid. Generally, examining validity is harder than assessing the reliability. This is because validity entails measurement of data related to knowledge while reliability is only concerned with consistency of scores (Jackson, 2015). This study tested reliability of the instruments, Internal consistency of latent constructs, measurement scale reliability and model's internal consistency. Content validity convergent, construct and discriminatory validity were also tested.

To test reliability of the instruments, Cronbach's alpha was utilized and a coefficient of 0.7 was adopted. Internal consistency of latent constructs was evaluated through composite reliability, which should be more than 0.6 (Hatcher, 1994). For purposes of determining the measurement scale reliability, the item to total correlation for all indicators was determined. The threshold total correlation should be 0.3 for reliability to be confirmed (Bryman, 2001). The model's internal consistency was measured by obtaining the average variance extracted (AVE) values which ought to be greater than 0.5 (Hatcher, 1994).

Content validity of the measuring instrument was derived from prevailing literature in addition to examination of measurement items by other researchers and experts. Pre-testing was done on five key individuals from the sector to ensure clarity and proper interpretation. In validating an instrument, a pre-test of five to 10 participants is adequate (Hair, Money, Samouel, & Page, 2007). For purposes of assessing the convergent, construct and discriminatory validity, confirmatory approach was utilized with a factor loading of at least 0.4 (Steven, 2012).

Each latent variable's AVE ought to be at least 0.5 or higher for convergent validity to be established (Hair, Black, Babin, & Anderson, 2010). Kaiser-Meyer-Olkin (KMO) and Bartlett's test of sphericity were first conducted for all construct to examine the appropriateness of factor analysis. For sampling adequacy, Kaiser (1974) suggests a value more than 0.5 while for Bartlett's test the significance value must be less than 0.05 (Bartlett, 1950) for factor analysis to be useful.

3.10 Data Analysis

Before the analysis could be conducted, the data was assessed for completeness, consistency as well as accuracy. This was followed with the data being coded. Part of the collected data was analyzed through descriptive statistics such as percentages, frequency and mean scored. On the other hand, the relationship between SOMPs and competitive advantage; SOMPs, organizational performance and competitive advantage; SOMPs, firm characteristics and competitive advantage and the joint effect of sustainable operations management practices, firm characteristics, environmental, economic and social performance on firm competitive advantage were analyzed using covariance based structural equation model. Each firm characteristic was analyzed differently.

Tables and other necessary graphic presentations were utilized in presenting the collected data for ease of comprehension and analysis. The generated information was interpreted, explained and discussed. Summarizing and interpreting of data was done with the aid of data analysis computer software's such as Microsoft excel, SPSS as well as AMOs. Data entry was done using Excel spreadsheet before exporting the data to SPSS for analysis of descriptive data. AMOS software on the other hand was adopted in testing the various relationships.

The data was analyzed using CB-SEM. It is normally utilized with an objective of model validation and requires a huge sample (preferably more than 200). The technique was found to be relevant because a sample size of 300 was considered adequate. The SEM is appropriate for investigating complex association and entails simultaneous examination of multiple variables as well as their connection. It is specifically useful in the development and expansion of theory, specifically when second and third order factors provide an increasing understanding of associations that might not be obvious from the onset (Astrachan, Patel, & Wanzenreid, 2014). The most noteworthy strength of SEM is the fact that, interrelationships among numerous latent variables can be explored in a manner that minimizes error in the model as variables with weak measurement are dropped (Hair, Hult, Ringle, & Sarstedt, 2016).

The major interest in SEM is the degree in which the theorized data fits or is sufficiently defined. Assessment of how a model fit has to arise from a number of viewpoints and it should reflect numerous conditions that evaluate the fitness of a model from a range of different views. Most indices in SEM are usually affected by the size of the sample. The least sample size that should be employed in SEM technique ought to be at least 10 times the sum of model parameters (Jayaram, Kannan & Tan, 2004). Bentler and Chou (1987) proposed a sample of 150 as the lowest for SEM.

The Chi-square goodness of fit metric relates theoretical description and the empirical data. Chi-square (x^2) test, assess the likelihood that the observed sample and the projected covariance matrices are equivalent. The x^2/degree of freedom (DF) ratio which is insignificant and below 3 shows satisfactory limits (Meydan & Şen, 2011). Degree of freedom signify the quantity of mathematical evidence which is used in the approximation of model parameters. The Goodness-of-Fit Index (GFI) evaluates the degree of variance and covariance. Its value increases as the size of the sample rises which can inhibit accurate outcomes for smaller samples. Its value ranges from 0 to 1, with 0.90 being suitable index of the model. The GFI and the Adjusted Goodness-of-Fit Index (AGFI) are based on the residuals (Bayram, 2010).

AGFI corrects downward the GFI value relative to model complexity, greater reduction is observed for models which are more complex. The size of the sample usually affects AGFI, as the size increases, the AGFI value also rises taking a value between 0 and 1, where 0.90 and above signifies a fit which is good (Bayram, 2010). The Normed Fit Index (NFI) represents the variance of the fitted and the null model divided by the null model values, ranging from 0 to 1 and NFI of 1 shows a perfect fit.

The Comparative Fit Index (CFI) relates the saturated and independent model. Its values can range from 0 to 1, 0.90 and above shows that the fit is good (Schermelleh-Engel, Moosbrugger, & Müller, 2003). It has numerous desired features, which include its insensitivity to complexity of a model, but not completely. The Tucker Lewis Index (TLI) compares the null and specified model normed x^2 values, which somehow considers model complexity. Values approaching one suggests a good fit while models with lower values shows a poor fit (Hu & Bentler, 1999).

Root Mean Square Error Approximation (RMSEA) is used to adjust the likelihood of rejection of models with big amount of variables observed in a fit test. It signifies the fitness of a model to a given population as well as the sample. It also does a comparison of the mean variances of each projected degree of freedom of a population with one another. The size of the sample highly affects its scale. For RMSEA a value of 0.05 and below shows a good fit (Bayram, 2010). However, values ranging from 0.05 to 0.08 are also satisfactory (Byrne, 2010). For a perfect model; Absolute fit (x^2 significance = p > 0.05; GFI > 0.90; RMSEA < 0.08), Incremental fit (AGFI > 0.90; NFI > 0.90; TLI > 0.90; CFI > 0.90) Parsimonious fit (x^2/df < 3.0). Although the threshold value of the fit index is 0.9, a value of 0.8 and above is acceptable (Baumgartner & Homburg, 1996; Doll, Xia, & Torkzadeh, 1994). Table 3.3 shows how the data to achieve each objective was analyzed.

3.11 Diagnostic Tests

In order to have estimates that mean something the assumptions should be reasonable and the sample data should appear to be sampled from a population that meets the assumption (Lewis-Beck & Lewis-Beck, 2015). Hence diagnostic tests including, normality, linearity, multicollinearity and heteroscedasticity should be conducted when checking for relationship between the independent and dependent variable. Linearity simply implies that the dependent variable can be expressed as a linear function of the explanatory variables chosen in explaining the variation of the dependent variable. Linear association between independent and dependent variables need to be tested. The strength in addition to the direction of the linear relationship is depicted by the correlation coefficient. A negative correlation is an indication of inverse relationship with an increase in one variable leading to a decrease in the other. On the other hand, a positive correlation is indicative of direct influence; i.e. an increase in one variable leads to an increase of the other (Field, 2013).

Majority of statical procedures such as correlation, regression, t tests as well as analysis of variance, which are referred to as parametric tests are based on the presumption that data will follow a normal distribution. This implies that it is assumed the population from which the respondent are is normally distributed. This assumption is essentially important when constructing reference intervals for constructs. Normality in addition to the rest of assumptions need to be considered crucial, as it is not possible to draw accurate and reliable conclusion regarding reality when these assumptions do not hold. It is possible to assess for normality visually by utilizing normal plots or using significance tests, where samples distribution is compared to a normal one (Field, 2009; Altman & Bland, 1995).

The normality tests supplement the graphical representation of normality. They compare the scores in the sample to the normally distributed set of scores having the same mean and standard deviation. Where the test score is significant, the distribution is said to be non-normal. The Shapiro-Wilk test is formulated on the correlation between data and the equivalent normal scores and providing better power (Peat & Barton, 2008). Power is among the chief measurement of value of a test for normality with the capacity of detecting the extent a sample comes from a non-normal distribution. Some researchers are of the review that Shapiro-Wilk test is the first choice in testing the normality of data (Thode, 2002).

Multicollinearity on the other hand is concerned with multiple regression where the predictor variables have high correlation amongst themselves. There are four basic sources of multicollinearity including the methods utilized in collecting data, constraints in the model and population, model specification as well as over-definition of the model. The presence of multicollinearity has a number of potentially critical impacts on the least squares estimates of the regression coefficients the most significant being acceptance of null hypothesis more readily (Cohen et al., 2013). Multicollinearity diagnostics are carried out with the adoption of variance inflation factor (VIF) as well as tolerance statics. The VIF denotes the reciprocal of the tolerance statics. The VIF for all the terms in the model measures the combined effect of the dependences among the regressors of the variance of the specific term. Among the challenges faced in cross-sectional data is heteroscedasticity or unequal variance in the error term. Some of the causes of heteroscedasticity are outliers in the data, incorrect functional form of regression model, incorrect transformation of data as well as mixing observation with varied measurement of scale.

Scatter plots was utilized to check for linearity among the dependent and independent variables. To test normality, Shapiro-Wilk test was used and if the p-value ≥ 0.05, it was an indication of normalcy while a p-value < 0.05 indicated that the data was not normal and it will be rejected on a significance level of 5 percent. A P value > 0.05 implied that the variable is sufficiently normally distributed on a significance level of 5% and is fit for further statistical analysis and will not result in inflated statistics and underestimated standard errors (Field, 2013). Multicollinearity was evaluated by computing tolerance and Variance Inflation Factor (VIF). If tolerance is less than one, then there is no multicollinearity, whereas VIF ranging from 1 to 10 indicates that multicollinearity is not a problem, while value greater than 10 indicates multicollinearity problem (Robinson &

Schumacker, 2009). Heteroscedasticity was tested using the Koenker test, where p-value ≤ 0.05 implies heteroscedasticity and scatter plot of residuals.

3.12 Ethical Considerations

Ethical concern is an essential part of a study. The process of the research required that the researcher gets approval of the university to collect data and a permit from NACOSTI, which was done. In this study the dignity of participants was prioritized. Their full permission was first acquired before the study commenced and the protection of their privacy and high confidentiality level was guaranteed. Affiliations were well stipulated and plagiarism was avoided.

Table 3. 3 Summary of Objectives, Hypotheses, Data to be Collected, Models, Analyses and Interpretation

Objectives	Hypotheses	Data	Model	Analyses	Interpretation
Determine the relationship between SOMPs and competitive advantage	H_1: SOMPs have no significant influence on firm's competitive advantage.	Primary	$CA = \beta_0 + \beta_1 SOMPs + \varepsilon_i$ CA: competitive advantage SOMPs	CB-SEM analysis, significance of path coefficient	H_1 is rejected if p-value of the path coefficient is ≤ 0.05
Examine effect of firm characteristics on the relationship between SOMPs and competitive advantage	H_2: Firm characteristics has no significant moderating effect on the relationship between SOMPs and firm competitive advantage	Primary	$CA = \beta_0 + \beta_1 SOMPs + \beta_2 FC + \beta_3 SOMPs*FC + \varepsilon_i$ FC: firm characteristics	CB-SEM analysis, significance of path coefficient	H_2 is rejected if p-value of the path coefficient is ≤ 0.05
	H_{2a}: Firm age has no significant moderating effect on the relationship between SOMPs and firm competitive advantage	Primary	$CA = \beta_0 + \beta_1 SOMPs + \beta_2 LO + \beta_3 SOMPs*FC + \varepsilon_i$ LO: length of operations	CB-SEM analysis, significance of path coefficient	H_2 is rejected if p-value of the path coefficient is ≤ 0.05
	H_{2b}: Firm size has no significant moderating effect on the relationship between SOMPs and firm competitive advantage	Primary	$CA = \beta_0 + \beta_1 SOMPs + \beta_2 SS + \beta_3 SOMPs*FC + \varepsilon_i$ SS: staff size	CB-SEM analysis, significance of path coefficient	H_2 is rejected if p-value of the path coefficient is ≤ 0.05

Objectives	Hypotheses	Data	Model	Analyses	Interpretation
	H_{2c}: Employees level of education has no significant moderating effect on the relationship between SOMPs and firm competitive advantage	Primary	$CA = \beta_0 + \beta_1$ SOMPs + β_2 HLE + β_3 SOMPs*FC + ε_i HLE: highest level of education	CB-SEM analysis, significance of path coefficient	H_2 is rejected if p-value of the path coefficient is ≤ 0.05
	H_{2d}: Employees' period of working has no significant moderating effect on the relationship between SOMPs and firm competitive advantage	Primary	$CA = \beta_0 + \beta_1$ SOMPs + β_2 LWM + β_3 SOMPs*FC + ε_i LWM: length of working in the manufacturing sector	CB-SEM analysis, significance of path coefficient	H_2 is rejected if p-value of the path coefficient is ≤ 0.05
Establish influence of organizational performance on the relationship between SOMPs and competitive advantage	H_3: Organizational performance has no significant mediating effect on the relationship between SOMPs and firm competitive advantage	Primary	$CA = \beta_0 + \beta_1$ SOMPs + β_2 OP + ε_i OP: Organizational performance	CB-SEM analysis, significance of path coefficient	H_3 is rejected if p-value of the path coefficient is ≤ 0.05
Determine joint effect of SOMPs, firm characteristics and organizational performance on firm competitive advantage	H_4: Joint effect of SOMPs, firm characteristics and organizational performance on firm competitive advantage is not significant	Primary	$CA = \beta_0 + \beta_1$ SOMPs + β_2 FC + β_3 OP + ε_i	CB-SEM analysis, significance of path coefficient	H_4 is rejected if p-value of the path coefficient is ≤ 0.05

CHAPTER FOUR: DATA ANALYSIS, FINDINGS AND DISCUSSIONS

4.1 Introduction

This chapter presents the analysis and findings of the study and provides information on the characteristics of the respondents. It also gives the inference of the findings which are centered to the objectives. In order to get the participants views, the nature of data collected was ordinal which was in a 5 - point Likert-type scale of (1) no extent at all (2) small extent (3) moderate extent (4) large extent (5) very large extent).

The focus was on 903 manufacturing firms registered with KAM, which deal with processing and value addition. This is because these firms are perceived to be large and have been in existence for some time, hence have accumulated large amount of resources to enable them implement SOMPs. The SOMPs require long-term investment, enough resources to implement and firms' commitment, hence most firms do not implement them early enough (Hart, 1995).

Using Slovin's formula (1960) a sample size of 277 firms was derived, but to cater for non-response the sample was increased to 300. Of the 300 targeted firms, response was received from 154 of them representing 51 percent response rate. Of the 154 questionnaires received, four of the questionnaires had serious omissions and had to be eliminated from the analysis, this left 150 questionnaires representing 50 percent. For a conclusion which is valid, the response is considered adequate.

4.2 Characteristics of the Respondents

This part analyzes various firms' background information from the sub-sector, years of operation, number of employees, staff's highest level of education and years of experience. Also included is registration with environmental management body, environmental management department, environmental management policy, frequency of meetings and trainings. Table 4.1 below summarizes the characteristics of the participants.

Table 4. 1 Characteristics of the Respondents

Features	Category	Frequency	Percent
Manufacturing sub sector	Pharmaceutical and Medical Equipment	5	3.3
	Metals and Allied	14	9.3
	Textile and Apparels	13	8.7
	Energy, Electrical and Electronics	9	6.0
	Paper and Board	7	4.7
	Plastic and Rubber	15	10.0
	Chemicals and Allied	15	10.0
	Food and Beverages	41	27.3
	Building, Mining and Construction	10	6.7
	Motor vehicles and Accessories	6	4.0
	Leather and Footwear	1	0.7
	Timber, Wood and Furniture	11	7.3
	Fresh Produce	3	2.0
	Total	150	100.0
Length of operation of firm	1-5 years	13	8.7
	6 to 10 years	25	16.7
	11 to 15 years	23	15.3
	16 to 20 years	11	7.3
	Above 20 years	78	52.0
	Total	150	100.0
Size of staff	1 to 50	49	32.7
	51 to 100	32	21.3
	101 to 150	17	11.3
	151 to 200	8	5.3
	Above 200	44	29.3
	Total	150	100.0
Highest level of education	Certificate	5	3.3
	Diploma	32	21.3
	Bachelor	70	46.7
	Masters	40	26.7
	Doctorate	3	2.0

Features	Category	Frequency	Percent
	Total	150	100.0
Length of working	1 to 5 years	36	24.0
	6 to 10 years	53	35.3
	11 to 15 years	30	20.0
	16 to 20 years	20	13.3
	Above 20 years	11	7.3
	Total	150	100.0

Source: Research data 2020

Table 4.1 above shows that data obtained was from all 13 sub sectors namely Pharmaceutical and Medical Equipment, Metals and Allied, Textile and Apparels, Energy, Electrical and Electronics, Paper and Board, Plastic and Rubber, Chemicals and Allied, Food and Beverages, Building, Mining and Construction, Motor vehicles and Accessories, Leather and Footwear, Timber, Wood and Furniture and Fresh Produce. Food and beverages firms contributed to most of the data at 27.3 percent, followed by plastic and rubber and chemicals and allied both at 10 percent, while the least firms were from leather and footwear sector responded. The reason behind this is that a bigger percentage of firms in the sector are food and beverage firms while leather and footwear makes the least percentage. Regarding the length of operation of the firms, the results show that 8.7 percent of the firms surveyed had operated between 1 and 5 years, 16.7 percent between 6 and 10 years while 15.3 percent had been in operation for 11 and 15 years and 7.3 percent had operated for 16 and 20 years.

A good percentage of the firms (52 percent) had existed for over 20 years. In terms of staff size, 54 percent had employees who were below 100, while 46 percent had more than 100 employees. This may be due to harsh economic times which have forced many firms to do more with less by cutting on the number of employees. The two characteristics imply that most of the firms are large and have been in existence for some time, hence have accumulated enough resources to enable them implement SOMPs.

The participants also specified their highest level of education and years of experience in the manufacturing firms. Majority of them (75.4 percent) were bachelor's degree holders and above, hence well-educated and knowledgeable; 76 percent had six years and more working experience giving them enough skills and expertise to be able to implement the various SOMPs. This is also an indication that, they have a good understanding of the firm and had been there long enough to see the firm implement the practices. Management competences are fundamental to the process of recognition, development, implementation as well as deployment of resources into valuable activities of the firm like SOMPs for achievement of competitive advantage (Mahoney, 1995).

Table 4. 2 Firm's Environmental Consciousness

Features	Category	Frequency	Percent
Registration with environmental management body	No	13	8.7
	Yes	137	91.3
	Total	150	100.0
Environmental management department	No	45	30.0
	Yes	105	70.0
	Total	150	100.0
Environmental management policy	No	15	10.0
	Yes	135	90.0
	Total	150	100.0
Frequency of meetings on environmental issues	0	11	7.3
	1-2	77	51.3
	3-4	39	26.0
	5 and above	23	15.3
	Total	150	100.0
Frequency of training on environmental management	0	17	11.3
	1-2	95	63.3
	3-4	30	20.0
	5 and above	8	5.3
	Total	150	100.0

Source: Research data 2020

Table 4.2 above shows the outcomes on the firms' consciousness with regard to environmental preservation. The participants were requested to specify if they were registered with an environmental management body, if they have an environmental management department and if they have an environmental management policy. The "yes" response was 91.3 percent, 70 percent and 90 percent, respectively. This implied that the firms are giving in to external pressure from customers, investors and government legislation and regulations, by adopting SOMPs hence increased level of consciousness of the environment. Regarding frequency of meetings and training, majority of the firms' 51.3 percent and 63.3 percent, respectively had a frequency of one to two trainings, followed by three to four trainings. This indicated that the firms were well aware and conscious of their environment.

4.3 Reliability and Validity

To test reliability of the instruments, Cronbach's alpha was used and internal consistency of latent constructs was assessed through composite reliability. For purposes of determination of reliability of the measurement scale, the item to total correlation for all indicators was determined. The internal consistency of the model was measured by obtaining the AVE values. Content validity was derived from literature already in existence in addition to examination of measurement items by other researchers and experts. Confirmatory approach was utilized for purposes of assessing the construct, convergent and discriminant validity. The KMO and Bartlett's test of sphericity was first carried out for all construct

Table 4.3 below shows that All KMO measures ranged from 0.686 to 0.883, indicating that all latent constructs of the study were above the 0.5 threshold. Bartlett's test of sphericity revealed that all the latent constructs had chi-square values (p-value = 0.000) that were significant at a level less than 0.05. These two tests implied that, factor analysis was relevant.

Table 4. 3 Kaiser-Meyer-Olkin and Bartlett's test

Latent Construct	KMO Measure	Approx. Chi-Square	df	Sig.
Sustainable product design and development	0.707	235.950	15	0.000
Sustainable material use	0.812	233.485	15	0.000
Sustainable manufacturing process	0.848	320.146	21	0.000
Sustainable distribution	0.841	219.323	10	0.000
Sustainable product use	0.809	297.766	15	0.000
Sustainable end-of-life	0.753	355.363	10	0.000
Environmental impact reduction	0.812	376.392	15	0.000
Environmental cost saving	0.848	441.446	15	0.000
Profitability	0.754	319.195	3	0.000
Productivity	0.793	241.541	10	0.000
Operations efficiency	0.883	497.502	15	0.000
Health and safety	0.711	244.227	3	0.000
Employment	0.686	164.632	3	0.000
Education	0.716	203.489	3	0.000
Well- being	0.876	484.392	15	0.000
Cost advantage	0.895	426.267	21	0.000
Differentiation advantage	0.900	554.417	21	0.000

Source: Research data (2020)

The SOMPs was measured using six set of indicators which included sustainable product design and development; sustainable material use; sustainable manufacturing process; sustainable distribution; sustainable product use; and sustainable end-of-life. These indicators were first tested through validity and reliability tests before analysis using CB-SEM, as explained below.

Sustainable product design and development construct was measured using six practices. Table 4.4 below shows that the mean ranged from 3.43 to 3.93 implying that the respondent practiced sustainable product design and development from a moderate to a larger extent. The practice with the highest mean was “design that minimizes waste” with a rating of 3.93 and a standard deviation (SD) of 0.928 while the practice “design for reuse and remanufacturing” had the lowest mean of 3.43 with a SD of 1.172. Generally, sustainable product design and development practice had a grand mean of 3.698 which is slightly above the moderate extent. The range of factor loadings was 0.592 to 0.743, while Cronbach’s alpha was 0.751 hence favorable. The range of Item - total correlation was 0.403 to 0.553, the threshold total correlation was above 0.3 hence reliability and construct validity were confirmed.

Table 4. 4 Sustainable Product Design and Development

Sustainable Product Design and Development	Sample Size	Mean	Standard Deviation	Factor Loadings	Item-Total Correlation	Alpha if Item Deleted
Design that minimizes or eliminates hazardous materials	150	3.71	0.931	0.743	0.553	0.700
Design that minimizes of wastes	150	3.93	0.928	0.659	0.458	0.724
Design that improved resource efficiency/preservation	150	3.85	0.895	0.592	0.403	0.738
Design that increases resource recovery by recycling	150	3.59	1.142	0.671	0.523	0.707
Design for reuse and remanufacturing	150	3.43	1.172	0.660	0.507	0.713
Design that increases sustainability aspect	150	3.68	0.936	0.693	0.517	0.709

Cronbach's alpha = 0.751, Grand mean = 3.698
Source: Research data 2020

Six items measured sustainable material construct. As shown in Table 4.5 below, the mean ranged from 3.47 to 3.65 implying that the respondent practiced sustainable material use to a reasonable extent. The practice with the highest mean rating of 3.65 was "use of non-exhaustible supplies" and SD of 1.124 while the practice with the lowest mean of 3.47 was "reduction of material weight and volume" and a SD of 1.091 from 150 responses. The grand mean for sustainable material use was 3.584 which implied that the practice had been implemented above the moderate extent by manufacturing firms. The range of factor loadings was 0.581 to 0.746, while Cronbach's alpha was 0.791, above 0.7 co-efficient adopted by the study hence favorable. The range of Item - total correlation was 0.426 to 0.588, the threshold total correlation was above 0.3, hence reliability and construct validity were confirmed and no item was dropped.

Table 4. 5 Sustainable Material Use

Sustainable Material Use	Sample Size	Mean	Standard Deviation	Factor Loadings	Item-Total Correlation	Alpha if Item Deleted
Assortment of materials of low impact	150	3.60	1.017	0.715	0.560	0.755
Use of non-exhaustible supplies	150	3.65	1.124	0.739	0.573	0.751
Use of low energy content materials	150	3.63	1.096	0.746	0.587	0.747
Use of recyclable/recycled materials	150	3.61	1.140	0.581	0.426	0.787
Reduction of material weight and volume	150	3.47	1.091	0.734	0.588	0.747
Use of replenishable materials	150	3.55	1.007	0.682	0.527	0.762

Cronbach's alpha = 0.791, Grand mean = 3.584
Source: Research data 2020

Table 4.6 below shows that sustainable manufacturing process construct was measured using seven practices. The mean ranged from 3.56 to 3.89 implying that the respondent practiced sustainable product design and development to a moderate extent. The practice "production techniques optimization" had the highest mean rating of 3.89 with a SD of

0.935 while the practice “fewer production processes” had the lowest mean of 3.56 and a SD of 1.077. Generally, sustainable manufacturing process had a grand mean of 3.705 which was above the moderate extent implying that the manufacturing firms had embraced the practice. The range of factor loadings was 0.592 to 0.789, while Cronbach’s alpha was 0.826. The range of Item - total correlation was 0.460 to 0.666, the threshold total correlation was above 0.3 hence all the scale items were maintained for use in model estimation.

Table 4. 6 Sustainable Manufacturing Process

Sustainable Manufacturing Process	Sample Size	Mean	Standard Deviation	Factor Loadings	Item-Total Correlation	Alpha if Item Deleted
Optimization of production techniques	150	3.89	0.935	0.667	0.538	0.808
Use of alternative techniques of production	150	3.73	1.036	0.725	0.603	0.797
Use of low/clean energy and resource consumption	150	3.59	1.056	0.685	0.550	0.806
Generation of low waste	150	3.77	1.032	0.722	0.595	0.798
Few/clean consumables	150	3.71	.885	0.731	0.600	0.799
Minimized utilization of auxiliary materials	150	3.68	.972	0.789	0.666	0.787
Fewer production processes	150	3.56	1.077	0.592	0.460	0.822

Cronbach's alpha = 0.826, Grand mean = 3.705
Source: Research data 2020

For the sustainable distribution construct, it was measured using five items. As shown in Table 4.7 below, the mean ranged from 3.91 to 4.11 implying that the respondent practiced sustainable distribution from moderate to greater extent. The practice with the highest mean rating of 4.11 was “efficient transport mode” and a SD of 0.894 whereas the practice with the lowest mean of 3.91 was “optimization of the weight/volume of the product” which has a SD of 0.893. The grand mean for sustainable distribution was 4.017

which implied that the practices had been employed to a large extent by manufacturing firms. The factor loadings were all above 0.4, while Cronbach's alpha was 0.814. Item - total correlation threshold were all above 0.3 and this indicated high reliability and construct validity.

Table 4. 7 Sustainable Distribution

Sustainable Distribution	Sample Size	Mean	Standard Deviation	Factor Loadings	Item-Total Correlation	Alpha if Item Deleted
Efficient distribution system	150	3.95	0.858	0.781	0.631	0.770
Efficient transport mode	150	4.11	0.894	0.736	0.580	0.785
Less/clean packaging	150	4.05	0.881	0.765	0.611	0.775
Efficient logistics	150	4.07	0.946	0.764	0.611	0.776
Optimization of weight/volume of the product	150	3.91	0.893	0.743	0.584	0.784

Cronbach's alpha= 0.814, Grand mean = 4.017
Source: Research data 2020

On sustainable product use, the construct was measured using six practices. As shown in Table 4.8 below, the mean ranged from 2.89 to 3.62 implying that the respondent practiced sustainable product use on a moderate to a large extent. The practice "consumption of low energy" had the highest mean rating of 3.62 with a SD of 1.066 and the practice "no energy use" had lowest mean of 2.89 with a SD of 1.286. Sustainable product use had a grand mean of 3.384 which implied that practices had been implemented slightly above the moderate extent by the manufacturing firms. The factor loadings ranged from 0.693 to 0.760, while Cronbach's alpha was 0.824. The range of Item - total correlation was 0.788 to 0.805, all above the threshold total correlation of 0.3, hence reliability was confirmed and all items were retained for further analysis.

Table 4. 8 Sustainable Product Use

Sustainable Product Use	Sample Size	Mean	Standard Deviation	Factor Loadings	Item-Total Correlation	Alpha if Item Deleted
Low energy consumption	150	3.62	1.066	0.742	0.597	0.795
Use of few/clean consumables	150	3.61	1.023	0.693	0.543	0.805
No energy use	150	2.89	1.286	0.733	0.599	0.795
Use of components consuming low energy	150	3.45	1.053	0.760	0.632	0.788
Use of clean sources of energy	150	3.53	1.127	0.725	0.589	0.796
Use of renewable energy sources	150	3.21	1.271	0.731	0.600	0.794

Cronbach's alpha= 0.824, Grand mean= 3.384

Source: Research data 2020

Table 4.9 shows that sustainable end-of-life construct was measured using five items. The range of the mean was 3.21 to 3.53 implying that the respondent practiced sustainable product design and development on a moderate extent. The practice “recycling of materials” had the highest mean rating of 3.53 with a SD of 1.344, while the practice “reuse of product” had the lowest mean of 3.21 with a SD of 1.233. In general, sustainable end-of-life had a grand mean of 3.379 which implied that manufacturing firms had embraced the practices moderately. The range of factor loadings was 0.616 to 0.867, while Cronbach’s alpha was 0.826 which was above the 0.7 co-efficient adopted by the study hence very favorable. The range of Item - total correlation was 0.462 to 0.743, the threshold total correlation was above 0.3 for all the items hence reliability and validity were confirmed.

Table 4. 9 Sustainable End-of-Life

Sustainable End of Life	Sample Size	Mean	Standard Deviation	Factor Loadings	Item-Total Correlation	Alpha if Item Deleted
Optimizing the end of life	150	3.40	1.049	0.673	0.542	0.813
Clean incineration	150	3.47	1.241	0.616	0.462	0.836
Product reuse	150	3.21	1.233	0.867	0.743	0.755
Recycling of materials	150	3.53	1.344	0.849	0.711	0.763
Remanufacturing of items	150	3.28	1.275	0.817	0.665	0.778

Cronbach's alpha= 0.826, Grand mean= 3.379
Source: Research data 2020

The latent construct organizational performance was measured using three subscales; environmental, economic and social performance. The subscales were first passed through validity and reliability test before CB-SEM analysis was done. The results were as shown in the following subsections. Environmental performance construct was measured using two sub variables; environmental impact reduction and environmental cost saving, each of which had its own indicators. To measure it, participants were required to specify the decrease in environmental effects that their organizations had experienced.

Environmental impact reduction was measured using six practices. Table 4.10 below shows that the highest reduction was the decrease of frequency for environmental accidents with a mean rating of 3.94 and a SD of 1.005. The lowest reduction was of air emission with a mean of 3.59 and a SD of 1.081. In general, environmental impact reduction had a grand mean of 3.762 which implied that, manufacturing firms experienced environmental impact reduction to a large extent. The range of factor loadings was 0.725 to 0.807, while Cronbach’s alpha was 0.852. The range of item - total correlation was 0.602 to 0.692, hence above the 0.3 threshold for all items which indicated high reliability.

Table 4. 10 Environmental Impact Reduction

Environmental Impact Reduction	Sample Size	Mean	Standard Deviation	Factor Loadings	Item-Total Correlation	Alpha if Item Deleted
Minimization of air emission	150	3.59	1.081	0.758	0.647	0.826
Minimization of waste water	150	3.73	1.067	0.725	0.602	0.835
Minimization of solid wastes	150	3.69	1.016	0.749	0.630	0.829
Reduction in the use of hazardous resources	150	3.72	1.094	0.747	0.620	0.832
Decrease of environmental accidents	150	3.94	1.005	0.780	0.652	0.825
Improved of organization’s environmental condition	150	3.90	0.888	0.807	0.692	0.820

Cronbach's alpha= 0.852, Grand mean= 3.762
Source: Research data 2020

Environmental cost saving variable was measured using six indicators as shown in Table 4.11 below. Decrease of cost for energy consumption was the highest saving with a mean rating of 3.37 (SD = 1.090, sample size = 150) while decrease of training cost was the lowest saving with a mean of 3.12 (SD = 1.080, sample size = 150). The grand mean for environmental cost saving was 3.249 which implies that the manufacturing firms experienced cost savings slightly above moderate extent. Factor loadings were all above 0.4, while Cronbach’s alpha was 0.881. Item - correlation for all the indicators were above 0.3 threshold. This showed that construct achieved all set levels for reliability and construct validity, hence retention of all six items for further analysis.

Table 4. 11 Environmental Cost Saving

Environmental Cost Saving	Sample Size	Mean	Standard Deviation	Factor Loadings	Item-Total Correlation	Alpha if Item Deleted
Reduction of cost for materials procured	150	3.29	1.095	0.805	0.703	0.858
Reduction of cost for energy intake	150	3.37	1.090	0.833	0.742	0.852
Reduction of fee for waste ejection	150	3.23	1.118	0.764	0.657	0.866
Reduction of fee for waste treatment	150	3.27	1.085	0.788	0.687	0.861
Reduction of investment	150	3.22	1.035	0.768	0.658	0.866
Decrease of training cost	150	3.12	1.080	0.794	0.693	0.860

Cronbach's alpha= 0.881, Grand mean= 3.249
Source: Research data 2020

The latent construct economic performance was measured using three subscales; profitability, productivity and operations efficiency. To measure the three, participants rated the extent to which they agreed with the increase of the indicators of profitability, productivity, operations efficiency that their organizations had experienced. Table 4.12 below shows that profitability construct had three determinants; increased gross profit, increased net profit and increased return on assets. The highest increase was increased gross profit with a mean of 3.36 (SD = 0.950, sample size = 150), followed closely by increased net profit, with a mean of 3.35 (SD = 0.990, sample size = 150), while the lowest was increased return on assets with a mean of 3.32 (SD = 0.929, sample size = 150. In general profitability had a grand mean of 3.342, which shows that the manufacturing firms had experienced slightly more than moderate increase in profit. The factor loadings were 0.930, 0.937 and 0.911, while Cronbach’s alpha was 0.917. Item -

total correlation were 0.840, 0.853 and 0.804 all above 0.3 hence all the items were retained for measuring model estimation.

Table 4. 12 Profitability Sub-Construct

Profitability	Sample Size	Mean	Standard Deviation	Factor Loadings	Item-Total Correlation	Alpha if Item Deleted
Increased gross profit	150	3.36	0.950	0.930	0.840	0.873
Increased net profit	150	3.35	0.990	0.937	0.853	0.862
Increased return on assets	150	3.32	0.929	0.911	0.804	0.902

Cronbach's alpha= 0.917, Grand mean= 3.342
Source: Research data 2020

Productivity sub-construct had five indicators. Their means ranged from 3.01 to 3.51 with the highest being an increase in output with a mean of 3.51 (SD = 0.910, sample size = 150), while the lowest was in low number of employees and working hours with a mean of 3.01 (SD = 1.059, sample size = 150). The grand mean was of 3.273, which is slightly above moderate implying that the manufacturing firms had experienced a moderate increase in productivity. The factor loadings were all above 0.4, while Cronbach's alpha was 0.812. Item - total correlation were all above 0.3 hence all the scale items were maintained for further analysis. All these indicated high reliability and construct validity.

Table 4. 13 Productivity Sub-Construct

Productivity	Sample Size	Mean	Standard Deviation	Factor Loadings	Item-Total Correlation	Alpha if Item Deleted
Increased in output	150	3.51	0.910	0.790	0.639	0.765
Increased revenue	150	3.42	1.005	0.809	0.658	0.757
Low levels of inventory	150	3.24	.960	0.714	0.555	0.788
Low operation cost	150	3.19	1.008	0.777	0.628	0.766
Low number of employees and working hours	150	3.01	1.059	0.692	0.528	0.798

Cronbach's alpha= 0.812, Grand mean= 3.273
Source: Research data 2020

Five indicators were used to measure operations efficiency. From Table 4.14 below, it was observed that the lowest was decreased setup and adjustment time with a mean of 3.53 (SD = 0.960, sample size = 150) while the highest was increased production yield with a mean of 3.85 (SD = 1.002, sample size = 150). A grand mean of 3.741 was recorded, which showed that the manufacturing firms had experienced a large increase in operational efficiency. The range of factor loadings was 0.734 to 0.863, while Cronbach's alpha was 0.894. The range of item - total correlation was 0.629 to 0.784 all above 0.3 threshold hence retention of all items.

Table 4. 14 Operations Efficiency Sub-Construct

Operations Efficiency	Sample Size	Mean	Standard Deviation	Factor Loadings	Item-Total Correlation	Alpha if Item Deleted
Decreased equipment failure	150	3.70	1.128	0.734	0.629	0.892
Decreased setup and adjustment time	150	3.53	0.960	0.793	0.697	0.879
Decreased idling and minor stoppages	150	3.83	1.022	0.861	0.784	0.865
Increased production speed	150	3.78	0.968	0.863	0.784	0.865
Decreased defects in process	150	3.76	0.946	0.819	0.724	0.875
Increase production yield	150	3.85	1.002	0.799	0.699	0.878

Cronbach's alpha= 0.894, Grand mean= 3.741 Source: Research data 2020

Social performance was measured using four sub-constructs; health and safety, employment, education and well-being. To measure the four, participants specified the extent to which they agreed that, the four sub-constructs have been enhanced in their organizations. Health and safety were measured using three items; advanced health status, rise in life expectancy and rise in health life years. Their means were 3.63 (SD =1.013, N=150), 3.56 (standard deviation =1.026, N=150) and 3.51 (SD =1.008, sample size =150) respectively and it still held the order of highest to lowest. The grand mean was of 3.569, which was slightly above moderate extent implying that there was a slightly above moderate enhancement in healthy and safety experienced by manufacturing firms. The factor loadings for health and safety were all above 0.4, Cronbach's alpha was 0.874. Item - total correlation were all above 0.3. Therefore, reliability and construct validity were confirmed.

Table 4. 15 Health and Safety

Health and Safety	Sample Size	Mean	Standard Deviation	Factor Loadings	Item-Total Correlation	Alpha if Item Deleted
Advanced health status	150	3.63	1.013	0.846	0.679	0.891
Rise in life expectancy	150	3.56	1.026	0.912	0.788	0.794
Rise in health life years	150	3.51	1.008	0.922	0.810	0.774

Cronbach's alpha= 0.874, Grand mean= 3.569
Source: Research data 2020

Employment sub-construct was measured using three indicators; retention and recruitment of staff, good staff relation and employee's productivity levels. Their means were 3.58 (SD = 0.971, sample size = 150), 4.01 (SD = 0.859, sample size =150) and 3.87 (SD = 0.910, sample size = 150) respectively which showed that, good staff relation had the highest mean, next was employee's productivity levels and the least was retention and recruitment of staff. The grand mean was of 3.820, which implied that the manufacturing firms had experienced a large enhancement in employment practice. The factor loadings were 0.791, 0.887 and 0.883 which were all above 0.4. Cronbach's alpha was 0.810 and Item - total correlation were 0.576, 0.713 and 0.702 all above 0.3 threshold. All this indicated that employment construct had a high reliability and construct validity.

Table 4. 16 Employment Sub-Construct

Employment	Sample Size	Mean	Standard Deviation	Factor Loadings	Item-Total Correlation	Alpha if Item Deleted
Retention and recruitment of staff	150	3.58	0.971	0.791	0.576	0.833
Good staff relation	150	4.01	0.859	0.887	0.713	0.691
Employees productivity levels	150	3.87	0.910	0.883	0.702	0.696

Cronbach's alpha= 0.810, Grand mean= 3.820
Source: Research data 2020

Three indicators were used to measure education sub-construct; human capital development, training and improvement of employees and availability of education funding for sustainability courses. Training and improvement of employees had the highest mean of 3.63 (SD=1.039, sample size=150), followed by human capital development, with a mean of 3.45 (SD = 1.046, sample size = 150) and lastly, the one with the lowest mean was availability of education funding for sustainability courses with a mean score of 3.08 (SD=1.251, sample size=150). In general, the grand education mean was 3.387, which is slightly above moderate extent implying that there was a slightly above moderate enhancement in education experienced by manufacturing firms. The factor loadings were 0.904, 0.891 and 0.844, while Cronbach's alpha of 0.847 was recorded. Item - total correlation were 0.763, 0.736 and 0.668. This showed high reliability and construct validity.

Table 4. 17 Education Sub-Construct

Education	Sample Size	Mean	Standard Deviation	Factor Loadings	Item-Total Correlation	Alpha if Item Deleted
Human capital development	150	3.45	1.046	0.904	0.763	0.747
Training and improvement of employees	150	3.63	1.039	0.891	0.736	0.772
Availability of education funding for sustainability	150	3.08	1.251	0.844	0.668	0.849

courses

Cronbach's alpha= 0.847, Grand mean= 3.387 Source: Research data 2020

Well-being was measured using six items, the range of the mean was 3.63 to 3.89. The lowest was improved community relation and involvement with a mean of 3.63 (SD=1.014, sample size=150) while the highest was conducive working environment with a mean of 3.89 (SD=0.863, sample size=150). A grand mean of 3.714 was recorded, which shows that manufacturing firms had experienced a large enhancement on matters wellbeing. The range of factor loadings was 0.758 to 0.851, while Cronbach's alpha was 0.893. The range of Item - total correlation was 0.658 to 0.767 all above 0.3 threshold hence no items were dropped and reliability and validity were confirmed.

Table 4. 18 Well- Being Sub-Construct

Well- Being	Sample Size	Mean	Standard Deviation	Factor Loadings	Item-Total Correlation	Alpha if Item Deleted
Improved employee satisfaction	150	3.70	0.968	0.825	0.729	0.872
Conducive working environment	150	3.89	0.863	0.810	0.714	0.875
Decent wages for the employees	150	3.73	0.864	0.851	0.767	0.867
Improved welfare programme	150	3.68	0.999	0.777	0.682	0.880
Improved community relation and involvement	150	3.63	1.014	0.758	0.658	0.884
Improved employee motivation	150	3.66	0.947	0.836	0.749	0.869

Cronbach's alpha= 0.893, Grand mean= 3.714

Source: Research data 2020

Competitive advantage comprised of two broad categories; cost advantage and differentiation advantage. To measure the two aspects, participants specified the extent to which they agreed with the advantages their organizations had experienced. Table 4.19 below shows the details of measurement of cost advantage. The mean range was from

3.69 to 3.95, with highest mean of 3.95 (SD=0.881, sample size=150) being technological advantages while minimized operations time had the lowest mean of 3.69 (SD=0.890, sample size=150). A grand mean of 3.872 was recorded, which showed that the manufacturing firms had experienced a large cost advantage. The range of factor loadings was 0.698 to 0.806, while Cronbach's alpha was 0.872. The range of Item - total correlation was 0.589 to 0.713 all above 0.3 threshold hence all the scale items were maintained for further analysis. All these indicated high reliability and construct validity.

Table 4. 19 Cost Advantage

Cost Advantage	Sample Size	Mean	Standard Deviation	Factor Loadings	Item-Total Correlation	Alpha if Item Deleted
Increased level of experience engineering of manufacturing process	150	3.91	0.972	0.741	0.637	0.855
Large scale/efficient supply chain	150	3.81	0.979	0.698	0.589	0.862
Minimized operations time	150	3.69	0.890	0.806	0.713	0.845
Tight cost and overhead control	150	3.89	0.987	0.721	0.612	0.859
Vigorous pursuit of cost reduction in all areas of operation	150	3.87	0.994	0.762	0.660	0.852
High capacity utilization	150	3.83	0.893	0.785	0.685	0.849
Technological advantages	150	3.95	0.881	0.762	0.659	0.852

Cronbach's alpha= 0.872, Grand mean= 3.850
Source: Research data 2020

As shown in Table 4.20 below differentiation advantage was measured using seven indicators. Their means ranged from 4.04 to 4.23, with the highest being improved customer service with SD=0.823 and sample size =150, while improved product quality had the lowest mean of 4.04 (SD=0.897, sample size=150). A grand mean of 4.110 was recorded, which showed that the manufacturing firms had experienced a large differentiation advantage. The range of factor loadings was 0.766 to 0.828, while Cronbach's alpha was 0.900. The range of Item - to total correlation was 0.674 to 0.750 all above 0.3 threshold. All these indicated high reliability and construct validity.

Table 4. 20 Differentiation Advantage

Differentiation Advantage	Sample Size	Mean	Standard Deviation	Factor Loadings	Item-Total Correlation	Alpha if Item Deleted
Improved product quality	150	4.04	0.897	0.791	0.707	0.885
High technology and innovativeness	150	4.05	0.979	0.766	0.676	0.890
Improved brand image	150	4.06	0.884	0.802	0.719	0.884
Improved product design features	150	4.18	0.852	0.821	0.744	0.881
Increased firm reputation	150	4.16	0.883	0.828	0.750	0.880
Improved customer service	150	4.23	0.823	0.771	0.684	0.888
Premium prices for the products	150	4.05	0.944	0.767	0.674	0.889

Cronbach's alpha= 0.900, Grand mean= 4.110
Source: Research data 2020

4.4 Diagnostic Tests

This study used several analysis to test for linearity, normality, multicollinearity and heteroscedasticity. Statistical analysis, which uses regression, correlation and analysis of variance, amongst others operate on the notion that, data set is linear, normally distributed, absence of multicollinearity and presence of homoscedastic in the data. Test of normality allow for inferences about the population, absence of multicollinearity leads to results stability, whereas over or under-estimation standard errors is ensured by homogeneity. For diagnostic tests Scatter plots was utilized to test for linearity. Shapiro-Wilk test was applied to test for normalcy. Multicollinearity was also tested by calculating tolerance and variance inflation factors. Heteroscedasticity was tested using Koenker test. The outcomes are as shown in the following subsections.

Figure 4.1 showed linearity, the R^2 was 0.3483. This means that SOMPs accounts for 34.83 percent of variance in competitive advantage, Wong (2013) stated that R^2 of 0.75 is substantial, 0.50 is moderate and 0.25 is weak, hence this showed that the portion of variance in competitive advantage that was accounted for by SOMPs was moderate.

Figure 4.1 Sustainable Operations Management Practices Versus Competitive Advantage

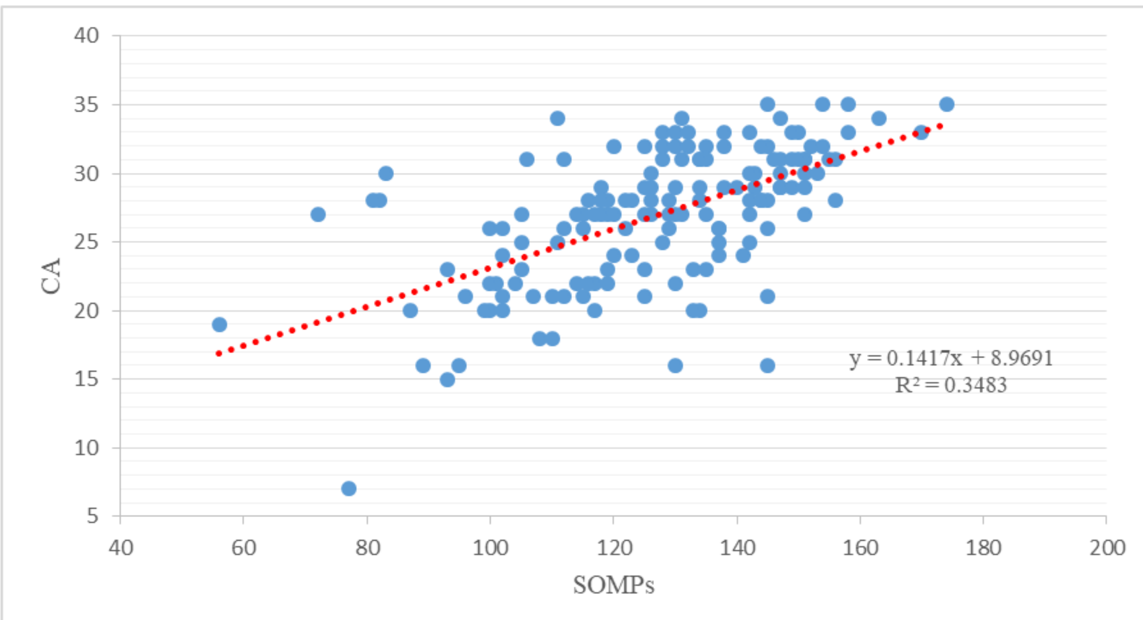


Table 4.21 below showed that the correlation coefficient (r) was 0.590 which was above 0.3. It indicated that the relationship between SOMPs and competitive advantage was positive and moderately strong.

Table 4. 21 Correlations Matrix

		CA	SOMPs
Pearson Correlation	CA	1.000	0.590
	SOMPs	0.590	1.000
Sig. (1-tailed)	CA	.	0.000
	SOMPs	0.000	.
N	CA	150	150
	SOMPs	150	150

Shapiro-Wilk test was utilized to test for normalcy. If the p-value > 0.05, it is a sign that the data is normal while a p-value < 0.05 indicates data that is not normal (Field, 2013). Table 4.22 showed that the p- values were all more than 0.05. Skewness values were also all below 1.0 and all the critical region for the kurtosis did not exceed 3.0 hence the data was normally distributed.

Table 4. 22 Tests of Normality

	Shapiro-Wilk						
	Statistic	df	Statistic	df	Sig.	Skewness	Kurtosis
NormalSOMP2	0.026	148	0.998	148	1.000	-0.002	-0.266
NormalCompA	0.042	148	0.995	148	0.932	0.072	-0.167
NormalFCMC	0.062	148	0.990	148	0.409	0.090	-0.179
NormalORGPERFORM	0.026	148	0.998	148	1.000	-0.001	-0.264

Every item skewness was also measured. An absolute value of skewness 1.0 or lower is an indication of a normally distributed data. Multivariate kurtosis statistic is also another method of assessing normality, critical region for the kurtosis should not exceed 3.0. Table 4.23 shows that all skewness values were below 1, while kurtosis values were below 3, hence normality was confirmed.

Table 4. 23 Skewness and Kurtosis

Variable	Minimum	Maximum	Skewness	Critical Ratio	Kurtosis	Critical Ratio
MP1	1.000	5.000	-0.577	-2.887	-0.056	-0.141
MP2	1.000	5.000	-0.600	-2.998	-0.096	-0.239
PF1	1.000	5.000	-0.112	-0.562	-0.254	-0.635
PF2	1.000	5.000	0.013	0.067	-0.424	-1.061
PD3	1.000	5.000	0.099	0.496	-0.126	-0.315

Variable	Minimum	Maximum	Skewness	Critical Ratio	Kurtosis	Critical Ratio
PD4	1.000	5.000	-0.078	-0.391	-0.251	-0.628
OE3	1.000	5.000	-0.634	-3.170	-0.231	-0.579
OE5	1.000	5.000	-0.699	-3.495	0.433	1.082
ECS1	1.000	5.000	-0.309	-1.543	-0.336	-0.841
ECS5	1.000	5.000	-0.158	-0.789	-0.465	-1.164
EIR5	1.000	5.000	-0.796	-3.978	0.253	0.633
EIR6	1.000	5.000	-0.554	-2.769	0.182	0.456
ED2	1.000	5.000	-0.521	-2.603	-0.116	-0.289
ED1	1.000	5.000	-0.299	-1.496	-0.300	-0.749
EP3	1.000	5.000	-0.700	-3.501	0.540	1.351
EP2	1.000	5.000	-0.854	-4.269	0.946	2.365
HS3	1.000	5.000	-0.332	-1.661	-0.274	-0.686
HS2	1.000	5.000	-0.349	-1.745	-0.471	-1.177
WB6	1.000	5.000	-0.513	-2.567	0.159	0.397
WB5	1.000	5.000	-0.638	-3.192	0.095	0.238
DA6	1.000	5.000	-0.961	-4.807	0.803	2.009
DA5	1.000	5.000	-0.845	-4.225	0.216	0.541
CA4	1.000	5.000	-0.613	-3.065	-0.262	-0.655
CA3	1.000	5.000	-0.279	-1.397	-0.104	-0.261
EL3	1.000	5.000	-0.269	-1.343	-0.837	-2.092
EL4	1.000	5.000	-0.503	-2.517	-0.990	-2.476
PU1	1.000	5.000	-0.532	-2.660	-0.282	-0.704
PU2	1.000	5.000	-0.479	-2.394	-0.212	-0.529
DS2	1.000	5.000	-0.902	-4.510	0.673	1.683
DS4	1.000	5.000	-0.944	-4.722	0.696	1.741
MU2	1.000	5.000	-0.611	-3.053	-0.302	-0.755
MU3	1.000	5.000	-0.724	-3.618	-0.008	-0.019
PDD4	1.000	5.000	-0.570	-2.851	-0.290	-0.726
PDD5	1.000	5.000	-0.541	-2.705	-0.407	-1.017
Multivariate					123.983	15.345

Multicollinearity was checked by computing tolerance and VIF and tolerance should not be more than 1 whereas VIF ranging from 1 to 10 will indicate no multicollinearity and values more than 10 indicates multicollinearity (Robinson & Schumacker, 2009). Table 4.24 shows VIF values ranging from 1.6 to 2.5 and all the tolerance value were less than 1, indicating no multicollinearity.

Table 4. 24 Coefficients[a]

Model		Collinearity Statistics	
		Tolerance	VIF
1	Product design and development	0.467	2.141
	Material use	0.398	2.510
	Manufacturing process	0.399	2.506
	Distribution	0.624	1.603
	Product use	0.582	1.719
	End of life	0.509	1.963

Table 4.25 below shows that correlation coefficient values ranged from 0.246 to 0.683 which were all below 0.8, signifying that multicollinearity was not a problem. A high pair-wise correlation coefficient, 0.80 and above among two regressors, is a sufficient indicator of multicollinearity problem, but it is not a necessary condition for its existence (Kumari, 2008).

Table 4. 25 Correlations Matrix

		Product design and development	Material use	Manufacturing process	Distribution	Product use	End of life
Product design and development	Pearson Correlation	1	.648**	.614**	.431**	.413**	.583**
	Sig. (2-tailed)		.000	.000	.000	.000	.000
	N	150	150	150	150	150	150
Material use	Pearson Correlation	.648**	1	.683**	.504**	.521**	.579**
	Sig. (2-tailed)	.000		.000	.000	.000	.000
	N	150	150	150	150	150	150
Manufacturing process	Pearson Correlation	.614**	.683**	1	.573**	.551**	.488**
	Sig. (2-tailed)	.000	.000		.000	.000	.000
	N	150	150	150	150	150	150
Distribution	Pearson Correlation	.431**	.504**	.573**	1	.378**	.246**
	Sig. (2-tailed)	.000	.000	.000		.000	.002

	N	150	150	150	150	150	150
Product use	Pearson Correlation	.413**	.521**	.551**	.378**	1	.541**
	Sig. (2-tailed)	.000	.000	.000	.000		.000
	N	150	150	150	150	150	150
End of life	Pearson Correlation	.583**	.579**	.488**	.246**	.541**	1
	Sig. (2-tailed)	.000	.000	.000	.002	.000	
	N	150	150	150	150	150	150

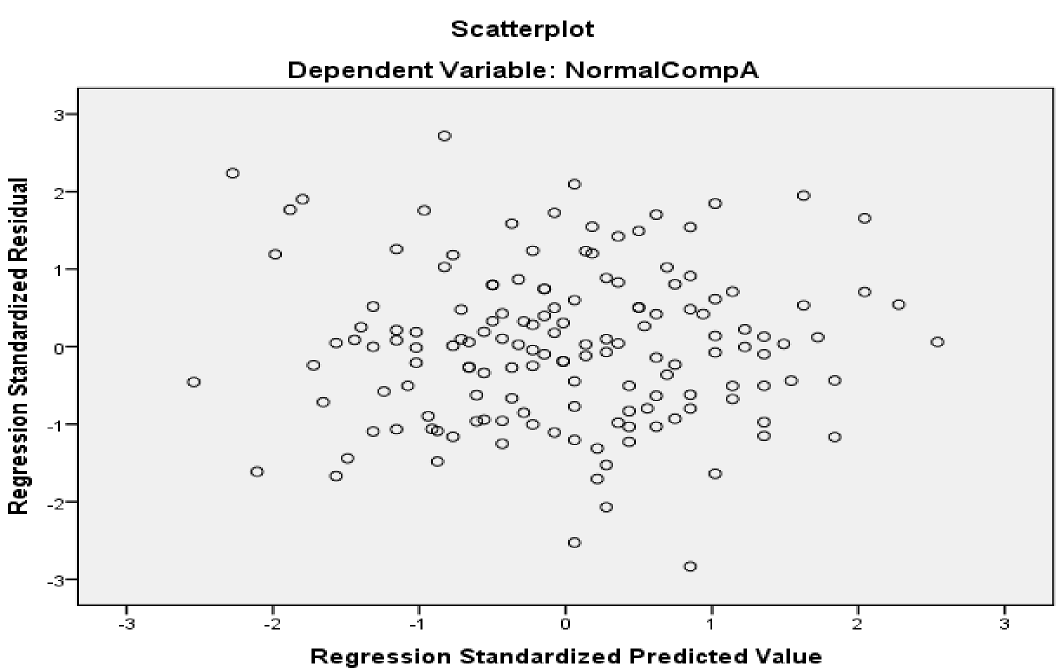
**. Correlation is significant at the 0.01 level (2-tailed).

Heteroscedasticity was tested using Koenker test and if p-value ≤ 0.05 would imply heteroscedasticity and would lead to rejection of null hypothesis. The p-value as indicated by Koenker test in Table 4.26 was 0.596 which was more than 0.05 hence null hypothesis that heteroskedasticity was not present was not rejected. The pattern of dots in the scatter plot was also not systematic it was rectangular which showed homoscedasticity.

Table 4. 26 Breusch-Pagan and Koenker Test Statistics and Sig-Values

	LM	Sig
BP	4.167	0.654
Koenker	4.598	0.596

Figure 4.2 Standardized Predicted Values Versus Standardized Residuals



4.5 Validation of the Measurement Model

AMOS was employed to carry out CFA so as to validate the measurement model and to establish acceptable goodness of fit levels. Thornhill, Saunders, and Lewis (2009) defined validity as the degree to which data collection approaches precisely achieve their intended purpose. Content validity of the measuring instrument was derived from literature which is in existence in addition to examination of measurement items by other researchers and experts. Pretesting was done on five key individuals from the sector to ensure clarity and proper interpretation. For purposes of assessing composite, construct, convergent and discriminatory validity various checks were conducted as seen below

Each of the measurement item should strongly correlate with its theoretic construct for convergent validity to be confirmed, meaning items which are construct indicator should unite or share in common variance in high proportion. In addition, AVE should be more than 0.5 (Fornell & Larcker, 1981). Using a formula put forward by Hair et al. (2010) each factors AVE was computed manually for all the constructs as follows:

$$AVE = \sum_{i=1}^{n} \lambda_i^2 / n \qquad (1)$$

AVE = average variance extract

λ_i = standardized factor loading

n = number of items

Reflective indicators standardized loadings ideal level is 0.70. However, a value of 0.60 is also deemed acceptable (Barclay et al., 1995). As seen in Table 4.27 below, the factor loadings were all more than the acceptable level of 0.60 and range from 0.64 to 0.93 hence convergent validity was verified.

Table 4. 27 Standardized Factor Loadings of Construct Items

Construct Items	Standard Factor Loadings	AVE
Product design and development	0.80	0.65
Design for reuse and remanufacturing	0.86	
Design that increases resource recovery by recycling	0.75	
Material use	0.75	0.57
Use of low energy content materials	0.65	
Use of non-exhaustible supplies	0.85	
Distribution	0.70	0.50
Efficient logistics	0.71	
Efficient transport mode	0.69	
Product use	0.79	0.63
Few/clean consumables during use	0.83	
Consumption of low energy	0.76	
End-of-life	0.88	0.77
Recycling of materials	0.85	
Reuse of product	0.90	
Cost advantage	0.71	0.51
Minimized operations time	0.73	
Tight cost and overhead control	0.70	
Differentiation advantage	0.79	0.62
Increased firm reputation	0.80	
Improved customer service	0.78	
Well- being	0.75	0.57
Improved community relation and involvement	0.64	
Improved employee motivation	0.85	
Health and safety	0.90	0.81
Rise in life expectancy	0.91	
Rise in health life years	0.89	
Employment	0.85	0.73
Good staff relation	0.82	
Employees productivity levels	0.89	
Education	0.86	0.74
Human capital development	0.81	
Training and improvement of employees	0.91	
Environmental impact reduction	0.84	0.71
Improve an enterprise’s environmental situation	0.86	
Decrease of frequency for environmental accidents	0.82	
Environmental cost saving	0.72	0.53
Decrease of investment	0.76	
Decrease of cost for materials purchasing	0.69	
Operations efficiency	0.80	0.65
Decreased defects in process	0.75	
Decreased idling and minor stoppages	0.86	
Productivity	0.74	0.55
Low operation cost	0.76	
Low levels of inventory	0.73	
Profitability	0.91	0.82
Increased net profit	0.93	

Construct Items	Standard Factor Loadings	AVE
Increased gross profit	0.89	
Manufacturing process	0.71	0.51
Use of alternative production techniques	0.71	
Production techniques optimization	0.72	

$p<0.01$

Table 4.28 below shows that all AVE were greater than 0.5 and factor loadings were greater than 0.7. To establish convergent validity, each latent variable's AVE should be at least 0.5 or higher (Hair, Black, Babin, & Anderson, 2010). For all the constructs, all item's standardized loadings were above the ideal level, hence confirmation of convergent validity.

Table 4. 28 Latent Constructs Average Variance Extracted and Factor Loadings

Latent Constructs	AVE	Factor Loadings
Sustainable operation management practices	0.61	0.77
Environmental performance	0.62	0.78
Economic performance	0.67	0.81
Social performance	0.71	0.84
Competitive advantage	0.57	0.75

The degree to which an instrument, measurement or a process gives similar outcome on repeated trials defines reliability (Carmines & Zeller, 1979). All items of reflective measures are regarded as parallel measure of the same construct. Hence construct path loadings have to be strong, equal or more than 0.70. The formula for calculating composite reliability as recommended by Hair et al. (2010) is given as follows:

$$CR = (\sum\lambda_i)^2/[(\sum\lambda_i)^2 + \sum(\delta_i)] \quad (2)$$

λi = standardized factor loading

$\boldsymbol{\delta}_i$ = indicators measurement error

Composite reliability measures the overall reliability of latent construct items. Reliability value is required to be more than 0.70. However, if the other indicators of the construct's validity are good, values ranging from 0.60 to 0.70 are also deemed acceptable (Hair et al., 2010). All composite reliabilities of construct had a value ranging from 0.66 to 0.91 indicating adequate internal consistency as presented in Table 4.29 below.

Table 4. 29 Average Variance Extracted and Composite Reliability of Construct Items

Construct Items	Standard Factor Loadings	AVE	Composite Reliability
Product design and development	0.80	0.65	0.74
Material use	0.75	0.57	0.68
Distribution	0.70	0.50	0.70
Product use	0.79	0.63	0.75
End-of-life	0.88	0.77	0.80
Cost advantage	0.71	0.51	0.70
Differentiation advantage	0.79	0.62	0.82
Well- being	0.75	0.57	0.72
Health and safety	0.90	0.81	0.89
Employment	0.85	0.73	0.87
Education	0.86	0.74	0.84
Environmental impact reduction	0.84	0.71	0.84
Environmental cost saving	0.72	0.53	0.66
Operations efficiency	0.80	0.65	0.80
Productivity	0.74	0.55	0.72
Profitability	0.91	0.82	0.91
Manufacturing process	0.71	0.51	0.68

Composite reliability and AVEs of the latent constructs are as presented in Table 4.30 below and all composite reliability of the five latent constructs had a value greater than 0.7, indicating a good internal consistency.

Table 4. 30 Average Variance Extracted and Composite Reliability of Latent Constructs

Constructs	AVE	Composite Reliability
Sustainable operation management practices	0.61	0.73
Environmental performance	0.62	0.75
Economic performance	0.67	0.81
Social performance	0.71	0.83
Competitive advantage	0.57	0.76

The AVE of individual factors and their shared variances were compared in order to examine discriminant validity (Fornell & Larcker, 1981). The-off diagonal items in Table 4.31 below represent the squared correlation between constructs whereas the diagonal items represent square root of AVE's, which measured the variance between the construct and its indicators. AVE values ranged from 0.71 to 0.91, where the lowest AVE value was 0.71 (Manufacturing Process (MP), Distribution (DS) and Competitive Advantage (CA)) which exceeded the largest squared correlation (0.64 – between Product Design and Development (PDD), End of Life (EL), Employment (EP) and Well-Being (WB)). This output indicated that the variance shared among factors were lower than of individual factors, hence discriminant validity was confirmed. The rule of thumb states that, each construct square root ought to be much larger compared to specific construct correlation relative to other model constructs (Chin, 1998) and ought to be at least 0.50 (Fornell & Larker, 1981).

Table 4. 31 Factor Correlation Matrix Showing Discriminant Validity

	PDD	MU	MP	DS	PU	EL	EIR	ECS	PF	PD	OE	HS	EP	ED	WB	CA	DA
PDD	0.81																
MU	0.06	0.76															
MP	0.32	0.34	0.71														
DS	0.06	0.43	0.41	0.71													
PU	0.12	0.32	0.36	0.32	0.79												
EL	0.64	0.04	0.25	0.01	0.12	0.88											
EIR	0.11	0.11	0.36	0.26	0.09	0.13	0.84										
ECS	0.16	0.34	0.17	0.32	0.21	0.18	0.16	0.73									
PF	0.04	0.08	0.01	0.04	0.01	0.08	0.10	0.17	0.91								
PD	0.08	0.14	0.07	0.20	0.11	0.11	0.10	0.18	0.55	0.74							
OE	0.02	0.25	0.36	0.33	0.23	0.05	0.17	0.22	0.15	0.27	0.81						
HS	0.06	0.06	0.10	0.07	0.06	0.08	0.15	0.01	0.05	0.12	0.14	0.90					
EP	0.04	0.10	0.09	0.23	0.14	0.05	0.12	0.04	0.07	0.16	0.30	0.25	0.85				
ED	0.01	0.03	0.14	0.20	0.16	0.09	0.10	0.07	0.09	0.15	0.22	0.31	0.41	0.86			
WB	0.03	0.16	0.18	0.27	0.25	0.10	0.09	0.06	0.07	0.25	0.27	0.27	0.64	0.45	0.75		
CA	0.16	0.15	0.22	0.22	0.18	0.16	0.27	0.29	0.15	0.22	0.58	0.21	0.56	0.16	0.34	0.71	
DA	0.01	0.04	0.16	0.13	0.08	0.02	0.18	0.02	0.09	0.19	0.43	0.22	0.44	0.25	0.35	0.43	0.79

Where PDD is product design and development, MU is material use, MP is manufacturing process, DS is distribution, PU is product use, EL is end-of-life, EIR is environmental impact reduction, ECS is environmental cost saving, PF is profitability, PD is productivity, OE is operations efficiency, HS is health and safety, EP is employment, ED is education, WB is well-being, CA is cost advantage and DA is differentiation advantage.

4.6 Confirmation of the Measurement Model Using Confirmatory Factor Analysis

Factor analysis acts as a gauge of the substantive importance of a given variable to the factor and it is used to identify and remove hidden constructs or variable items that do not meet the objectives of the study and which may not be apparent from direct analysis (Ragin, 2014). After the measurement instrument validation was fulfilled, valuation of the measurement model fit was done using CFA results in order to approve the hypothesized structure as shown in Figure 4.3 below.

Figure 4.3 Confirmatory Factor Analysis Output of the Measurement Model

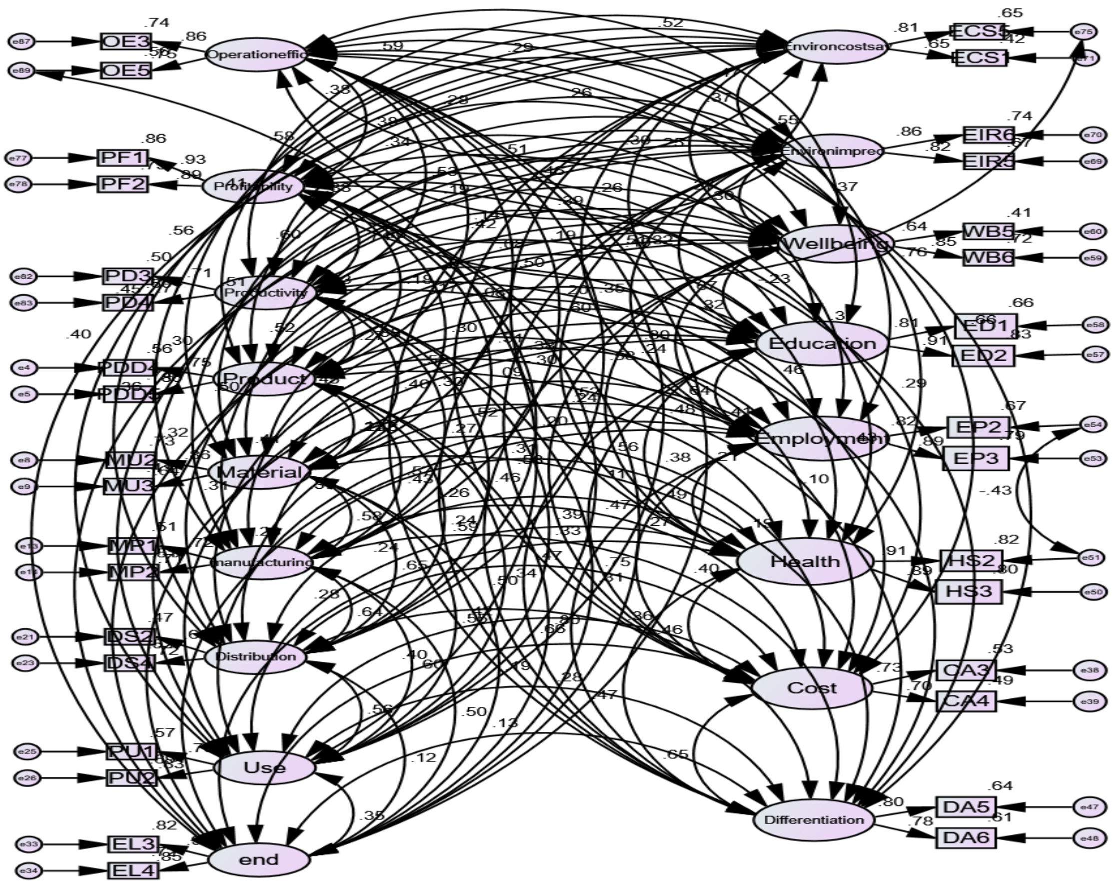


Figure 4.3 above shows the measurement model, which comprises of 17 factors. A minimum of two observed variables were used to measure each factor. Random

measurement error influenced reliability, as shown by the related error term. Regression was done to each of the observed variables into its specific factor. Lastly, inter-correlation between all the 17 factors was presented. The hypothesized model was recursive, meaning it was unidirectional and the sample size was 150. Two important features usually define recursive models: uncorrelated disturbances, and unidirectional of all causal effects. Model variables were 85, 34 observed, 51 unobserved, 51 exogenous and 34 endogenous.

The projected model was an over-identified one with a DF value of 388 as shown in Table 4.33. It shows a good construct items' loadings and cross loadings after CFA which also confirms convergent validity. In the model, there were 595 distinct sample moments and 207 distinct parameters, leaving 388 (595 - 207) degrees of freedom, which was positive. Multicollinearity effects was eliminated in this study, as there was achievement of the minimum iteration, hence assurance that an admissible solution was attained through the estimation process.

Table 4. 32 Confirmatory Factor Analysis Results

	PF	MP	PD	OE	ECS	EIR	ED	EP	HS	WB	DA	CA	EL	PU	DS	MU	PDD
MP1	0.062	0.716	0.19	0.431	0.295	0.426	0.27	0.212	0.222	0.306	0.287	0.337	0.356	0.429	0.459	0.414	0.407
MP2	0.062	0.713	0.189	0.43	0.294	0.425	0.269	0.212	0.221	0.305	0.286	0.336	0.355	0.427	0.458	0.412	0.405
PF1	0.928	0.081	0.686	0.356	0.475	0.273	0.28	0.248	0.197	0.241	0.272	0.344	0.253	0.098	0.185	0.274	0.171
PF2	0.887	0.077	0.656	0.34	0.454	0.261	0.268	0.237	0.188	0.23	0.26	0.329	0.242	0.094	0.177	0.262	0.164
PD3	0.526	0.189	0.71	0.377	0.419	0.199	0.277	0.287	0.227	0.361	0.304	0.324	0.223	0.238	0.325	0.285	0.191
PD4	0.571	0.205	0.771	0.41	0.455	0.217	0.3	0.311	0.247	0.392	0.33	0.352	0.242	0.258	0.353	0.309	0.207
OE3	0.329	0.517	0.456	0.858	0.397	0.358	0.402	0.471	0.317	0.447	0.564	0.652	0.183	0.416	0.494	0.426	0.117
OE5	0.288	0.452	0.398	0.751	0.347	0.313	0.352	0.412	0.277	0.391	0.494	0.57	0.16	0.168	0.432	0.373	0.102
ECS1	0.333	0.268	0.383	0.301	0.65	0.24	0.168	0.125	0.05	0.163	0.072	0.335	0.257	0.29	0.364	0.378	0.25
ECS5	0.278	0.332	0.475	0.373	0.806	0.298	0.208	0.155	0.061	0.203	0.089	0.415	0.319	0.36	0.451	0.469	0.31
EIR5	0.241	0.489	0.23	0.343	0.303	0.82	0.262	0.284	0.313	0.246	0.349	0.429	0.292	0.242	0.417	0.271	0.276
EIR6	0.254	0.514	0.242	0.36	0.319	0.863	0.275	0.299	0.329	0.259	0.367	0.451	0.307	0.255	0.439	0.285	0.29
ED2	0.275	0.343	0.354	0.426	0.235	0.29	0.909	0.579	0.506	0.609	0.453	0.358	0.278	0.369	0.406	0.155	0.075
ED1	0.245	0.306	0.316	0.381	0.21	0.259	0.812	0.517	0.452	0.543	0.405	0.32	0.248	0.329	0.362	0.138	0.067
EP3	0.237	0.263	0.358	0.487	0.17	0.307	0.565	0.887	0.438	0.707	0.585	0.662	0.206	0.331	0.427	0.278	0.175
EP2	0.219	0.242	0.33	0.449	0.157	0.283	0.521	0.817	0.404	0.652	0.539	0.61	0.19	0.305	0.393	0.256	0.161
HS3	0.189	0.277	0.285	0.33	0.068	0.34	0.497	0.441	0.892	0.465	0.422	0.407	0.247	0.219	0.235	0.216	0.214
HS2	0.192	0.281	0.29	0.335	0.069	0.346	0.505	0.448	0.907	0.473	0.429	0.414	0.251	0.222	0.239	0.22	0.218
WB6	0.221	0.364	0.433	0.443	0.214	0.255	0.57	0.679	0.444	0.851	0.503	0.497	0.275	0.428	0.443	0.339	0.158
WB5	0.166	0.274	0.326	0.333	0.161	0.192	0.429	0.511	0.334	0.64	0.378	0.374	0.207	0.322	0.333	0.255	0.119
DA6	0.229	0.313	0.333	0.513	0.086	0.332	0.389	0.515	0.369	0.461	0.78	0.508	0.105	0.217	0.28	0.149	0.075
DA5	0.235	0.321	0.341	0.525	0.088	0.34	0.398	0.527	0.377	0.472	0.798	0.52	0.107	0.222	0.287	0.153	0.077
CA4	0.259	0.329	0.319	0.53	0.36	0.365	0.275	0.521	0.319	0.407	0.455	0.698	0.28	0.295	0.325	0.264	0.283
CA3	0.271	0.345	0.334	0.555	0.377	0.383	0.288	0.546	0.334	0.427	0.476	0.731	0.294	0.309	0.34	0.277	0.296
EL3	0.247	0.45	0.284	0.193	0.358	0.322	0.276	0.21	0.251	0.292	0.121	0.363	0.904	0.312	0.106	0.169	0.719
EL4	0.232	0.423	0.266	0.181	0.336	0.302	0.259	0.197	0.235	0.274	0.114	0.341	0.849	0.293	0.099	0.158	0.675
PU1	0.08	0.454	0.253	0.367	0.338	0.224	0.307	0.283	0.186	0.381	0.211	0.32	0.262	0.757	0.425	0.42	0.259
PU2	0.088	0.497	0.278	0.402	0.37	0.245	0.337	0.31	0.203	0.417	0.231	0.35	0.287	0.83	0.466	0.46	0.284
DS2	0.137	0.439	0.313	0.393	0.383	0.348	0.305	0.329	0.18	0.356	0.246	0.318	0.08	0.384	0.684	0.442	0.166
DS4	0.144	0.461	0.328	0.413	0.402	0.365	0.32	0.346	0.189	0.374	0.258	0.334	0.084	0.403	0.718	0.464	0.175
MU2	0.253	0.495	0.344	0.425	0.498	0.283	0.146	0.268	0.208	0.342	0.164	0.324	0.16	0.474	0.554	0.856	0.196
MU3	0.19	0.372	0.258	0.319	0.374	0.213	0.11	0.201	0.156	0.257	0.123	0.243	0.12	0.357	0.416	0.644	0.147
PDD4	0.138	0.425	0.201	0.102	0.288	0.252	0.062	0.148	0.18	0.139	0.072	0.303	0.595	0.256	0.182	0.171	0.748
PDD5	0.159	0.489	0.231	0.117	0.331	0.29	0.071	0.17	0.207	0.16	0.083	0.349	0.684	0.294	0.209	0.197	0.86

Table 4.32 shows a good construct items' loadings and cross loadings after CFA which also confirms convergent validity. Where PF is profitability, MP is manufacturing process, PD is productivity, OE is operations efficiency, ECS is environmental cost saving, EIR is environmental impact reduction, ED is education, EP is employment, HS is health and safety, WB is well-being, DA is differentiation advantage, CA is cost advantage, EL is end-of-life, PU is product use, DS is distribution, MU is material use and PDD is product design and development.

The results shown in Table 4.33 below offer a clear model of fit summary, which comprises of the x^2 value of 496.561, degrees of freedom of 388 and probability value (0.000). The table shows the minimum discrepancy (CMIN/DF); DF is the degrees of freedom; probability value (P) and the number of parameters (NPAR).

Table 4. 33 Analysis of a Moment Structures Output Showing Measurement Model Fit

Model	NPAR	CMIN (x^2)	DF	P	CMIN/DF
Default model	207	496.561	388	0.000	1.280
Saturated model	595	0.000	0		
Independence model	34	3027.092	561	0.000	5.396

In this model the x^2 value of 496.561 was small compared to independence model value (3027.092), hence the x^2 value was good. It was also suitable to look at the value of CMIN/DF as the x^2 measurement is specifically sensitive to sample size. This means that, probability of rejection of a model increases with an increase in the sample size. For a good model fit the recommendation is that, this metric should not exceed five (Bentler, 1989). From Table 4.34 below, the value was 1.280, which showed a good fit. The other measures for assessment of model fitness were as shown in Table 4.34 below.

Table 4. 34 Fit Statistics of the Measurement Model

Name of Category	Fit Statistic	Recommended	Obtained
Absolute fit	x^2 significance	P > 0.05	0.000
	RMSEA	< 0.08	0.043
	GFI	> 0.90	0.85
Incremental fit	AGFI	> 0.90	0.80
	NFI	> 0.90	0.84
	CFI	> 0.90	0.96
	TLI	> 0.90	0.94
Parsimonious fit	x^2/df	< 3.0	1.280

The fit indices provided a reasonably model fit and for absolute fitness, GFI obtained was 0.85 and RMSEA was 0.043. The chi-square likelihood ratio (CMIN) was significant at p-value = 0.000. The test is supposed to be insignificant as it is a difference test, but due to negligence of SEM assumptions this value is usually significant in most cases. For the incremental fit, AGFI was 0.80. The NFI, CFI, and TLI were 0.84, 0.96, 0.94, respectively. Although some of the values did not exceed the 0.9 threshold, they were still within the acceptable range of 0.8 and above as suggested by Baumgartner and Homburg (1996) and Doll, Xia, and Torkzadeh (1994). It was therefore concluded that the theorized model provided a good fit with the observed data.

4.7 Structural Model Path Diagrams and Analysis

This study had four objectives. To achieve the four objectives, structural models path diagram which showed the hypotheses formulated were constructed, followed by structural model analysis. The SEM represent the graphical outlay of its mathematical expression, where there is an interrelation of the dependent variables to their explanatory variables by a set of equations. The outputs, both graphical and textual are as follows.

4.7.1 Sustainable Operations Management Practices and Firm Competitive Advantage

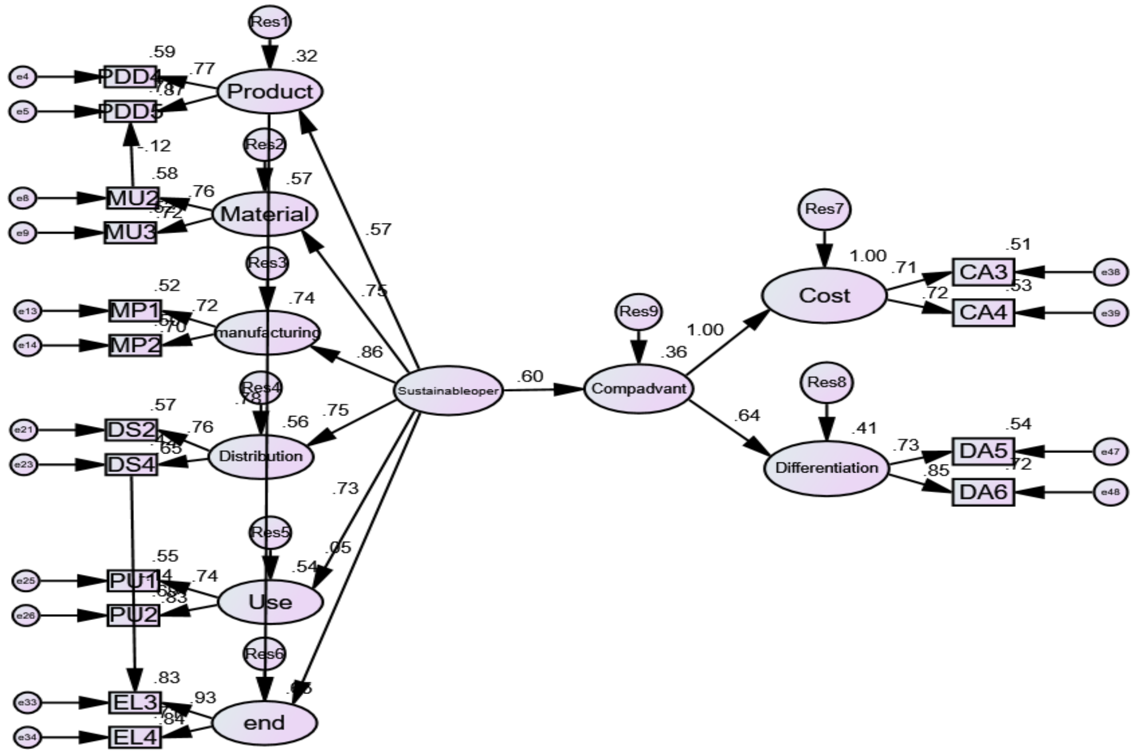


Figure 4.4 Sustainable Operations Management Practices and Competitive Advantage

Figure 4.4 above, shows that when sustainable operations management increased by one SD, competitive advantage increased by 0.60 SD. Squared multiple correlation (R^2) indicated that SOMPs accounted for 0.36 variance in competitive advantage. There were 10 unobserved and 16 observed variables. The model was recursive with a sample size of 150. Model variables were 51, 16 observed, 35 unobserved, 26 exogenous and 25 endogenous. Table 4.35 shows DF of 93 and there were 136 distinct sample moments, and 43 distinct parameters, leaving 93 (136 - 43) DF hence over-identified.

Table 4. 35 Analysis of a Moment Structures Output Showing Model Fit for Objective 1

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	43	65.797	93	0.985	0.707
Saturated model	136	0.000	0		
Independence model	16	944.083	120	0.000	7.867

The fit indices signified a perfect model fit as seen on Table 4.36 below. The GFI obtained was 0.948; AGFI was 0.925; and NFI; CFI; TLI were 0.930, 1.000 and 1.043, respectively. The p-value was 0.985 and RMSEA was 0.000, hence, the conclusion drawn was that, the model fitted the data perfectly well.

Table 4. 36 Fit Statistics of the Structural Model for Objective 1

Name of Category	Fit Statistic	Recommended	Obtained
Absolute fit	x^2 significance	P > 0.05	0.985
	RMSEA	< 0.08	0.000
	GFI	> 0.90	0.948
Incremental fit	AGFI	> 0.90	0.925
	NFI	> 0.90	0.930
	CFI	> 0.90	1.000
	TLI	> 0.90	1.043
Parsimonious fit	x^2 /df	< 3.0	0.707

The full structural equation model was taken into account. All the paths reflect literature findings and the Figure 4.4 above, shows the graphical outlay of SEM. For objective one, which was to determine the link between SOMPs and competitive advantage, the null hypothesis was stated as follows - H_1: SOMPs have no significant influence on firm competitive advantage.

Table 4. 37 Regression Weight for Hypotheses Tested for Objective 1

			Estimate	Standard Error	C.R.	P	Label
Compadvant	<---	Sustainableoper	0.694	0.172	4.035	***	Supported

Note: *** means p-value at significant level is <0.001 in AMOS output

The study null hypothesis H_1 that SOMPs have no significant influence on firm competitive advantage was rejected since p-value < 0.001 was less than alpha (α) value = 0.05, as seen on Table 4.37 above, hence it was concluded that SOMPs had significant influence on firm's competitive advantage.

4.7.2 Moderating Effect of Firm Characteristics on the Relationship Between Sustainable Operations Management Practices and Firm Competitive Advantage

The second objective was to examine the moderating effect of firm characteristics on the relationship between SOMPs and competitive advantage. The variable representing firm characteristics were size represented by the size of staff; age represented by the length of operations; and managerial capabilities represented by the level of education and working experience, as shown below. Each of the firm characteristics was analyzed differently and standardization of variables was done to decrease multicollinearity. The interaction terms of each firm characteristic's indicators with SOMPs variable were also computed.

4.7.2.1 Sustainable Operations Management Practices, Firm Age and Competitive Advantage

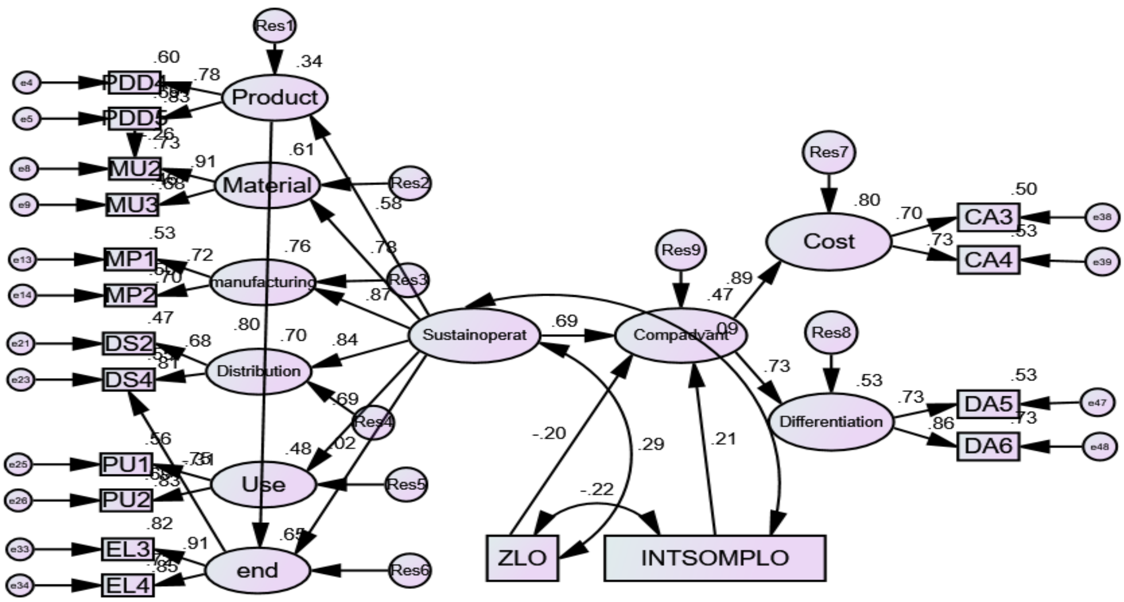


Figure 4.5 Sustainable Operations Management Practices, Firm Age and Competitive Advantage

Figure 4.5 above shows that when SOMPs increased by 1 SD, competitive advantage increased by 0.69 SD and when the firms age increased by 1 SD, competitive advantage reduces by 0.20 standard deviation. When the interaction (product) of SOMPs and firms age increased by 1 SD, competitive advantage increased by 0.21 SD. It was estimated that the 0.47 (estimate R^2) variance in competitive advantage was described by the predictor variables.

It was a recursive model with a sample size of 150. Model variables were 53, 18 observed, 35 unobserved, 28 exogenous and 25 endogenous and DF was 120. Table 4.38 shows that, there were 171 distinct sample moments and 51 distinct parameters, leaving 120 (171-51) DF, which was positive hence over-identified.

Table 4. 38 Analysis of a Moment Structures Output Showing Model Fit for Objective 2a

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	51	94.667	120	0.958	0.789
Saturated model	171	0.000	0		
Independence model	18	997.143	153	0.000	6.517

The fit indices provided a perfect model fit as seen on Table 4.39. The GFI obtained was 0.936; AGFI was 0.908; and NFI, CFI, TLI were 0.905, 1.000 and 1.038, respectively. The RMSEA was 0.000 and the p-value was 0.958. Hence, the conclusion was that the model fitted the data perfectly.

Table 4. 39 Fit Statistics of the Structural Model for Objective 2a

Name of Category	Fit Statistic	Recommended	Obtained
Absolute fit	x^2 significance	P > 0.05	0.958
	RMSEA	< 0.08	0.000
	GFI	> 0.90	0.936
Incremental fit	AGFI	> 0.90	0.908
	NFI	> 0.90	0.905
	CFI	> 0.90	1.000
	TLI	> 0.90	1.038
Parsimonious fit	x^2 /df	< 3.0	0.789

The null hypothesis for objective 2a was stated as follows - H_{2a}: firm age has no significant moderating effect on the relationship between SOMPs and firm competitive advantage

Table 4. 40 Regression Weight for Hypotheses Tested for Objective 2a

			Estimate	S.E.	C.R.	P	Label
Compadvant	<---	Sustainoperat	.681	.170	4.009	***	Significant
Compadvant	<---	ZLO	-.110	.055	-1.981	.048	Significant
Compadvant	<---	INTSOMPLO	.108	.048	2.254	.024	Significant

Note: *** means p-value at significant level is <0.001 in AMOS output

Since the p-value < 0.001 was less than α-value = 0.05 as seen on Table 4.40, SOMPs had an influence of competitive advantage. In addition, firm's age had a significant effect on competitive advantage since p-value = 0.048 was less than α-value = 0.05; and lastly, the interaction effect was significant since p-value = 0.024 was less than α-value = 0.05. The null hypothesis was rejected. Hence it was concluded that the moderating effect of firms age on the relationship between SOMPs and competitive advantage was significant.

4.7.2.2 Sustainable Operations Management Practices, Firm Size and Competitive Advantage

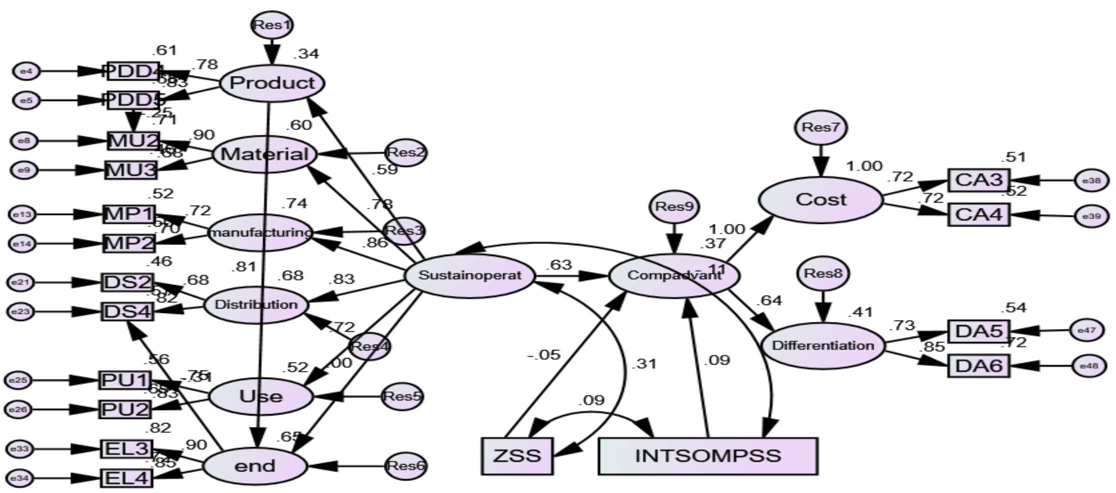


Figure 4.6 Sustainable Operations Management Practices, Firm Size and Competitive Advantage

Figure 4.6 above shows that when SOMPs increased by 1 SD, competitive advantage increased by 0.63 SD; when firm size increased by 1 SD competitive advantage decreased by 0.05 SD; and when the interaction (product) of SOMPs and firm size increased by 1 SD, competitive advantage increased by 0.09 SD. It was estimated that the predictor variables accounted for 0.37 variance in competitive advantage.

The model was recursive with a sample size of 150. Model variables were 53, 18 observed, 35 unobserved, 28 exogenous and 25 endogenous. Table 4.41 shows that, it had positive DF (121) and there were 171 distinct sample moments and 50 distinct parameters, leaving 121 (171-50) DF.

Table 4. 41 Analysis of a Moment Structures Output Showing Model Fit for Objective 2b

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	50	93.892	121	.968	.776
Saturated model	171	.000	0		
Independence model	18	986.952	153	.000	6.451

Table 4.42 shows that, the fit indices provided a perfect model fit since GFI was 0.936; AGFI was 0.910; NFI was 0.905; CFI was 1.000 and TLI was 1.041. The RMSEA was 0.000 and the p-value was 0.968. Hence, the conclusion arrived at was that the proposed model fitted the data very well.

Table 4. 42 Fit Statistics of the Structural Model for Objective 2b

Name of Category	Fit Statistic	Recommended	Obtained
Absolute fit	x^2 significance	P > 0.05	0.968
	RMSEA	< 0.08	0.000
	GFI	> 0.90	0.936
Incremental fit	AGFI	> 0.90	0.910
	NFI	> 0.90	0.905
	CFI	> 0.90	1.000
	TLI	> 0.90	1.041
Parsimonious fit	x^2 /df	< 3.0	0.776

The null hypothesis for objective 2b was as follows H_{2b}: firm size has no significant moderating effect on the relationship between SOMPs and firm competitive advantage.

Table 4. 43 Regression Weight for Hypotheses Tested for Objective 2b

			Estimate	S.E.	C.R.	P	Label
Compadvant	<---	Sustainoperat	0.702	0.173	4.063	***	Significant
Compadvant	<---	ZSS	-0.034	0.060	-0.577	0.564	Not significant
Compadvant	<---	INTSOMPSS	0.057	0.057	0.985	0.324	Not significant

Note: *** means p-value at significant level is < 0.001 in AMOS output

It was concluded that the relationship between SOMPs and competitive advantage was significant since the p-value < 0.001 was less than α-value = 0.05, as shown in Table 4.43. Firm size had no significant effect on competitive advantage since the p-value = 0.564 was more that α-value = 0.05 and the interaction effect was not significant since the p-value = 0.324 was more than α-value = 0.05. It was, therefore, concluded that the moderating effect of firm size on the relationship between SOMPs and competitive advantage was not significant and the null hypothesis was not rejected.

4.7.2.3 Sustainable Operations Management Practices, Employees Level of Education and Competitive Advantage

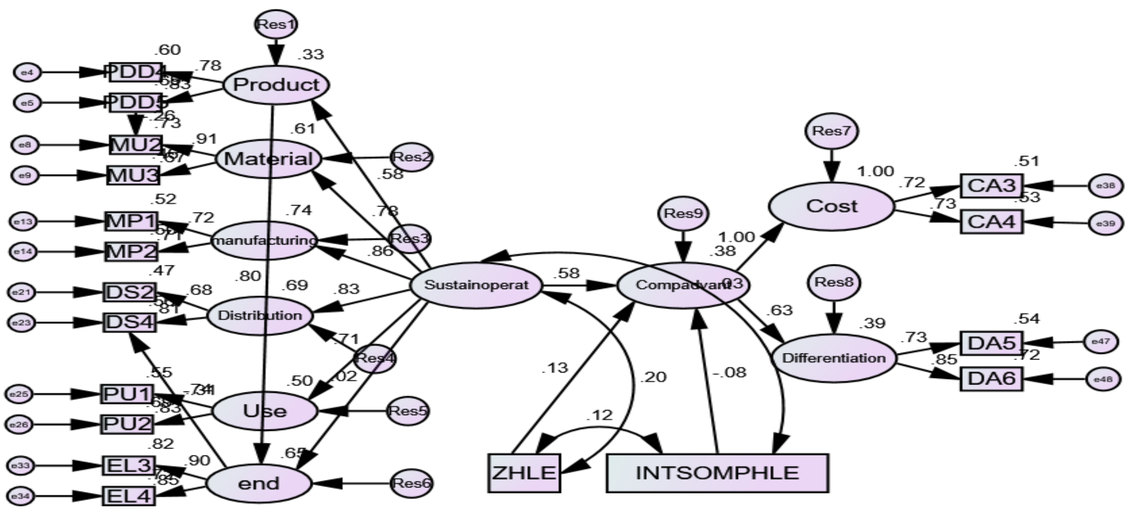


Figure 4.7 Sustainable Operations Management Practices, Employees Level of Education and Competitive Advantage

Figure 4.7 above shows that when SOMPs increased by 1 SD, competitive advantage increased by 0.58 SD; when employees level of education increased by 1 SD competitive advantage increased by 0.13 SD; and when the interaction of SOMPs and employees' level of education increased by 1 SD, competitive advantage decreased by 0.08 SD. The R^2 value of 0.38 indicated the portion of the variance in competitive advantage accounted for by the predictor variables.

The model was recursive with a sample size of 150. Model variables were 53, 18 observed, 35 unobserved, 28 exogenous and 25 endogenous. Table 4.44 shows that, the model had positive DF (121) and there were 171 distinct sample moments and 50 distinct parameters, leaving 121 (171-50) DF, hence over-identified.

Table 4. 44 Analysis of a Moment Structures Output Showing Model Fit for Objective 2c

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	50	96.146	121	0.953	0.795
Saturated model	171	0.000	0		
Independence model	18	983.781	153	0.000	6.430

The fit indices signified a good model fit as seen on Table 4.45. For absolute fitness, GFI obtained was 0.934 and RMSEA was 0.000. The CMIN value appeared to be significant at p-value 0.953. For the incremental fit AGFI was 0.907 as against the recommended value of above 0.90; NFI, CFI, TLI were 0.902, 1.000, and 1.038, respectively, hence the model showed a great fit.

Table 4. 45 Fit Statistics of the Structural Model for Objective 2c

Name of Category	Fit Statistic	Recommended	Obtained
Absolute fit	x^2 significance	P > 0.05	0.953
	RMSEA	< 0.08	0.000
	GFI	> 0.90	0.934
Incremental fit	AGFI	> 0.90	0.907
	NFI	> 0.90	0.902
	CFI	> 0.90	1.000
	TLI	> 0.90	1.038
Parsimonious fit	x^2 /df	< 3.0	0.795

For objective 2c, null hypothesis was H_{2c}: employee's level of education has no significant moderating effect on the relationship between SOMPs and firm competitive advantage**.**

Table 4. 46 Regression Weight for Hypotheses Tested for Objective 2c

			Estimate	S.E.	C.R.	P	Label
Compadvant	<---	Sustainoperat	.657	.165	3.991	***	Significant
Compadvant	<---	ZHLE	.081	.057	1.424	.155	Not significant
Compadvant	<---	INTSOMPHLE	-.055	.059	-.937	.349	Not significant

Note: *** means p-value at significant level is <0.001 in AMOS output

Table 4.46 above shows a p-value < 0.001 which was less than α-value = 0.05, hence it was concluded that the link between SOMPs and competitive advantage was significant. Employees' level of education had no significant effect on competitive advantage since p-value = 0.155 was more than α-value = 0.05; and with the interaction effect, the results were not significant as p-value of 0.349 was more than α-value = 0.05. Therefore, the null hypothesis that employee's level of education has no significant moderating effect on the relationship between SOMPs and firm competitive advantage was not rejected.

4.7.2.4 Sustainable Operations Management Practices, Employees' Period of Working and Competitive Advantage

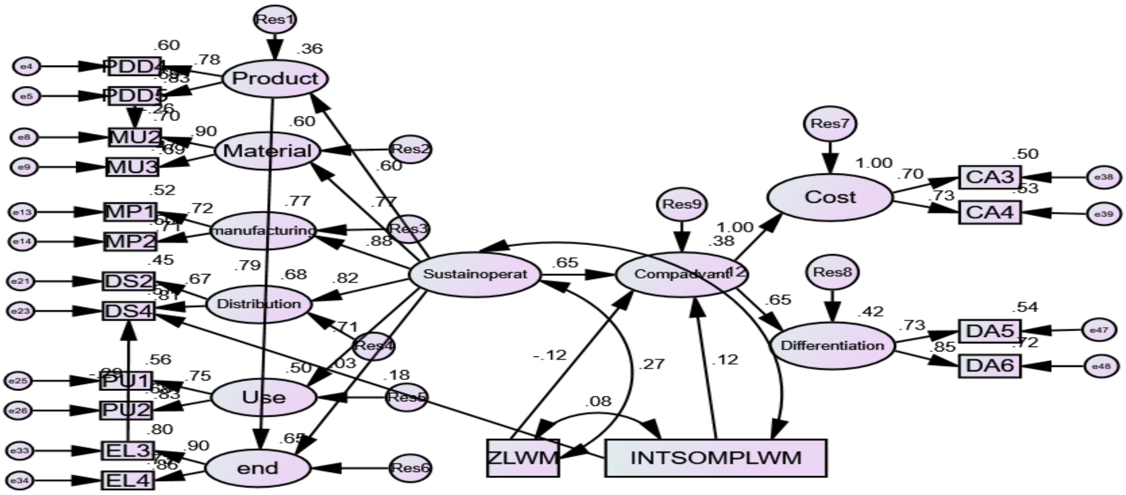


Figure 4.8 Sustainable Operations Management Practices, Employees' Period of Working and Competitive Advantage

Figure 4.8 above shows that when SOMPs increased by 1 SD, competitive advantage increased by 0.65 SD; when employees' period of working increased by 1 SD competitive advantage decreased by 0.12 SD; and when the interaction (product) of SOMPs and employees' period of working increased by 1 SD, competitive advantage increased by 0.12 SD. It was estimated that 0.38 (estimate R^2) variance in competitive advantage was explained by the predictor.

The model was recursive with a sample size of 150. Model variables were 53, 18 observed, 35 unobserved, 28 exogenous and 25 endogenous. The model had positive DF of 120 as seen on Table 4.47, and there were 171 distinct sample moments, and 51 distinct parameters, leaving 120 (171-51) DF.

Table 4. 47 Analysis of a Moment Structures Output Showing Model Fit for Objective 2d

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	51	101.175	120	0.893	0.843
Saturated model	171	0.000	0		
Independence model	18	998.372	153	0.000	6.525

Table 4.48 shows that, the model fit indices provided a reasonable fit with GFI of 0.931; AGFI of 0.902; NFI of 0.899; CFI of 1.000; and TLI of 1.028. The RMSEA was 0.000 and the p-value was 0.893. Hence, the proposed model fitted the data well.

Table 4. 48 Fit Statistics of the Structural Model for Objective 2d

Name of Category	Fit Statistic	Recommended	Obtained
Absolute fit	x^2 significance	P > 0.05	0.893
	RMSEA	< 0.08	0.000
	GFI	> 0.90	0.931
Incremental fit	AGFI	> 0.90	0.902
	NFI	> 0.90	0.899
	CFI	> 0.90	1.000
	TLI	> 0.90	1.028
Parsimonious fit	x^2 /df	< 3.0	0.843

The null hypothesis for objective 2d was employees' period of working has no significant moderating effect on the relationship between SOMPs and firm competitive advantage**.**

Table 4. 49 Regression Weight for Hypotheses Tested for Objective 2d

			Estimate	S.E.	C.R.	P	Label
Compadvant	<---	Sustainoperat	.692	.165	4.203	***	Significant
Compadvant	<---	ZLWM	-.077	.058	-1.335	.182	Not significant
Compadvant	<---	INTSOMPLWM	.064	.049	1.302	.193	Not significant

Note: *** means p-value at significant level is <0.001 in AMOS output

The output on Table 4.49 above, shows that the link between SOMPs and competitive advantage was significant since p-value < 0.001 was less than α-value = 0.05. In addition, employees' period of working had no significant effect on competitive advantage because p-value = 0.182 was more than α-value = 0.05, whereas the interaction effect was not significant since p-value of 0.193 was more than α-value =

0.05, hence it was concluded that the moderating effect of employees’ period of working on the link between SOMPs and competitive advantage was not significant and the null hypothesis was, therefore, not rejected.

4.7.3 Sustainable Operations Management Practices, Organizational Performance and Competitive Advantage

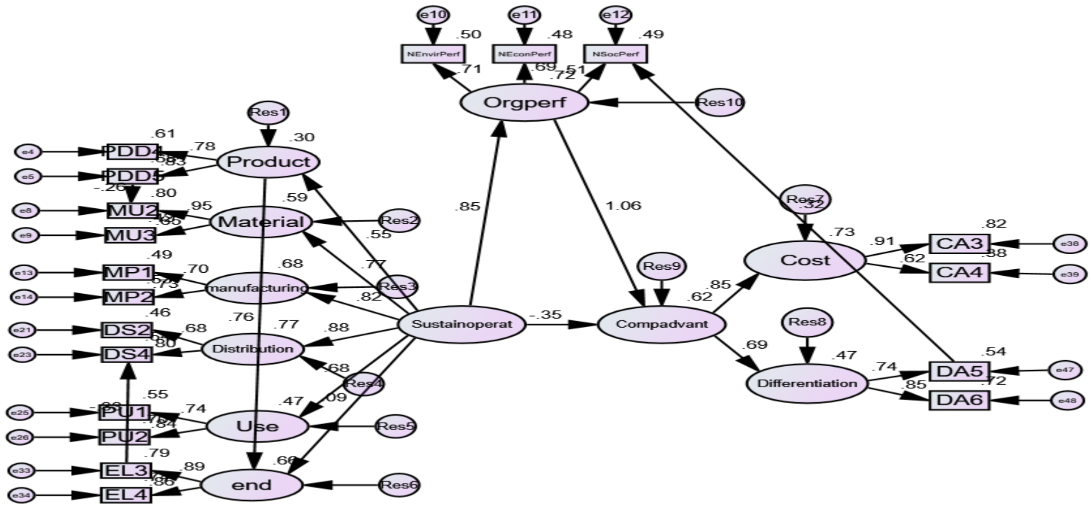


Figure 4.9 Sustainable Operations Management Practices, Organizational Performance and Competitive Advantage

Figure 4.9 above shows that when SOMPs increased by 1 SD, competitive advantage decreased by 0.35 SD; when SOMPs increased by 1 SD, organizational performance increased by 0.85 SD, and when organizational performance increased by 1 SD, competitive advantage increased by 1.06 SD. Squared multiple correlation (R^2) indicated that SOMPs and organization performance accounted for 0.62 variance in competitive advantage.

The model was recursive with a sample size of 150. Model variables were 59, 19 observed, 40 unobserved, 30 exogenous and 29 endogenous. Table 4.50 below shows that, the model had positive DF (139) and there were 190 distinct sample moments, and 51 distinct parameters, leaving 138 (190 - 51) DF, which was positive.

Table 4. 50 Analysis of a Moment Structures Output Showing Model Fit for Objective 3

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	51	159.920	139	0.108	1.151
Saturated model	190	0.000	0		
Independence model	19	1256.166	171	0.000	7.346

The fit indices provided a good model fit as seen on Table 4.51 - GFI obtained was 0.905; AGFI was 0.870; NFI, CFI, and TLI were 0.873, 0.981 and 0.976, respectively. The RMSEA was 0.032, the p-value was 0.108 which was above 0.05. Hence, it was concluded that the proposed model had an overall good fit.

Table 4. 51 Fit Statistics of the Structural Model for Objective 3

Name of Category	Fit Statistic	Recommended	Obtained
Absolute fit	x^2 significance	P > 0.05	0.108
	RMSEA	< 0.08	0.032
	GFI	> 0.90	0.905
Incremental fit	AGFI	> 0.90	0.870
	NFI	> 0.90	0.873
	CFI	> 0.90	0.981
	TLI	> 0.90	0.976
Parsimonious fit	x^2 /df	< 3.0	1.151

Objective three aimed at establishing the influence of organizational performance on the relationship between SOMPs and competitive advantage, the null hypothesis was stated as H_3 that organizational performance has no significant mediating effect on the link between SOMPs and firm competitive advantage.

Table 4. 52 Regression Weight for Hypotheses Tested for Objective 3

			Estimate	S.E.	C.R.	P	Label
Orgperf	<---	Sustainoperat	3.326	.695	4.784	***	Significant
Compadvant	<---	Sustainoperat	-.473	.433	-1.093	.274	Not significant
Compadvant	<---	Orgperf	.372	.120	3.093	.002	Significant

Note: *** means p-value at significant level is <0.001 in AMOS output

Table 4.52 above shows that SOMPs had no significant effect on competitive advantage as the P-value = 0.274. Also, SOMPs had a significant effect on organizational performance since p-value < 0.001 was less than α-value = 0.05, whereas organizational performance had a significant effect on competitive advantage because p-value =0.002 was less than α-value = 0.05, hence the null hypothesis that organizational performance had no significant mediating effect on the relationship between SOMPs and firm competitive advantage was rejected and the alternate hypothesis was adopted. However, since the direct relationship was not significant, the mediation was full, that is, SOMPs has only indirect effect on competitive advantage.

4.7.4 Sustainable Operations Management Practices, Firm Characteristics, Organizational Performance and Competitive Advantage

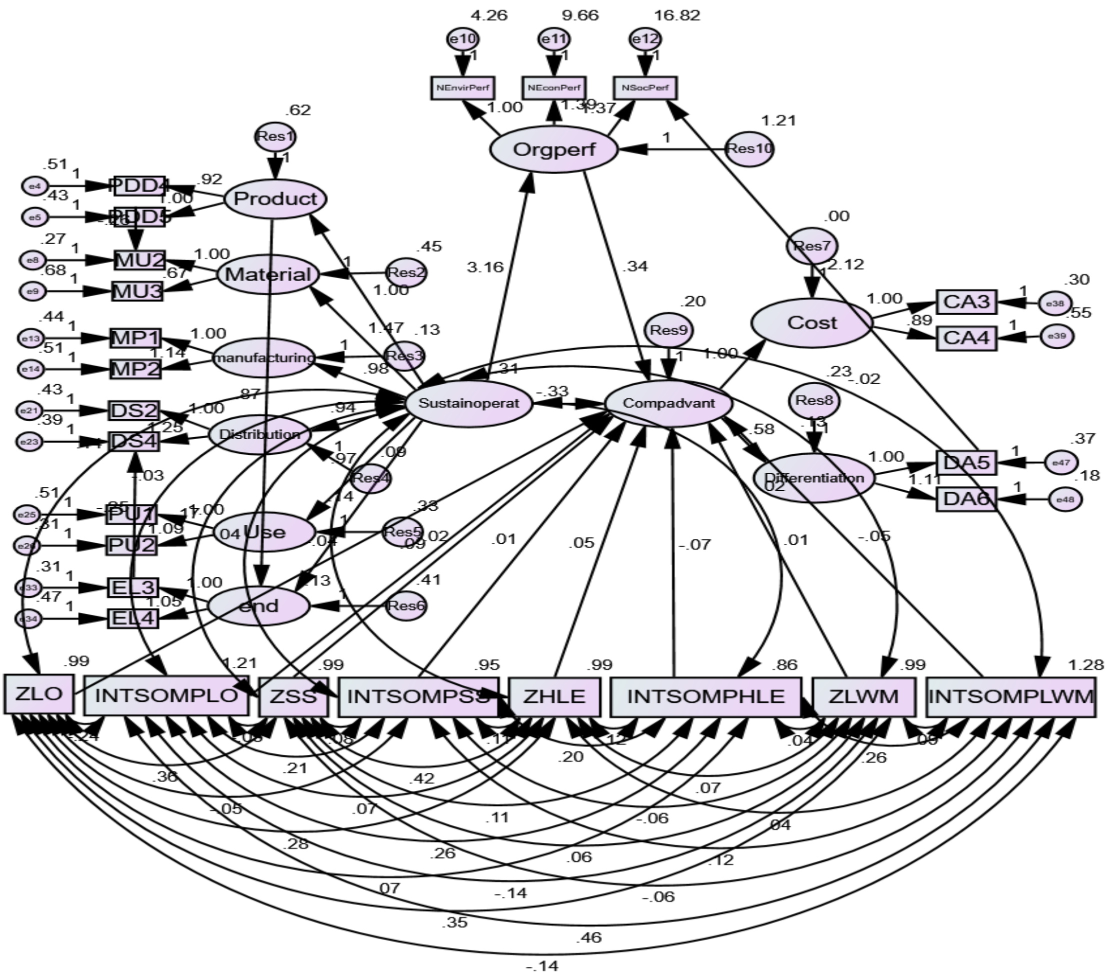


Figure 4.10 Sustainable Operations Management Practices, Firm Characteristics, Organizational Performance and Competitive Advantage

Figure 4.10 above shows that when SOMPs increased by 1 SD, competitive advantage decreased by 0.33, while organizational performance increased by 3.16 SD. When organizational performance increased by 1 SD, competitive advantage increased by 0.34 SD. It was estimated that the predictor variables accounted for 0.62 variance in competitive advantage

The model was recursive with a sample size of 150. Model variables were 67, 27 observed, 40 unobserved, 38 exogenous and 29 endogenous. It had positive DF (275) with 378 distinct sample moments and 103 distinct parameters, leaving 275 (378-103) DF as seen on Table 4.53 below.

Table 4. 53 Analysis of a Moment Structures Output Showing Model Fit for Objective 4

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	103	323.444	275	0.024	1.176
Saturated model	378	0.000	0		
Independence model	27	1596.147	351	0.000	4.547

The model fit indices on Table 4.54 below provided a good model fit, with GFI as 0.869, RMSEA was 0.034. The CMIN value was significant when the p-value was 0.024 and for the incremental fit; AGFI was 0.821 against the recommended value of 0.90; NFI, CFI, TLI were 0.800, 0.961, 0.950, respectively hence, the model fitted the data well.

Table 4. 54 Fit Statistics of the Structural Model for Objective 4

Name of Category	Fit Statistic	Recommended	Obtained
Absolute fit	x^2 significance	P > 0.05	0.024
	RMSEA	< 0.08	0.034
	GFI	> 0.90	0.869
Incremental fit	AGFI	> 0.90	0.821
	NFI	> 0.90	0.800
	CFI	> 0.90	0.961
	TLI	> 0.90	0.950
Parsimonious fit	x^2 /df	< 3.0	1.176

The null hypothesis for objective four was H_4 - joint effect of SOMPs, firm characteristics and organizational performance on firm competitive advantage is not significant.

Table 4. 55 Regression Weight for Hypotheses Tested for Objective 4

			Estimate	S.E.	C.R.	P	Label
Orgperf	<---	Sustainoperat	3.162	.630	5.016	***	Significant
Compadvant	<---	Sustainoperat	-.329	.376	-.875	.382	Not significant
Compadvant	<---	Orgperf	.343	.109	3.139	.002	Significant
Compadvant	<---	ZLO	-.040	.067	-.601	.548	Not significant
Compadvant	<---	INTSOMPLO	.092	.058	1.584	.113	Not significant
Compadvant	<---	ZSS	-.022	.067	-.324	.746	Not significant
Compadvant	<---	INTSOMPSS	.014	.060	.238	.812	Not significant
Compadvant	<---	ZHLE	.055	.064	.861	.389	Not significant
Compadvant	<---	INTSOMPHLE	-.067	.065	-1.031	.302	Not significant
Compadvant	<---	ZLWM	.014	.062	.226	.821	Not significant
Compadvant	<---	INTSOMPLWM	-.046	.055	-.840	.401	Not significant

Note: *** means p-value at significant level is <0.001 in AMOS output

As seen from Table 4.55 above, all the relationships were not significant except for the mediating effect SOMPs and organizational performance (p-value < 0.001) and organizational performance and competitive advantage (p-value < 0.002). It was, therefore, concluded that joint effect of SOMPs, firm characteristics and organizational performance on firm competitive advantage was not significant.

4.8 Discussion of the Results

This section discusses the findings based on firm characteristics, extent of implementation of SOMPS and the objectives and hypotheses formulated from the literature. On the bases of objectives, the section looks into SOMPS and firm competitive advantage; SOMPs, firm characteristics and competitive advantage; SOMPs, organizational performance and competitive advantage; and lastly SOMPs, firm characteristics, organizational performance and competitive advantage.

Research findings shows that data obtained was from all 13 sub sectors. Food and beverages firms contributed to most of the data at 27.3 percent, followed by plastic and rubber and chemicals and allied both at 10 percent, while the least firms were from leather and footwear sector responded. The reason behind this is that a bigger percentage of firms in the sector are food and beverage firms while leather and footwear make the least percentage. Regarding the length of operation of the firms, the results show that a good percentage of the firms (52 percent) had existed for over 20 years. In terms of staff size, 54 percent had employees who were below 100, while 46 percent had more than 100 employees. This may be due to harsh economic times which have forced many firms to do more with less by cutting on the number of employees. The two characteristics imply that most of the firms are large and have been in existence for some times, hence have accumulated enough resources to enable them implement SOMPs.

The participants also specified their highest level of education and years of experience in the manufacturing firms. Majority of them (75.4 percent) were bachelor's degree holders and above, hence well-educated and knowledgeable; 76 percent had six years and more working experience giving them enough skills and expertise to be able to implement the various SOMPs. This is also an indication that, they have a good understanding of the firm and had been there long enough to see the firm implement the practices. Management competences are fundamental to the process of recognition, development, implementation as well as deployment of resources into valuable activities of the firm like SOMPs for achievement of competitive advantage (Mahoney, 1995).

For firms' consciousness with regard to environmental preservation. The participants were requested to specify if they were registered with an environmental management body, if they have an environmental management department and if they have an environmental management policy. The "yes" response was 91.3 percent, 70 percent and 90 percent, respectively. This implied that the firms are giving in to external pressure from customers, investors and government legislation and regulations, by adopting SOMPs hence increased level of consciousness of the environment. Regarding frequency of meetings and training, majority of the firms' 51.3 percent and 63.3 percent, respectively had a frequency of one to two trainings, followed by three to four trainings. This indicated that the firms were well aware and conscious of their environment.

The KMO and Bartlett's test of sphericity was first carried out for all construct. All KMO measures ranged from 0.686 to 0.883, indicating that all latent constructs of the study were above the 0.5 threshold. Bartlett's test of sphericity revealed that all the latent constructs had chi-square values (p-value = 0.000) that were significant at a level less than 0.05. These two tests implied that, factor analysis was relevant.

Sustainable product design and development construct was measured using six practices. The mean ranged from 3.43 to 3.93 implying that the respondent practiced sustainable product design and development from a moderate to a larger extent. The practice with the highest mean was "design that minimizes waste" with a rating of 3.93 and a standard deviation (SD) of 0.928 while the practice "design for reuse and remanufacturing" had the lowest mean of 3.43 with a SD of 1.172. Generally, sustainable product design and development practice had a grand mean of 3.698 which is slightly above the moderate extent. Six items measured sustainable material construct. The mean ranged from 3.47 to 3.65 implying that the respondent practiced sustainable material use to a reasonable extent. The practice with the highest mean rating of 3.65 was “use of non-exhaustible supplies” and SD of 1.124 while the practice with the lowest mean of 3.47 was “reduction of material weight and volume” and a SD of 1.091 from 150 responses. The grand mean for sustainable material use was 3.584 which implied that the practice had been implemented above the moderate extent by manufacturing firms.

Sustainable manufacturing process construct was measured using seven practices. The mean ranged from 3.56 to 3.89 implying that the respondent practiced sustainable product design and development to a moderate extent. The practice “production techniques optimization” had the highest mean rating of 3.89 with a SD of 0.935 while the practice “fewer production processes” had the lowest mean of 3.56 and a SD of 1.077. Generally, sustainable manufacturing process had a grand mean of 3.705 which was above the moderate extent implying that the manufacturing firms had embraced the practice. Sustainable distribution construct, it was measured using five items. The mean ranged from 3.91 to 4.11 implying that the respondent practiced sustainable distribution from moderate to greater extent. The practice with the highest mean rating of 4.11 was “efficient transport mode” and a SD of 0.894 whereas the practice with the lowest mean of 3.91 was “optimization of the weight/volume of the product” which has a SD of 0.893. The grand mean for sustainable distribution was 4.017 which implied that the practices had been employed to a large extent by manufacturing firms.

On sustainable product use, the construct was measured using six practices. The mean ranged from 2.89 to 3.62 implying that the respondent practiced sustainable product use on a moderate to a large extent. The practice “consumption of low energy” had the highest mean rating of 3.62 with a SD of 1.066 and the practice “no energy use” had lowest mean of 2.89 with a SD of 1.286. Sustainable product use had a grand mean of 3.384 which implied that practices had been implemented slightly above the moderate extent by the manufacturing firms. Sustainable end-of-life construct was measured using five items. The range of the mean was 3.21 to 3.53 implying that the respondent practiced sustainable product design and development on a moderate extent. The practice “recycling of materials” had the highest mean rating of 3.53 with a SD of 1.344, while the practice “reuse of product” had the lowest mean of 3.21 with a SD of 1.233. In general, sustainable end-of-life had a grand mean of 3.379 which implied that manufacturing firms had embraced the practices moderately.

The latent construct organizational performance was measured using three subscales; environmental, economic and social performance. Environmental performance construct was measured using two sub variables; environmental impact reduction and environmental cost saving, each of which had its own indicators. To measure it, participants were required to specify the decrease in environmental effects that their organizations had experienced. Environmental impact reduction was measured using six practices. The highest reduction was the decrease of frequency for environmental accidents with a mean rating of 3.94 and a SD of 1.005. The lowest reduction was of air emission with a mean of 3.59 and a SD of 1.081. In general, environmental impact reduction had a grand mean of 3.762 which implied that, manufacturing firms experienced environmental impact reduction to a large extent.

Environmental cost saving variable was measured using six indicators. Decrease of cost for energy consumption was the highest saving with a mean rating of 3.37 (SD =

1.090, sample size = 150) while decrease of training cost was the lowest saving with a mean of 3.12 (SD = 1.080, sample size = 150). The grand mean for environmental cost saving was 3.249 which implies that the manufacturing firms experienced cost savings slightly above moderate extent.

The latent construct economic performance was measured using three subscales; profitability, productivity and operations efficiency. To measure the three, participants rated the extent to which they agreed with the increase of the indicators of profitability, productivity, operations efficiency that their organizations had experienced. Profitability construct had three determinants; increased gross profit, increased net profit and increased return on assets. The highest increase was increased gross profit with a mean of 3.36 (SD = 0.950, sample size = 150), followed closely by increased net profit, with a mean of 3.35 (SD = 0.990, sample size = 150), while the lowest was increased return on assets with a mean of 3.32 (SD = 0.929, sample size = 150. In general profitability had a grand mean of 3.342, which shows that the manufacturing firms had experienced slightly more than moderate increase in profit.

Productivity sub-construct had five indicators. Their means ranged from 3.01 to 3.51 with the highest being an increase in output with a mean of 3.51 (SD = 0.910, sample size = 150), while the lowest was in low number of employees and working hours with a mean of 3.01 (SD = 1.059, sample size = 150). The grand mean was of 3.273, which is slightly above moderate implying that the manufacturing firms had experienced a moderate increase in productivity. Five indicators were used to measure operations efficiency. It was observed that the lowest was decreased setup and adjustment time with a mean of 3.53 (SD = 0.960, sample size = 150) while the highest was increased production yield with a mean of 3.85 (SD = 1.002, sample size = 150). A grand mean of 3.741 was recorded, which showed that the manufacturing firms had experienced a large increase in operational efficiency.

Social performance was measured using four sub-constructs; health and safety, employment, education and well-being. To measure the four, participants specified the extent to which they agreed that, the four sub-constructs have been enhanced in their organizations. Health and safety were measured using three items; advanced health status, rise in life expectancy and rise in health life years. Their means were 3.63 (SD =1.013, N=150), 3.56 (standard deviation =1.026, N=150) and 3.51 (SD =1.008, sample size =150) respectively and it still held the order of highest to lowest. The grand mean was of 3.569, which was slightly above moderate extent implying that there was a slightly above moderate enhancement in healthy and safety experienced by manufacturing firms. Employment sub-construct was measured using three indicators; retention and recruitment of staff, good staff relation and employee's productivity levels. Their means were 3.58 (SD = 0.971, sample size = 150), 4.01 (SD = 0.859, sample size =150) and 3.87 (SD = 0.910, sample size = 150) respectively which showed that, good staff relation had the highest mean, next was employee's productivity levels and the least was retention and recruitment of staff. The grand mean was of 3.820, which implied that the manufacturing firms had experienced a large enhancement in employment practice.

Three indicators were used to measure education sub-construct; human capital development, training and improvement of employees and availability of education funding for sustainability courses. Training and improvement of employees had the highest mean of 3.63 (SD=1.039, sample size=150), followed by human capital development, with a mean of 3.45 (SD = 1.046, sample size = 150) and lastly, the one with the lowest mean was availability of education funding for sustainability courses with a mean score of 3.08 (SD=1.251, sample size=150). In general, the grand education mean was 3.387, which is slightly above moderate extent implying that there was a slightly above moderate enhancement in education experienced by manufacturing firms. Well-being was measured using six items, the range of the mean was 3.63 to 3.89. The lowest was improved community relation and involvement with a mean of 3.63 (SD=1.014, sample size=150) while the highest was conducive working environment with a mean of 3.89 (SD=0.863, sample size=150). A grand mean of 3.714 was recorded, which shows that manufacturing firms had experienced a large enhancement on matters wellbeing.

Competitive advantage comprised of two broad categories; cost advantage and differentiation advantage. To measure the two aspects, participants specified the extent to which they agreed with the advantages their organizations had experienced. The mean range was from 3.69 to 3.95, with highest mean of 3.95 (SD=0.881, sample size=150) being technological advantages while minimized operations time had the lowest mean of 3.69 (SD=0.890, sample size=150). A grand mean of 3.872 was recorded, which showed that the manufacturing firms had experienced a large cost advantage. Differentiation advantage was measured using seven indicators. Their means ranged from 4.04 to 4.23, with the highest being improved customer service with SD=0.823 and sample size =150, while improved product quality had the lowest mean of 4.04 (SD=0.897, sample size=150). A grand mean of 4.110 was recorded, which showed that the manufacturing firms had experienced a large differentiation advantage. For all sub constructs/indicators, the factor loadings were all above 0.4, while Cronbach's alpha were above 0.7 coefficient adopted by the study. Item - total correlation were all above 0.3 hence all the scale items were maintained for further analysis. All these indicated high reliability and construct validity.

This study used several analyses to test for linearity, normality, multicollinearity and heteroscedasticity. The outcomes for linearity showed that R^2 was 0.3483. This means that SOMPs accounts for 34.83 percent of variance in competitive advantage, Wong (2013) stated that R^2 of 0.75 is substantial, 0.50 is moderate and 0.25 is weak, hence this showed that the portion of variance in competitive advantage that was accounted for by SOMPs was moderate. The correlation coefficient (r) was 0.590 which was above 0.3. It indicated that the relationship between SOMPs and competitive advantage was positive and moderately strong.

Shapiro-Wilk test was utilized to test for normalcy. If the p-value > 0.05, it is a sign that the data is normal while a p-value < 0.05 indicates that the data is not normal (Field, 2013). The Shapiro-Wilk test p- values were all more than 0.05. Skewness values were also all below 1.0 and all the critical region for the kurtosis did not exceed 3.0 hence the data was normally distributed. Every item skewness was also measured. An absolute value of skewness 1.0 or lower is an indication of a normally distributed data. Multivariate kurtosis statistic is also another method of assessing normality, critical region for the kurtosis should not exceed 3.0. All skewness values were below 1, while kurtosis values were below 3, hence normality was confirmed.

Multicollinearity was checked by computing tolerance and VIF and tolerance should not be more than 1 whereas VIF ranging from 1 to 10 will indicate no multicollinearity and values more than 10 indicates multicollinearity (Robinson & Schumacker, 2009). VIF values ranging from 1.6 to 2.5 and all the tolerance value were less than 1, indicating no multicollinearity. Correlation coefficient values ranged from 0.246 to 0.683 which were all below 0.8, signifying that multicollinearity was not a problem. A high pair-wise correlation coefficient, 0.80 and above among two regressors, is a sufficient indicator of multicollinearity problem, but it is not a necessary condition for its existence (Kumari, 2008). Heteroscedasticity was tested using Koenker test and if p-value ≤ 0.05 would imply heteroscedasticity and would lead to rejection of null hypothesis. The p-value as indicated by Koenker test was 0.596 which was more than 0.05 hence null hypothesis that heteroskedasticity was not present was not rejected. The pattern of dots in the scatter plot was also not systematic it was rectangular which showed homoscedasticity.

AMOS was employed to carry out CFA so as to validate the measurement model and to establish acceptable goodness of fit levels. Pretesting was done on five key individuals from the sector to ensure clarity and proper interpretation. For purposes of assessing composite, construct, convergent and discriminatory validity various checks were conducted. Using a formula put forward by Hair et al. (2010). Reflective indicators standardized loadings ideal level is 0.70. However, a value of 0.60 is also deemed acceptable (Barclay et al., 1995). The factor loadings were all more than the acceptable level of 0.60 and range from 0.64 to 0.93 hence convergent validity was verified. All AVE were greater than 0.5 and factor loadings were greater than 0.7. To establish convergent validity, each latent variable's AVE should be at least 0.5 or higher (Hair, Black, Babin, & Anderson, 2010). For all the constructs, all item's standardized loadings were above the ideal level, hence confirmation of convergent validity. All composite reliabilities of construct had a value ranging from 0.66 to 0.91 indicating adequate internal consistency. All composite reliability of the five latent constructs had a value greater than 0.7, indicating a good internal consistency.

The AVE of individual factors and their shared variances were compared in order to examine discriminant validity (Fornell & Larcker, 1981). The-off diagonal items represent the squared correlation between constructs whereas the diagonal items represent square root of AVE's, which measured the variance between the construct and its indicators. AVE values ranged from 0.71 to 0.91, where the lowest AVE value was 0.71 (Manufacturing Process (MP), Distribution (DS) and Competitive Advantage (CA)) which exceeded the largest squared correlation (0.64 – between Product Design and Development (PDD), End of Life (EL), Employment (EP) and Well-Being (WB)). This output indicated that the variance shared among factors were lower than of individual factors, hence discriminant validity was confirmed. The rule of thumb states that, each construct square root ought to be much larger compared to specific construct correlation relative to other model constructs (Chin, 1998) and ought to be at least 0.50 (Fornell & Larker, 1981).

After the measurement instrument validation was fulfilled, valuation of the measurement model fit was done using CFA results in order to approve the hypothesized structure. The measurement model, comprised of 17 factors. A minimum of two observed variables were used to measure each factor. Random measurement error influenced reliability, as shown by the related error term.

Regression was done to each of the observed variables into its specific factor. Lastly, inter- correlation between all the 17 factors was presented. The hypothesized model was recursive, meaning it was unidirectional and the sample size was 150. Two important features usually define recursive models: uncorrelated disturbances, and unidirectional of all causal effects. Model variables were 85, 34 observed, 51 unobserved, 51 exogenous and 34 endogenous.

The projected model was an over-identified one with a DF value of 388. It shows a good construct items' loadings and cross loadings after CFA which also confirms convergent validity. In the model, there were 595 distinct sample moments and 207 distinct parameters, leaving 388 (595 - 207) degrees of freedom, which was positive. Multicollinearity effects was eliminated in this study, as there was achievement of the minimum iteration, hence assurance that an admissible solution was attained through the estimation process. There was a good construct items' loadings and cross loadings after CFA which also confirms convergent validity.

The results showed a clear model of fit summary, which comprises of the x^2 value of 496.561, degrees of freedom of 388 and probability value (0.000). It also showed the minimum discrepancy (CMIN/DF); DF is the degrees of freedom; probability value (P) and the number of parameters (NPAR). In the model the x^2 value of 496.561 was small compared to independence model value (3027.092), hence the x^2 value was good. It was also suitable to look at the value of CMIN/DF as the x^2 measurement is specifically sensitive to sample size. This means that, probability of rejection of a model increases with an increase in the sample size. For a good model fit the recommendation is that, this metric should not exceed five (Bentler, 1989). The value was 1.280, which showed a good fit.

The fit indices provided a reasonably model fit and for absolute fitness, GFI obtained was 0.85 and RMSEA was 0.043. The chi-square likelihood ratio (CMIN) was significant at p-value = 0.000. The test is supposed to be insignificant as it is a difference test, but due to negligence of SEM assumptions this value is usually significant in most cases. For the incremental fit, AGFI was 0.80. The NFI, CFI, and TLI were 0.84, 0.96, 0.94, respectively. Although some of the values did not exceed the 0.9 threshold, they were still within the acceptable range of 0.8 and above as suggested by Baumgartner and Homburg (1996) and Doll, Xia, and Torkzadeh (1994). It was therefore concluded that the theorized model provided a good fit with the observed data.

4.8.1 Sustainable Operations Management Practices and Firm Competitive Advantage

The hypothesis formulated stated that SOMPs had no significant influence on firm competitive advantage. However, findings indicated that SOMPs had a significant influence on firm competitive advantage. Efforts for minimizing environmental, economical, as well as social effects lead to minimized operating costs, enhanced satisfaction of employees and environmental improvements leading to competitive advantage (Shahbazpour & Seidel, 2006).

The link between SOMPs and competitive advantage has been studied by various authors and it represents an issue in literature which is complex. While some authors found a positive link (Bennett, Nunes, & Shaw, 2013; Drake & Spinler, 2013), others did not (Wagner, 2005; Watson, Klingenberg, Polito, & Geurts, 2004). This study, therefore, provides clarity on the link between the two variables by confirming the findings of the authors who found a positive relationship. It also supports NRBV, OST and TPF theories which grounded this relationship.

The study adds to knowledge by filling the gaps of the past studies. First, it has contributed to scarce empirical evidence, as seen, there are limited studies which are specifically on SOMPs. Bennett, Nunes, and Shaw (2013) did a qualitative case study. Drake and Spinler (2013) also employed qualitative research design but did not consider TBL approach and ignored the whole product life cycle. Sustainability rests on three constituent categories based upon TBL (environmental, economic and social). Although this point is often neglected, the three are tangled and they reinforce each other, hence need to be addressed in connection with one another (Svensson & Wagner, 2012a). In the operationalization of SOMPs, the whole life cycle of product needs to be covered. This is because SOMPs incorporates all aspects of operations within and beyond the firm in order to obtain maximum possible benefits (Hill, 2007).

This study was a survey which allowed for generalization of the findings and it took a holistic approach by employing TBL approach covering the whole product life cycle to ensure maximum possible benefits. To capture the whole product life cycle from when the operations cycle commences, the study adopted a significant set of indicators which included sustainable product design and development; sustainable material use; sustainable manufacturing process; sustainable distribution; sustainable product use and sustainable end-of-life.

4.8.2 Sustainable Operations Management Practices, Firm Characteristics and Competitive Advantage

The second objective was to examine the effect of firm characteristics on the relationship between SOMPs and competitive advantage. The model was based on the argument that firm characteristics have no significant moderating effect on the relationship between SOMPs and firm competitive advantage. The four variables representing firm characteristics were size represented by the number of staff, age represented by the length of operations and managerial capabilities represented by the level of education and working experience. Each of the firm characteristics was analyzed differently and only one (age) was found to be a significant moderating factor since the p-value = 0.024 of the interaction effect was less than α-value = 0.05.

The alternate hypothesis was therefore accepted that firm age had a significant moderating effect on the relationship between SOMPs and firm competitive advantage. The results were robust and in line with the outcomes of Hui et al. (2013) and Coad et al. (2013); and conforms to Bahk and Gort (1993) and Garnsey (1998) hypothesis of learning by doing. The theory of learning suggests that there is a possibility that firms can improve their productive efficiency by learning from experience as the firms age increases (Bahk & Gort, 1993). New firms are disadvantaged as they are required to make search processes to find a way out every time they encounter new problem (Garnsey, 1998). Learning process introduces a series of problem-solving procedures hence eliminating the need for open search process in problem-solving response. Birley and Westhead (1990) established that, the more the years of existence of the firm, the higher the possibility of accumulating properties and competences, enabling them to implement SOMPs that may lead to overall improvement and competitive advantage. Older firms also have a likelihood of attracting first class vendors who may have implemented SOMPs, which may diffuse in the organization and improve their competitive advantage. The capability of integrating suppliers into young entities SOMPs may not be feasible because they only account for a small part of supplier's output (Koufteros, Cheng, & Lai, 2007).

Based on the argument extended in literature, it was expected that larger organizations who have implemented SOMPs will have a competitive edge over small organizations. The reason behind this is that big organizations have more assets, skills and competences as compared to smaller firms who struggle to garner them, enabling them to easily transfer information, try costly and risky environmental investments such as SOMPs, which gives them a competitive advantage (Ismail & King, 2014). Moreover, small firms have little likelihood of hiring specialists with wide ranging experience to directly handle SOMPs issues, as seen from NRBV these tacit skills may lead to competitive advantage (Leonidou et al., 2017). The positive effect of size may also be seen from the viewpoint of economics of scale. As output grows, the average unit cost reduces, however, contrary to the expectations the outcomes revealed that size was not a factor in determining competitive advantage due to implementation of SOMPs by a firm. The result corroborates the findings of Evans (1987); Goddard, Tavakoli, and Wilson (2005); Amato and Burson (2007) and Ammar et al (2003) and the argument of structural inertia. The structural inertia theory argue that organizations suffer inflexibility and bureaucratic bottlenecks as they grow, which may transform into resistance to change (Hannan & Freeman, 1984).

The theoretical anchorage behind managerial capabilities (experience and education level) moderating the relationship between SOMPs and firm competitive advantage is explained by RBV, which proposes that management competences are fundamental to the process of recognition, development, implementation as well as deployment of resources into valuable activities of the firm like SOMPs for achievement of competitive advantage (Mahoney, 1995). The finding of this study deviates from RBV's argument and it contradicts the notion that manager's experience makes them better leaders who successful lead the firm. Findings by Waweru (2008) revealed that the characteristics of top management have no significant impact on performance of the organization. Mutuku (2012) findings indicated that academic qualification, diversity in tenure and performance have a negative association. In the same vein, Flanigan, Bishop, Brachle, and Winn (2017) found out that demographic characteristics had no moderating effects on firm performance.

4.8.3 Sustainable Operations Management Practices, Organizational Performance and Competitive Advantage

The model was developed based on the argument that organizational performance had no significant mediating effect on the relationship between SOMPs and firm competitive advantage. To validate the model, the following relationships were tested SOMPs and competitive advantage, SOMPs and organizational performance, organizational performance and competitive advantage – the findings were contrary to the hypothesis. Literature suggested that, implementation of SOMPs would result in improved organizational performance (Yang et al., 2010; Wagner, 2005; Grant et al., 2008; Adebambo, Ashari, & Nordin, 2015). The results from this study, which established a significant positive link between SOMPs and organizational performance adds backing to the findings of the past studies. This study also looked at the whole concept of SOMPs by incorporating the whole product life cycle, an issue which previous studies overlooked.

The link between organizational performance and competitive advantage has been studied in the past (Crittenden et al., 2011; Esty & Charnovitz, 2013). It was proposed that minimization of adverse environmental and social impact reduces operating costs and improves staff satisfaction hence achievement of competitive advantage (Hart, 1995; Crittenden et al., 2011). This is in line with the results of this study which established a strong positive relationship between organizational performance and competitive advantage. The inclusion of organizational performance as a mediator increased the variance (R^2) explained in competitive advantage significantly as compared to the direct relationship. This study incorporated all the aspects of sustainability as they work together and influence each other. Improvement of environmental performance of business organizations by adopting SOMPs is attributable to competitive improvement and enhanced financial performance (Crittenden et al., 2011). The SOMPs leads to unceasing improvement on capital productivity through enhanced customer relationships, employee's productivity, effectiveness, business performance enhancement in addition to competitive edge (Rezaee, 2017). This also conforms to the findings of the current study which established a positive relationship between SOMPs and competitive advantage.

The relationship between SOMPs, organization performance and competitive advantage has been looked at by several authors (Adebambo, Ashari, & Nordin, 2015; Esty & Charnovitz, 2013; Thomas, Fugate, Robinson, & Tasçioglu, 2016; Abdul-

Rashid et al., 2017). This study extended knowledge by looking at the whole concept of SOMPs and examined the three dimensions of TBL approach, which was overlooked by previous studies. The context of this study was Kenya, as studies reviewed were limited to developed economies. This study was also not prone to environmental influence as it was a survey. Literature is also scanty on the mediating effect of organizational performance on the relationship between SOMPs and firm competitive advantage, which was covered by this study. Business models may be incomplete if they fail to specify mediating and moderating variables. Therefore, they may be unable to give solution to actual business problems (Namazi & Namazi, 2016). Past studies in Kenya were on some of the facets of SOMPs (Odock, Awino, Njihia, & Iraki, 2016; Mwaura et al., 2016). However, this study, considered all the facets of SOMPs. It also used CB-SEM, as it allows for more sophisticated and comprehensive analyses (Hair et al., 2010)

4.8.4 Sustainable Operations Management Practices, Firm Characteristics, Organizational Performance and Competitive Advantage

It was hypothesized that implementation of SOMPs will enhance organizational performance, which will result in improved competitive advantage where firm characteristics (size, age, experience and education) will moderate the strength of the relationship. To validate the model, the following relationships were tested; SOMPs and competitive advantage, SOMPs and organizational performance, organizational performance and competitive advantage, length of firm operation and competitive advantage, interaction effect of SOMPs and length of firm operation on competitive advantage, staff size and competitive advantage, interaction effect of SOMPs and staff size on competitive advantage, length working in manufacturing and competitive advantage, interaction effect of SOMPs and length working in manufacturing on competitive advantage, level of education and competitive advantage, interaction effect of SOMPs and level of education on competitive advantage.

All the above relationships above were found not to be significant except for the mediating effects, SOMPs and organizational performance and organizational performance and competitive advantage. These findings partly confirm the findings in literature that reduction of environmental and social impact leads to improved employee satisfaction and reduced operating costs plus improvements in the environment. The SOMPs leads to unceasing improvement on capital productivity through enhanced customer relationships, employee's productivity, effectiveness, and business performance (Rezaee, 2017). Sustainability is majorly perceived as an important success factor within the long run strategy of a business and enterprises that adopt it are believed to attain differentiation competitive edge over the rivals (Crittenden et al., 2011).

Inclusion of firm characteristics in the previous model with organizational performance as a mediator did not change the variance (R^2) in competitive advantage. This clearly confirmed that firm characteristics had no impact in the model. This was contrary with the findings in literature, which state that large organizations have more resources and capabilities, which allow them to be very productive and preserve their competitive advantage. Sustainable practices require long-term investment, enough resources to implement and firms commitment, hence most firms do not implement them early enough (Hart, 1995).

The link between firm age, size and competitive advantage has been a focus of various theoretic (structural inertia theory, liability of obsolescence, learning by doing and senescence). Organizational inertia, is the condition of being too old or big to adjust. In connection to age, a stream of studies argues that as firm get older they enjoy some benefits, such as learning from experience and are not likely to suffer problems of newness (Stinchcombe, 1965), hence achieve greater performance. A different stream of research, however, argues that as firms get older they suffer bureaucratic ossification and inertia that goes alongside age, hence they are unable to be flexible in adjusting rapidly to varying circumstances leading to likeliness of losing out the performance share to firms which are newer and more responsive (Marshall, 1956).

Researchers who advanced a negative relationship are (Dogan, 2013; Majumdar, 1997; Amato & Burson, 2007 & Evans 1987). This stand is explained by the liabilities of senescence, which is inefficiency of organizations internal environment arising from aging of a firm (Hannan, 1998). It may also be attributed to Gardner's (1965) organismic life cycle analogy that, just as plants and people, organizations to have a life cycle period, that is, a time where they enjoy a lot of strength and ability and an old age when all these diminishes and exit becomes almost inevitable. In the same vein, this relationship may also be observed from the viewpoint of liability of obsolescence, whereby as organizations get old, their performance declines as well (Barnett, 1990). Competition and rivalry which causes environmental drift can be attributed to the decline (Utterback & Abernathy, 1975). The growing external incompatibility with the environment leads to liabilities of obsolescence.

The firm size and competitive advantage have had robust stands beginning from the notable Gibrat (1931) hypothesis which states that the growth of a firm does not depend on its size. In connection with Gibrat (1931), proportionate growth hypothesis, Jónsson (2007) establish an insignificant weak connection between size and profitability. Similarly, Goddard, Molyneux and Wilson (2004) establish a weak evidence of an association between size and profitability. Others who found a negative relationship are (Ammar et al, 2003; Goddard, Tavakoli, & Wilson, 2005; Amato & Burson, 2007). Structural inertia theory has explained the reason behind the weak and negative findings (Hannan & Freeman, 1984) by arguing that, the volume of bureaucracy in an organization increases with increase in size of the firm and this might result to resistance to change leading to a decrease in profit levels hence competitive advantage.

In connection to managerial capabilities, it was established that the level of manager education does not have a significant influence on organizational performance and competitive advantage. In other words, managerial characteristics don't play a significant role in design and implementation work of an organization, which explains why age, experience, level of education and functional track of managers do not influence organizational performance. This requires a second thought into the notion that experienced managers make better leaders who improve performance and competitive advantages. The connection between the above variables has been studied by various authors (Esty & Charnovitz, 2013; Thomas, Fugate, Robinson, & Tasçioglu, 2016; Kannadhasan & Nandagopal, 2009). These studies partly touch on the sustainability dimensions, but not all the three dimensions. To take care of the gap, this study employed TBL approach. On the same note, little is known about the mediating and moderating effect of organization performance and firm characteristics on the relationship between SOMPs and firm competitive advantage, which was one of the objectives of this study hence a contribution to knowledge.

4.9 Summary

This chapter presents the analysis, findings and discussions of the study and provided participants information as well as the variable descriptive statistics. Reliability and construct validity were tested and KMO and Bartlett's test of sphericity were first carried out for all constructs to examine the appropriateness of factor analysis. For the diagnostic tests; linearity, normality, multi-collinearity and heteroscedasticity were tested. The CFA was also carried out using to validate the measurement model. In AMOS, normality was assessed by the measurement of skewness for every item construct. Confirmation of both measurement and structural model were also done to ascertain the degree of fitness of the hypothesized data to sample data. The fit indices used were GFI, AGFI, NFI, CFI, TLI, the p-value and RMSEA. Structural model hypotheses testing was also conducted to enable acceptance or rejection of the null hypothesis. The chapter ended by discussing the results and giving the implication of the findings. A summary of the findings is as shown in Table 4.56 below

Table 4. 56 Summary of Objectives, Hypotheses, Findings and Interpretation

Objectives	Hypotheses	Findings	Interpretations
Determine the relationship between SOMPs and competitive advantage	H_1: SOMPs had no significant influence on firm competitive advantage.	GFI = 0.948, AGFI = 0.925, NFI = 0.930, CFI = 1.000, TLI = 1.043. p-value = 0.985, RMSEA = 0.000. The model fitted the data perfectly well	H_1 was not supported. This implied that SOMPs had a significant influence on firm competitive advantage
Examine effect of firm characteristics on the relationship between	H_2: Firm characteristics had no significant moderating effect on the relationship	H_2 was rejected if p-value of the path coefficient is ≤ 0.05. Absolute fit (X^2 significance = p > 0.05; RMSEA < 0.08; GFI > 0.90)	

SOMPs and competitive advantage	between SOMPs and firm competitive advantage	Incremental fit (AGFI > 0.90; NFI > 0.90; CFI > 0.90; TLI > 0.90, Parsimonious fit (X^2/df < 3.0)	
	H_{2a}: Firm age had no significant moderating effect on the relationship between SOMPs and firm competitive advantage	GFI = 0.936, AGFI = 0.908, NFI = 0.905, CFI = 1.000, TLI = 1.038. p-value = 0.958, RMSEA = 0.000. The model fitted the data perfectly	H_{2a} was not supported, implying that firm age had a significant moderating effect on the relationship between SOMPs and firm competitive advantage
	H_{2b}: Firm size had no significant moderating effect on the relationship between SOMPs and firm competitive advantage	GFI = 0.936, AGFI = 0.910, NFI = 0.905, CFI = 1.000, TLI = 1.041. p-value = 0.968, RMSEA = 0.000. The model fitted the data well	H_{2b} was supported. This implied that firm size had no significant moderating effect on the relationship between SOMPs and firm competitive advantage
	H_{2c}: Employee's level of education had no significant moderating effect on the relationship between SOMPs and firm competitive advantage	GFI = 0.934, AGFI = 0.907, NFI = 0.902, CFI = 1.000, TLI = 1.038. p-value = 0.953, RMSEA = 0.000. The model showed a great fit.	H_{2c} was supported. Implying that employee's level of education had no significant moderating effect on the relationship between SOMPs and firm competitive advantage
	H_{2d}: Employees' period of working had no significant moderating effect on the relationship between SOMPs and firm competitive advantage	GFI = 0.931, AGFI = 0.902, NFI = 0.899, CFI = 1.000, TLI = 1.028. p-value = 0.893, RMSEA = 0.000. The model fitted the data well.	H_{2d} was supported, it implied that employees' period of working had no significant moderating effect on the relationship between SOMPs and firm competitive advantage
Establish influence of organizational performance on the relationship between SOMPs and competitive advantage	H_3: Organizational performance had no significant mediating effect on the relationship between SOMPs and firm competitive	GFI = 0.910, AGFI = 0.876, NFI = 0.882, CFI = 0.991, TLI = 0.988. p-value = 0.262, RMSEA = 0.022. The model had an overall good fit.	H_3 was not supported, implying that organizational performance had a significant mediating effect on the relationship between SOMPs and firm competitive advantage

	advantage		
Determine joint effect of SOMPs, firm characteristics and organizational performance on firm competitive advantage	H_4: Joint effect of SOMPs, firm characteristics and organizational performance on firm competitive advantage was not significant	GFI = 0.871, AGFI = 0.822, NFI = 0.800, CFI = 0.964, TLI = 0.954. p-value = 0.033, RMSEA = 0.033. The model fit the data well	H_4 was supported, it implied that joint effect of SOMPs, firm characteristics and organizational performance on firm competitive advantage was not significant

CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter captures the summary of the findings, the conclusion and provides recommendations and suggestions for further studies. It starts by summarising the findings as per the analysis of the objectives, followed by the conclusion drawn, the study limitations and finally suggestions for future research.

5.2 Summary of Findings

The aim of this study was to establish the relationship between SOMPs and competitive advantage; the effect of firm characteristics on the relationship between SOMPs and competitive advantage; the influence of organization performance on the relationship between SOMPs and competitive advantage and lastly the joint effect of SOMPs, firm characteristics, organization performance on competitive advantage. The survey also sought to determine the extent to which SOMPs have been adopted by manufacturing firms in Kenya. This section draws conclusions from the research findings in this study.

Research findings shows that data obtained was from all 13 sub sectors namely Pharmaceutical and Medical Equipment, Metals and Allied, Textile and Apparels, Energy, Electrical and Electronics, Paper and Board, Plastic and Rubber, Chemicals and Allied, Food and Beverages, Building, Mining and Construction, Motor vehicles and Accessories, Leather and Footwear, Timber, Wood and Furniture and Fresh Produce. Food and beverages firms contributed to most of the data at 27.3 percent, followed by plastic and rubber and chemicals and allied both at 10 percent, while the least firms were from leather and footwear sector responded. The reason behind this is that a bigger percentage of firms in the sector are food and beverage firms while leather and footwear makes the least percentage. Regarding the length of operation of the firms, the results show that 8.7 percent of the firms surveyed had operated between 1 and 5 years, 16.7 percent between 6 and 10 years while 15.3 percent had been in operation for 11 and 15 years and 7.3 percent had operated for 16 and 20 years.

A good percentage of the firms (52 percent) had existed for over 20 years. In terms of staff size, 54 percent had employees who were below 100, while 46 percent had more than 100 employees. This may be due to harsh economic times which have forced many firms to do more with less by cutting on the number of employees. The two characteristics imply that most of the firms are large and have been in existence for some time, hence have accumulated enough resources to enable them implement SOMPs. The participants also specified their highest level of education and years of experience in the manufacturing firms. Majority of them (75.4 percent) were bachelor's degree holders and above, hence well-educated and knowledgeable; 76 percent had six years and more working experience giving them enough skills and expertise to be able to implement the various SOMPs. This is also an indication that, they have a good understanding of the firm and had been there long enough to see the firm implement the practices. Management competences are fundamental to the process of recognition, development, implementation as well as deployment of resources into valuable activities of the firm like SOMPs for achievement of competitive advantage (Mahoney, 1995).

For firms' consciousness with regard to environmental preservation. The participants were requested to specify if they were registered with an environmental management body, if they have an environmental management department and if they have an environmental management policy. The "yes" response was 91.3 percent, 70 percent and 90 percent, respectively. This implied that the firms are giving in to external pressure from customers, investors and government legislation and regulations, by adopting SOMPs hence increased level of consciousness of the environment. Regarding frequency of meetings and training, majority of the firms' 51.3 percent and 63.3 percent, respectively had a frequency of one to two trainings, followed by three to four trainings. This indicated that the firms were well aware and conscious of their environment.

To test reliability of the instruments, Cronbach's alpha was used and internal consistency of latent constructs was assessed through composite reliability. For purposes of determination of reliability of the measurement scale, the item to total correlation for all indicators was determined. The internal consistency of the model was measured by obtaining the AVE values. Content validity was derived from literature already in existence in addition to examination of measurement items by other researchers and experts. Confirmatory approach was utilized for purposes of assessing the construct, convergent and discriminant validity. The KMO and Bartlett's test of sphericity was first carried out for all construct. All KMO measures ranged from 0.686 to 0.883, indicating that all latent constructs of the study were above the 0.5 threshold. Bartlett's test of sphericity revealed that all the latent constructs had chi-square values (p-value = 0.000) that were significant at a level less than 0.05. These two tests implied that, factor analysis was relevant.

Sustainable product design and development construct was measured using six practices. The mean ranged from 3.43 to 3.93 implying that the respondent practiced sustainable product design and development from a moderate to a larger extent. The practice with the highest mean was "design that minimizes waste" with a rating of 3.93 and a standard deviation (SD) of 0.928 while the practice "design for reuse and remanufacturing" had the lowest mean of 3.43 with a SD of 1.172. Generally, sustainable product design and development practice had a grand mean of 3.698 which is slightly above the moderate extent. Six items measured sustainable material construct. The mean ranged from 3.47 to 3.65 implying that the respondent practiced sustainable material use to a moderate extent. The practice with the highest mean rating of 3.65 was "use of non-exhaustible supplies" and SD of 1.124 while the practice with the lowest mean of 3.47 was "reduction of material weight and volume" and a SD of 1.091 from 150 responses. The grand mean for sustainable material use was 3.584 which implied that the practice had been implemented above the moderate extent by manufacturing firms.

Sustainable manufacturing process construct was measured using seven practices. The mean ranged from 3.56 to 3.89 implying that the respondent practiced sustainable product design and development to a moderate extent. The practice "production techniques optimization" had the highest mean rating of 3.89 with a SD of 0.935 while the practice "fewer production processes" had the lowest mean of 3.56 and a SD of 1.077. Generally, sustainable manufacturing process had a grand mean of 3.705 which was above the moderate extent implying that the manufacturing firms had embraced the practice. Sustainable distribution construct, it was measured using five items. The mean ranged from 3.91 to 4.11 implying that the respondent practiced sustainable distribution from moderate to greater extent. The practice with the highest mean rating of 4.11 was “efficient transport mode” and a SD of 0.894 whereas the practice with the lowest mean of 3.91 was “optimization of the weight/volume of the product” which has a SD of 0.893. The grand mean for sustainable distribution was 4.017 which implied that the practices had been employed to a large extent by manufacturing firms.

On sustainable product use, the construct was measured using six practices. The mean ranged from 2.89 to 3.62 implying that the respondent practiced sustainable product use on a moderate to a large extent. The practice “consumption of low energy” had the highest mean rating of 3.62 with a SD of 1.066 and the practice “no energy use” had lowest mean of 2.89 with a SD of 1.286. Sustainable product use had a grand mean of 3.384 which implied that practices had been implemented slightly above the moderate extent by the manufacturing firms. Sustainable end-of-life construct was measured using five items. The range of the mean was 3.21 to 3.53 implying that the respondent practiced sustainable product design and development on a moderate extent. The practice “recycling of materials” had the highest mean rating of 3.53 with a SD of 1.344, while the practice “reuse of product” had the lowest mean of 3.21 with a SD of 1.233. In general, sustainable end-of-life had a grand mean of 3.379 which implied that manufacturing firms had embraced the practices moderately.

The latent construct organizational performance was measured using three subscales; environmental, economic and social performance. The subscales were first passed through validity and reliability test before CB-SEM analysis was done. Environmental performance construct was measured using two sub variables; environmental impact reduction and environmental cost saving, each of which had its own indicators. To measure it, participants were required to specify the decrease in environmental effects that their organizations had experienced. Environmental impact reduction was measured using six practices. The highest reduction was the decrease of frequency for environmental accidents with a mean rating of 3.94 and a SD of 1.005. The lowest reduction was of air emission with a mean of 3.59 and a SD of 1.081. In general, environmental impact reduction had a grand mean of 3.762 which implied that, manufacturing firms experienced environmental impact reduction to a large extent.

Environmental cost saving variable was measured using six indicators. Decrease of cost for energy consumption was the highest saving with a mean rating of 3.37 (SD = 1.090, sample size = 150) while decrease of training cost was the lowest saving with a mean of 3.12 (SD = 1.080, sample size = 150). The grand mean for environmental cost saving was 3.249 which implies that the manufacturing firms experienced cost savings slightly above moderate extent.

The latent construct economic performance was measured using three subscales; profitability, productivity and operations efficiency. To measure the three, participants rated the extent to which they agreed with the increase of the indicators of profitability, productivity, operations efficiency that their organizations had experienced. Profitability construct had three determinants; increased gross profit, increased net profit and increased return on assets. The highest increase was increased gross profit with a mean of 3.36 (SD = 0.950, sample size = 150), followed closely by increased net profit, with a mean of 3.35 (SD = 0.990, sample size = 150), while the lowest was increased return on assets with a mean of 3.32 (SD = 0.929, sample size =

150. In general profitability had a grand mean of 3.342, which shows that the manufacturing firms had experienced slightly more than moderate increase in profit.

Productivity sub-construct had five indicators. Their means ranged from 3.01 to 3.51 with the highest being an increase in output with a mean of 3.51 (SD = 0.910, sample size = 150), while the lowest was in low number of employees and working hours with a mean of 3.01 (SD = 1.059, sample size = 150). The grand mean was of 3.273, which is slightly above moderate implying that the manufacturing firms had experienced a moderate increase in productivity. Five indicators were used to measure operations efficiency. It was observed that the lowest was decreased setup and adjustment time with a mean of 3.53 (SD = 0.960, sample size = 150) while the highest was increased production yield with a mean of 3.85 (SD = 1.002, sample size = 150). A grand mean of 3.741 was recorded, which showed that the manufacturing firms had experienced a large increase in operational efficiency.

Social performance was measured using four sub-constructs; health and safety, employment, education and well-being. To measure the four, participants specified the extent to which they agreed that, the four sub-constructs have been enhanced in their organizations. Health and safety were measured using three items; advanced health status, rise in life expectancy and rise in health life years. Their means were 3.63 (SD =1.013, N=150), 3.56 (standard deviation =1.026, N=150) and 3.51 (SD =1.008, sample size =150) respectively and it still held the order of highest to lowest. The grand mean was of 3.569, which was slightly above moderate extent implying that there was a slightly above moderate enhancement in healthy and safety experienced by manufacturing firms. Employment sub-construct was measured using three indicators; retention and recruitment of staff, good staff relation and employee's productivity levels. Their means were 3.58 (SD = 0.971, sample size = 150), 4.01 (SD = 0.859, sample size =150) and 3.87 (SD = 0.910, sample size = 150) respectively which showed that, good staff relation had the highest mean, next was employee's productivity levels and the least was retention and recruitment of staff. The grand mean was of 3.820, which implied that the manufacturing firms had experienced a large enhancement in employment practice.

Three indicators were used to measure education sub-construct; human capital development, training and improvement of employees and availability of education funding for sustainability courses. Training and improvement of employees had the highest mean of 3.63 (SD=1.039, sample size=150), followed by human capital development, with a mean of 3.45 (SD = 1.046, sample size = 150) and lastly, the one with the lowest mean was availability of education funding for sustainability courses with a mean score of 3.08 (SD=1.251, sample size=150). In general, the grand education mean was 3.387, which is slightly above moderate extent implying that there was a slightly above moderate enhancement in education experienced by manufacturing firms. Well-being was measured using six items, the range of the mean was 3.63 to 3.89. The lowest was improved community relation and involvement with a mean of 3.63 (SD=1.014, sample size=150) while the highest was conducive working environment with a mean of 3.89 (SD=0.863, sample size=150). A grand mean of 3.714 was recorded, which shows that manufacturing firms had experienced a large enhancement on matters wellbeing.

Competitive advantage comprised of two broad categories; cost advantage and differentiation advantage. To measure the two aspects, participants specified the extent to which they agreed with the advantages their organizations had experienced. The mean range was from 3.69 to 3.95, with highest mean of 3.95 (SD=0.881, sample size=150) being technological advantages while minimized operations time had the lowest mean of 3.69 (SD=0.890, sample size=150). A grand mean of 3.872 was recorded, which showed that the manufacturing firms had experienced a large cost advantage. Differentiation advantage was measured using seven indicators. Their means ranged from 4.04 to 4.23, with the highest being improved customer service with SD=0.823 and sample size =150, while improved product quality had the lowest mean of 4.04 (SD=0.897, sample size=150). A grand mean of 4.110 was recorded, which showed that the manufacturing firms had experienced a large differentiation advantage. For all sub constructs/indicators, the factor loadings were all above 0.4, while Cronbach's alpha were above 0.7 coefficient adopted by the study. Item - total correlation were all above 0.3 hence all the scale items were maintained for further analysis. All these indicated high reliability and construct validity.

This study used several analysis to test for linearity, normality, multicollinearity and heteroscedasticity. Test of normality allow for inferences about the population, absence of multicollinearity leads to results stability, whereas over or under-estimation standard errors is ensured by homogeneity. For diagnostic tests Scatter plots was utilized to test for linearity. Shapiro-Wilk test was applied to test for normalcy. Multicollinearity was also tested by calculating tolerance and variance inflation factors. Heteroscedasticity was tested using Koenker test. The outcomes for linearity showed that R2 was 0.3483. This means that SOMPs accounts for 34.83

percent of variance in competitive advantage, Wong (2013) stated that R2 of 0.75 is substantial, 0.50 is moderate and 0.25 is weak, hence this showed that the portion of variance in competitive advantage that was accounted for by SOMPs was moderate. The correlation coefficient (r) was 0.590 which was above 0.3. It indicated that the relationship between SOMPs and competitive advantage was positive and moderately strong.

Shapiro-Wilk test was utilized to test for normalcy. If the p-value > 0.05, it is a sign that the data is normal while a p-value < 0.05 indicates that the data is not normal (Field, 2013). The Shapiro-Wilk test p- values were all more than 0.05. Skewness values were also all below 1.0 and all the critical region for the kurtosis did not exceed 3.0 hence the data was normally distributed. Every item skewness was also measured. An absolute value of skewness 1.0 or lower is an indication of a normally distributed data. Multivariate kurtosis statistic is also another method of assessing normality, critical region for the kurtosis should not exceed 3.0. All skewness values were below 1, while kurtosis values were below 3, hence normality was confirmed.

Multicollinearity was checked by computing tolerance and VIF and tolerance should not be more than 1 whereas VIF ranging from 1 to 10 will indicate no multicollinearity and values more than 10 indicates multicollinearity (Robinson & Schumacker, 2009). VIF values ranging from 1.6 to 2.5 and all the tolerance value were less than 1, indicating no multicollinearity. Correlation coefficient values ranged from 0.246 to 0.683 which were all below 0.8, signifying that multicollinearity was not a problem. A high pair-wise correlation coefficient, 0.80 and above among two regressors, is a sufficient indicator of multicollinearity problem, but it is not a necessary condition for its existence (Kumari, 2008). Heteroscedasticity was tested using Koenker test and if p-value ≤ 0.05 would imply heteroscedasticity and would lead to rejection of null hypothesis. The p-value as indicated by Koenker test was 0.596 which was more than 0.05 hence null hypothesis that heteroskedasticity was not present was not rejected. The pattern of dots in the scatter plot was also not systematic it was rectangular which showed homoscedasticity.

AMOS was employed to carry out CFA so as to validate the measurement model and to establish acceptable goodness of fit levels. Pretesting was done on five key individuals from the sector to ensure clarity and proper interpretation. For purposes of assessing composite, construct, convergent and discriminatory validity various checks were conducted. Each of the measurement item should strongly correlate with its theoretic construct for convergent validity to be confirmed, meaning items which are construct indicator should unite or share in common variance in high proportion. In addition, AVE should be more than 0.5 (Fornell & Larcker, 1981). Using a formula put forward by Hair et al. (2010). Reflective indicators standardized loadings ideal level is 0.70. However, a value of 0.60 is also deemed acceptable (Barclay et al., 1995). The factor loadings were all more than the acceptable level of 0.60 and range from 0.64 to 0.93 hence convergent validity was verified.

All AVE were greater than 0.5 and factor loadings were greater than 0.7. To establish convergent validity, each latent variable's AVE should be at least 0.5 or higher (Hair, Black, Babin, & Anderson, 2010). For all the constructs, all item's standardized loadings were above the ideal level, hence confirmation of convergent validity. The degree to which an instrument, measurement or a process gives similar outcome on repeated trials defines reliability (Carmines & Zeller, 1979). All items of reflective measures are regarded as parallel measure of the same construct. Hence construct path loadings have to be strong, equal or more than 0.70. Composite reliability measures the overall reliability of latent construct items. Reliability value is required to be more than 0.70. However, if the other indicators of the construct's validity are good, values ranging from 0.60 to 0.70 are also deemed acceptable (Hair et al., 2010). All composite reliabilities of construct had a value ranging from 0.66 to 0.91 indicating adequate internal consistency. All composite reliability of the five latent constructs had a value greater than 0.7, indicating a good internal consistency.

The AVE of individual factors and their shared variances were compared in order to examine discriminant validity (Fornell & Larcker, 1981). The-off diagonal items represent the squared correlation between constructs whereas the diagonal items represent square root of AVE's, which measured the variance between the construct and its indicators. AVE values ranged from 0.71 to 0.91, where the lowest AVE value was 0.71 (Manufacturing Process (MP), Distribution (DS) and Competitive Advantage (CA)) which exceeded the largest squared correlation (0.64 – between Product Design and Development (PDD), End of Life (EL), Employment (EP) and Well-Being (WB)). This output indicated that the variance shared among factors were lower than of individual factors, hence discriminant validity was confirmed. The rule of thumb states that, each construct square root ought to be much larger compared to specific construct correlation relative to other model constructs (Chin, 1998) and ought to be at least 0.50 (Fornell & Larker, 1981).

Factor analysis acts as a gauge of the substantive importance of a given variable to the factor and it is used to identify and remove hidden constructs or variable items that do not meet the objectives of the study and which may not be apparent from direct analysis (Ragin, 2014). After the measurement instrument validation was fulfilled, valuation of the measurement model fit was done using CFA results in order to approve the hypothesized structure. The measurement model, comprised of 17 factors. A minimum of two observed variables were used to measure each factor. Random measurement error influenced reliability, as shown by the related error term. Regression was done to each of the observed variables into its specific factor. Lastly, inter- correlation between all the 17 factors was presented. The hypothesized model was recursive, meaning it was unidirectional and the sample size was 150. Two important features usually define recursive models: uncorrelated disturbances, and unidirectional of all causal effects. Model variables were 85, 34 observed, 51 unobserved, 51 exogenous and 34 endogenous.

The projected model was an over-identified one with a DF value of 388. It shows a good construct items' loadings and cross loadings after CFA which also confirms convergent validity. In the model, there were 595 distinct sample moments and 207 distinct parameters, leaving 388 (595 - 207) degrees of freedom, which was positive. Multicollinearity effects was eliminated in this study, as there was achievement of the minimum iteration, hence assurance that an admissible solution was attained through the estimation process. There was a good construct items' loadings and cross loadings after CFA which also confirms convergent validity. Where PF was profitability, MP was manufacturing process, PD was productivity, OE was operations efficiency, ECS was environmental cost saving, EIR was environmental impact reduction, ED was education, EP was employment, HS was health and safety, WB was well-being, DA was differentiation advantage, CA was cost advantage, EL was end-of-life, PU was product use, DS was distribution, MU was material use and PDD was product design and development.

The results showed a clear model of fit summary, which comprises of the x^2 value of 496.561, degrees of freedom of 388 and probability value (0.000). It also showed the minimum discrepancy (CMIN/DF); DF is the degrees of freedom; probability value (P) and the number of parameters (NPAR). In the model the x^2 value of 496.561 was small compared to independence model value (3027.092), hence the x^2 value was good. It was also suitable to look at the value of CMIN/DF as the x^2 measurement is specifically sensitive to sample size. This means that, probability of rejection of a model increases with an increase in the sample size. For a good model fit the recommendation is that, this metric should not exceed five (Bentler, 1989). The value was 1.280, which showed a good fit.

The fit indices provided a reasonably model fit and for absolute fitness, GFI obtained was 0.85 and RMSEA was 0.043. The chi-square likelihood ratio (CMIN) appeared to be significant when the p-value was 0.000. The test is supposed to be insignificant as it is a difference test, but due to negligence of SEM assumptions this value is usually significant in most cases. For the incremental fit, AGFI was 0.80. The NFI, CFI, and TLI were 0.84, 0.96, 0.94, respectively. Although some of the values did not exceed the 0.9 threshold, they were still within the acceptable range of 0.8 and above as suggested by Baumgartner and Homburg (1996) and Doll, Xia, and Torkzadeh

(1994). It was therefore concluded that the theorized model provided a good fit with the observed data.

The first objective was to determine the link between SOMPs and competitive advantage of manufacturing firms in Kenya. The CB-SEM was utilized to analyze the data to achieve this objective. The model was based on two latent constructs, an exogenous variable (SOMPs) and endogenous variable (competitive advantage). The null hypothesis was stated as follows - H_1: SOMPs have no significant influence on firm competitive advantage. The study null hypothesis H_1 that SOMPs have no significant influence on firm competitive advantage was rejected since p-value < 0.001 was less than alpha (α) value = 0.05, hence it was concluded that SOMPs had significant influence on firm's competitive advantage.

The SOMPs accounted for 36 percent variance in competitive advantage. So, as the variance explained of a specific endogenous construct to be considered satisfactory R^2 values should be equivalent to or more than 0.10 (Falk & Miller, 1992). Chin (1998) suggested R^2 values for endogenous latent variables based on 0.67 (substantial), 0.33 (moderate), 0.19 (weak). Hence, the variance explained was moderate. The fit indices signified a perfect model fit. The GFI obtained was 0.948; AGFI was 0.925; and NFI; CFI; TLI were 0.930, 1.000 and 1.043, respectively. The p-value was 0.985 and RMSEA was 0.000, hence, the conclusion drawn was that, the model fitted the data perfectly well.

The second objective entailed the examination of the effect of firm characteristics on the relationship between SOMPs and competitive advantage. The variables representing firm characteristics were size represented by the size of staff, age represented by the length of operations and managerial capabilities represented by education level and working experience. Each of the firm characteristics was analyzed differently.

The null hypothesis for objective 2a was stated as follows - H_{2a}: firm age has no significant moderating effect on the relationship between SOMPs and firm competitive advantage**.** Since the p-value < 0.001 was less than α-value = 0.05, SOMPs had an influence of competitive advantage. In addition, firm's age had a significant effect on competitive advantage since p-value = 0.048 was less than α-value = 0.05; and lastly, the interaction effect was significant since p-value = 0.024 was less than α-value = 0.05. Hence it was concluded that the moderating effect of firms age on the relationship between SOMPs and competitive advantage was significant. The fit indices provided a perfect model fit. The GFI obtained was 0.936; AGFI was 0.908; and NFI, CFI, TLI were 0.905, 1.000 and 1.038, respectively. The RMSEA was 0.000 and the p-value was 0.958. Hence, the conclusion was that the model fitted the data perfectly.

The null hypothesis for objective 2b was as follows H_{2b}: firm size has no significant moderating effect on the relationship between SOMPs and firm competitive advantage. It was concluded that the relationship between SOMPs and competitive advantage was significant since the p-value < 0.001 was less than α-value = 0.05. Firm size had no significant effect on competitive advantage since the p-value = 0.564 was more that α-value = 0.05 and the interaction effect was not significant since the p-value = 0.324 was more than α-value = 0.05. It was, therefore, concluded that the moderating effect of firm size on the relationship between SOMPs and competitive advantage was not significant and the null hypothesis was not rejected. The fit indices provided a perfect model fit since GFI was 0.936; AGFI was 0.910; NFI was 0.905; CFI was 1.000 and TLI was 1.041. The RMSEA was 0.000 and the p-value was 0.968. Hence, the conclusion arrived at was that the proposed model fitted the data very well.

For objective 2c, null hypothesis was H_{2c}: employee's level of education has no significant moderating effect on the relationship between SOMPs and firm competitive advantage**.** The output showed a p-value < 0.001 which was less than α-value = 0.05, hence it was concluded that the link between SOMPs and competitive advantage was significant. Employees' level of education had no significant effect on competitive advantage since p-value = 0.155 was more than α-value = 0.05; and with the interaction effect, the results were not significant as p-value of 0.349 was more than α-value = 0.05. Therefore, the null hypothesis that employee's level of education has no significant moderating effect on the relationship between SOMPs and firm competitive advantage was not rejected. The fit indices signified a good model fit. For absolute fitness, GFI obtained was 0.934 and RMSEA was 0.000. The CMIN value appeared to be significant at p-value 0.953. For the incremental fit AGFI was 0.907 as against the recommended value of above 0.90; NFI, CFI, TLI were 0.902, 1.000, and 1.038, respectively, hence the model showed a great fit.

The null hypothesis for objective 2d was employees' period of working has no significant moderating effect on the relationship between SOMPs and firm competitive advantage**.** The output showed that the link between SOMPs and competitive advantage was significant since p-value < 0.001 was less than α-value = 0.05. In addition, employees' period of working had no significant effect on competitive advantage because p-value = 0.182 was more than α-value = 0.05, whereas the interaction effect was not significant since p-value of 0.193 was more than α-value = 0.05, hence it was concluded that the moderating effect of employees' period of working on the link between SOMPs and competitive advantage was not significant and the null hypothesis was, therefore, not rejected. The model fit indices provided a reasonable fit with GFI of 0.931; AGFI of 0.902; NFI of 0.899; CFI of 1.000; and TLI of 1.028. The RMSEA was 0.000 and the p-value was 0.893. Hence, the proposed model fitted the data well.

Only one variable (age) was established to have a significant moderating effect. It was estimated that 0.47, 0.37, 0.38 and 0.38 (estimate R^2) variance in competitive advantage was described by the predictor variables; firm age, firm size, length of working in manufacturing and highest level of education respectively. The variances explained were all above moderate, hence adequate.

The third objective was to establish the influence of organizational performance on the relationship between SOMPs and competitive advantage. The null hypothesis was stated as H_3 that organizational performance has no significant mediating effect on the link between SOMPs and firm competitive advantage. SOMPs had no significant effect on competitive advantage as the P-value = 0.274. Also, SOMPs had a significant effect on organizational performance since p-value < 0.001 was less than α-value = 0.05, whereas organizational performance had a significant effect on competitive advantage because p-value = 0.002 was less than α-value = 0.05.

Hence the null hypothesis that organizational performance had no significant mediating effect on the relationship between SOMPs and firm competitive advantage was rejected and the alternate hypothesis was adopted. However, since the direct relationship was not significant, the mediation was full, that is, SOMPs has only indirect effect on competitive advantage. It was also established that SOMPs and organization performance accounted for 0.62 variance in competitive advantage. The effect of size of the predictor variable was found to be substantial. The fit indices provided a good model fit. GFI obtained was 0.905; AGFI was 0.870; NFI, CFI, and TLI were 0.873, 0.981 and 0.976, respectively. The RMSEA was 0.032, the p-value was 0.108 which was above 0.05. It was concluded that the proposed model had an overall good fit.

The fourth objective was to determine the joint effect of SOMPs, firm characteristics and organizational performance on firm competitive advantage. The null hypothesis for objective four was H_4 - joint effect of SOMPs, firm characteristics and organizational performance on firm competitive advantage is not significant. To validate the model, the following relationships were tested; SOMPs and competitive advantage, SOMPs and organizational performance, organizational performance and competitive advantage, length of firm operation and competitive advantage, interaction effect of SOMPs and length of firm operation on competitive advantage, staff size and competitive advantage, interaction effect of SOMPs and staff size on competitive advantage, length working in manufacturing and competitive advantage, interaction effect of SOMPs and length working in manufacturing on competitive advantage, level of education and competitive advantage, interaction effect of SOMPs and level of education on competitive advantage.

All the relationships were not significant except for the mediating effect SOMPs and organizational performance (p-value < 0.001) and organizational performance and competitive advantage (p-value < 0.002). It was, therefore, concluded that joint effect of SOMPs, firm characteristics and organizational performance on firm competitive advantage was not significant. The model fit indices provided a good model fit, with GFI as 0.869, RMSEA was 0.034. The CMIN value was significant when the p-value was 0.024 and for the incremental fit; AGFI was 0.821 against the recommended value of 0.90; NFI, CFI, TLI were 0.800, 0.961, 0.950, respectively hence, the model fitted the data well. The output projected that the predictor variable accounted for 0.62 variance in competitive advantage.

5.3 Conclusion of the Study

The main conclusion was that SOMPs leads to competitive advantage. Efforts of minimizing environmental, economical, as well as social effects lead to minimized operating costs, enhanced satisfaction of employees and environmental improvements through product marketing leading to competitive advantage (Shahbazpour & Seidel, 2006). This is due to the fact that the continued existence and competitiveness of organizations are dependent on their practices, as well as capabilities for adapting to the external environment, attributable to variation in customer preferences, government regulations, technology as well as competitors (Machuca, Jiménez, & Garrido-Vega, 2011). This is irrespective of firm’s size, age or its managerial capabilities. Companies should, therefore, not view environmental protection activities as detrimental to the company but see it as an opportunity.

The years of existence of the firm can be linked to learning curve and high possibility of accumulating properties and competences that may amount to overall improvement and competitive advantage (Birley & Westhead, 1990). However, organization size, managerial experience and level of education did not moderate the relationship between SOMPs and competitive advantage. Organizations suffer inflexibility and bureaucratic bottlenecks as they grow, which may transform into resistance to change (Hannan & Freeman, 1984). More experienced individuals with high level of education within an organization do not necessarily make better leaders and improve competitive advantages.

Organizational performance mediates the relationship between SOMPs and competitive advantage. Successful implementation of SOMPs improves several dimensions of organizational performance including environmental, economic as well as social (Moldan, Janouskova, & Hak, 2012). By improving the efficiency of production to reduce scraps, defects and emissions, a firm lowers its operating costs by reducing the cost of raw material and waste stream, hence achieve improved environmental performance (Yang et al., 2010). Organizations that emphasize on enhancement of SOMPs with regard to the reduction of adverse outputs from manufacturing process will ultimately enhance their economic performance (Wagner, 2005). Social activities present opportunities for a company, allowing it to meet its needs and those of its stakeholders, achieve social performance, while still pursuing profit goals (Grant et al., 2008).

Sustainability is a major success factor within the long run strategy of a business and enterprises that adopt it attain differentiated competitive edge over the rivals (Crittenden et al., 2011). Enhancement of environmental performance with regard to the reduction of adverse outputs from manufacturing process will ultimately enhance economic performance (Wagner, 2005). Social responsibility allows a firm to evade strict regulations, which will lead to cost reduction, meeting the different requirements of its various stakeholders while still operate profitably (Hart, 1995). The study also concluded that, firm characteristics (size, age and managerial capabilities) do not moderate the relationship between SOMPs and firm's competitive advantage. This indicates that implementation of SOMPs results in improved firm competitive advantage. The relationship can also be mediated by organizational performance but the relationship is irrespective of firm size, age or managerial capabilities. Therefore, the conclusion was that the three variables did not have a joint significant effect on competitive advantage.

5.4 Implications of the Study

This section looks at the contribution of the study to knowledge, theory, policy and practices. It evaluates the implications of the study and brings theoretical underpinning, conceptual and methodological references and improvement in practices and future studies.

5.4.1 Contribution to knowledge

SOMPs potentially plays a critical role in contribution of solutions for challenges faced by humanity. Despite its importance and ongoing efforts, it has not yet fused into the mainstream of operations management research as studies in the area of SOMPs are limited (Gavronski, Paiva, Teixeira, & de Andrade, 2013). This study therefore adds to knowledge in the less explored field of SOMPs. There are also concerns on whether implementation of sustainable practices will actually lead to competitive advantage. Whereas some studies have found a positive connection (Bennett et al., 2013; Drake & Spinler, 2013), Wagner (2005) identified a relatively weak positive link, while Watson, Klingenberg, Polito and Geurts (2004) did not identify any link. This study helps resolve the inconsistencies by affirming that SOMPs have a positive impact on competitive advantage.

Sustainability rests on three constituent categories based upon TBL (environmental, economic and social). However, previous studies (Esty & Charnovitz, 2013; Longoni & Cagliano, 2015) paid attention on some of the aspects of sustainability (environmental and social) but they did not take into consideration the three dimensions of sustainability. The three aspects are tangled and they reinforce each other, hence need to be addressed in connection with one another (Svensson & Wagner, 2012a). This study took a holistic approach by analyzing the three dimensions together hence, gives a clear perspective.

In the operationalization of SOMPs, some researchers (Abdul-Rashid et al., 2017; Drake & Spinler, 2013) used few indicators, which did not capture the whole product life cycle. The SOMPs incorporate all aspects of operations within and beyond the firm in order to obtain maximum possible benefits (Hill, 2007). This study captures the whole product life cycle from when the operations cycle commences.

Successful implementation of SOMPs requires resources and capability and has the possibility of improving several dimensions of organizational performance (Moldan, Janouskova, & Hak, 2012). However, little is known about the moderating and mediating effect of firm characteristics and organizational performance on the relationship between SOMPs and competitive advantage. Business models may be incomplete if they fail to specify mediating and moderating variables. Therefore, they may be unable to give solution to actual business problems (Namazi & Namazi, 2016). This study looked at indirect causes hence providing further insights in the area.

Most of the studies reviewed are limited to other countries and developed economies (US, Malaysia, UK, India). African countries face major environmental challenges (ILO, 2012) hence clear understanding and sufficient knowledge will facilitate implementation and problem-solving process. The context of the study is Kenya which is in Africa. This will serve as a reference point for African countries who wish to implement SOMPs.

Previous studies done in Kenya covered the area of green manufacturing and GSCM (Odock, Awino, Njihia, & Iraki, 2016; Mwaura et al., 2016). These studies were on some of the facets of SOMPs. However, a study which considers all the facets of SOMPs is important, this study looked at the whole product life cycle. In methodology, Mwaura, Letting, Ithinji, and Orwa (2016) used regression analysis while Adebambo, Ashari, and Nordin (2015) used PLS-SEM. This study used CB-SEM, hence allowed for more sophisticated and comprehensive analyses (Hair et al., 2010). Thomas, Fugate, Robinson, and Tasçioglu (2016) did a behavioral experimental research, which is prone to human error and environmental influence. This study adopted cross sectional survey to avoid the shortcomings.

5.4.2 Contribution to Theory

Three major theories grounded the study: TPF, NRBV and OST. The key anchoring theory for this the study was the TPF, which is the highest level of performance that a manufacturing unit can achieve using a set of operating choices. The study posit that implementation of SOMPs would give an organization a competitive advantage and improve its performance. The operating frontiers of firms denote distinctive resources which are more vital than the asset frontiers in competitive advantage achievement. This is because they are specific to a particular firm, rare and hard to mimic (Vastag, 2000). Intangible assets like know-how or culture of being sustainable through the implementation of SOMPs are important resources which gives an organization a mileage from its competitors. This is because it requires time for them to acquire these resources and by the time they catch up, the organization will have moved on to a different level, hence improves on its performance leading to competitive advantage. This argument conforms to the findings of this study which also demonstrate the significance of NRBV.

The results are consistent with the NRBV which suggests that a firm can gain competitive edge with regards to its association to the natural environment (Hart & Dowell, 2011). Pollution prevention strategies like SOMPs depend upon tacit skills developed and sharpened through workforce engagement making it hard to observe and quickly copy, hence improves an organization performance and gives it a competitive advantage (Willig, 1994). Product stewardship offers an organization a chance to attain competitive advantage by enabling communication across departments, functions as well as organizational boundaries so as to coordinate SOMPs among all parties (Schmidheiny, 1992). Sustainable development alludes to technological cooperation, working with state and business in the building of relevant infrastructure, nurture human resources and explore means for achieving competitiveness (Schmidheiny, 1992). Firms need to work in harmony with all stakeholders like suppliers, by ensuring that they implement SOMPs hence supply them with sustainable resources, giving them a competitive advantage (Hart & Ahuja, 1996). This study provides empirical evidence that the implementation of SOMPs practices results in improved organizational performance and competitive advantage because the firm builds complex resources that are difficult to replicate

The findings of this study are also consistent with arguments of OST. The results reflected the importance of OST in the study of the relationship between SOMPs and firm competitive advantage hence extends to conceptual and empirical research in the area related to SOMPs by recognizing that organizations are not closed systems, just like any other system, they derive their input from the environment converted into output that is released to the environment. As organization acquires resources for their survival, this may lead to adoption or diffusion of other partner's sustainable practices resulting to competitive advantage (Sarkis, Gonzalez-Torre, & Adenso-Diaz, 2010). They are also affected by customer demands, competition and government regulations (Cummings & Worley, 2014). An organization cannot be autonomous with respect to critical resources. To be competitive, they need to take care of this reliance for sustainable development (Wathne & Heide, 2004). Through sustainable operations, an organization meets customer demands, adheres to environmental policies and tries to be innovative enough to serve the ever-changing taste, preferences and concerns of the customer. This differentiates it and gives it a competitive advantage. The findings of this research show that the distinct resources and tacit skills are strategic resource which leads to competitiveness.

5.4.3 Contribution to Policy and Practices

The findings provide significant information for the development and review of environmental policies and practices like waste management policy. A clear perspective of the relation between SOMPs and competitive advantage is relevant in designing effective environmental policies. Awareness of this link is vital to governmental policymakers so as to achieve environmental goals. By making sustainable enhancement to manufacturing activities, firms come to the realization of operational expense savings hence competitive advantage (Schäpke et al., 2017). Regulators may use the findings to persuade other organizations to implement SOMPs by use of voluntary environmental plans and partnership and by presenting enticements to firms that have already implemented SOMPs. The research can also enable the government to identify gaps in their present policies hence assisting them in making new and better ones.

The focus of the study was on manufacturing firms registered with KAM. This is because these firms are perceived to be large and have been in existence for some time, hence have accumulated enough resources to enable them implement SOMPs. The SOMPs require long-term investment, large amount of resources to implement and firms commitment, hence most firms do not implement them early (Hart, 1995). This shows that small organization do not have the resources needed to implement

SOMPs hence the government may recognize their part in availing the essential enticements to enable proper adoption of SOMPs.

5.5 Recommendations of the Study

The results established that SOMPs leads to improved organization performance and competitive advantage. Therefore, manufacturing firms should implement SOMPs as there are possible benefits which come with implementation such as unceasing improvement on capital productivity through enhanced customer relationships, employees' productivity, effectiveness, business performance enhancement in addition to competitive edge. Firms' operation management choices are the main cause to anthropogenic conditions on ecology sustainability, hence an important stream.

Climatic variations are largely due to anthropogenic causes of manufacturing firms. Company's operations management decisions form part of the key contributors to the anthropogenic impact on the ecosystem. Companies should not only be concerned in their operations of business, but also for establishing good environmental behavior by adopting SOMPs. The SOMPs potentially play a critical role in contribution of solutions for challenges faced by humanity. Kenyan government has identified manufacturing as one of its big four-agenda. It is among the sectors selected to aid in the attainment of a sustainable annual Gross Domestic Product (GDP) growth. However, its advancement has been sluggish in some previous years, which is attributed to adverse weather conditions, high production costs and competition. From the research outcomes, it can be recommended that since government rules, regulations, legislations and firm's competencies drive SOMPs implementation, they should take an initiative of evaluating their policies, make environmental regulation more stringent and assign additional resources to warrant proper employment of SOMPs. Since the environment is the foundation of economic and social growth in Kenya; priority should be given to environment sustainability.

There is a requirement for major changes in the policy process. Sustainability ought to be regarded as an important notion across various sectors and fields and governments are required shift from concepts to action. It is vital that the government looks past the narrow process of policy implementation and rather concentrate on projects and programs implementation that have strong connections which will guarantee achievement of sustainability. The government should come up with new policies to promote SOMPs and other organizational programmes concerning the environment. In order to attain both environmental and economic obligations, business ventures should take into consideration a change of prevailing policies and developing structures to support in sealing the gaps. These are critical concerns which the policymakers should address. It is time for the link between sustainability and competitiveness be acknowledged and advanced as a corporate opportunity and a matter of policy.

Open system theory recognizes that organizations are not closed systems. Just like any other system, they derive their input from the environment converted into output that is released to the environment. They are also affected by customer demands, competition and government regulations. The OST confirms the interdependence between the environment and the organization where they both need one another for success, growth and survival. Through sustainable operations, an organization meets customer demands and adhere to environmental policies, this differentiates it and give it a competitive advantage. Managers should, therefore, stop being only shareholders' agents but also being builders of stakeholder relations.

5.6 Limitations of the Study

Among the limitation of this study was that, some participants considered the information requested as confidential. This left some questionnaires unanswered. Most organizations were unwilling to disclose their performance data mostly because of fear of the information being leaked to competitors. The findings were also limited to the sectors analyzed in the Kenyan context and only a sample of manufacturing firms registered by KAM were incorporated. Therefore, the results from this research should be generalized with caution. All manufacturing firms in Kenya ought to be analyzed to allow for generalization.

This study relied deeply on information provided by firm managers. This is a methodological weakness. The information collected from the primary source on SOMPs, competitive advantage, organization performance and firm characteristics was perceived information, which was prone to biasness. It was based on individuals' opinion and their perception of a given situation. The fact is, people perceive things differently and have different opinion regarding a given situation or issue. Objective data usually gives the best picture and increases reliability.

Another limitation was the limited sample of interviews realized. Future research should include larger samples to generate a wider overview. Covariance - based SEM works well with a large sample; with some respondents deeming the information required as confidential, it was difficult to gather enough data for the analysis. Questionnaires were dropped and in the time of picking, they were either not filled or excuses were given. This prolonged the data collection period. In addition, finding managers to fill the questionnaires was hard as they were always busy and kept on postponing the process, which was very challenging.

5.7 Suggestions for Further Research

The researcher suggests that upcoming research should capture SOMPs in other economic sectors as they also form part of the contributors to the advancement of the economic system. The research used perceived information founded on the views of the managers taking part in the survey. To add confidence in the results, future research should consider, more direct objective measurements. This study used cross sectional survey design where data was gathered at a point in time across various firms. Nevertheless, the paybacks of SOMPs can be recognized after a long duration (longitudinal study) rather than short duration of time. Despite its importance, studies in the area of SOMPs are limited. Therefore, more research should be generated that allows for efficiency in the production systems with regard to the environment, economic and social influences. Such studies should eventually advice and influence practice and/or policy.

In addition, it is relevant to take note of the fact that this study picked its representative sample from the manufacturing firms in a developing country (Kenya). It is likely that it may not be practical to generalize the outcomes of the study to a developed country or any developing country having different economic and environmental guidelines from the context of this study. So, future researchers are encouraged to assess the model of the study in other contexts and more so extending the study to the various levels of competitiveness to offer a comprehensive view of such commitments.

Besides, it would be good to study moderating and mediating effects. This study can be enhanced by incorporating other strategic resources to act as mediator and/or other aspects as moderator variables in the theoretic model as previous studies did not consider this issue. This way, researchers as well as specialists will be presented with further understanding of reciprocal causal mechanism linking SOMPs and competitive advantage and circumstances shaping that link. The theoretical foundation on which much of SOMPs research is founded is an area of concern that future researchers should consider. The SOMPs is a developing field, hence additional research and results are required in the future to assist in generation of ideas which will contribute to the expansion of SOMPs knowledge base.

Another issue that was captured in the course of this study is that some aspects (environmental and social) have received more focus than others. This indicate the need to go into the less explored areas and probably examine the prevailing paradigm that presently impacts SOMPs research. The major challenge in the future appears to be the incorporation an all-inclusive TBL knowledge. The probable future opportunity for knowledge to develop in a stable way in the field will involve analysis and advancement of the current framework. Researchers are also required to participate in more theory development as improvement of the settings for empirical studies requires to be aimed in the direction of coming up with new theoretical concepts. Theory development process in SOMPs need not be limited to the old deductive model comprising of hypotheses testing. Business sustainability do not require to be deductive and confirmatory but rather inductive and exploratory.

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APPENDICES

Appendices I Structural Models

Model One
Relationship between sustainable operations management practices and firm competitive advantage

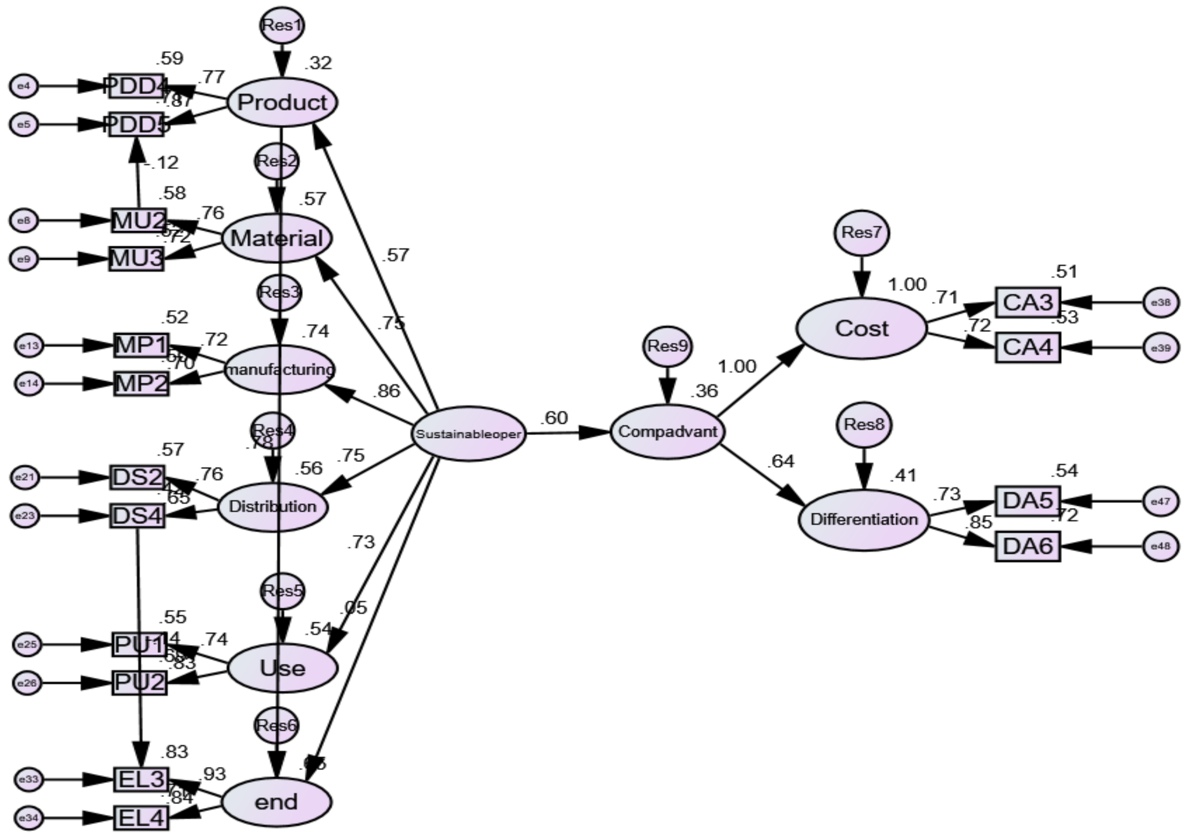

Figure 4.11 Sustainable Operations Management Practices and Competitive Advantage

Chi-square = 65.797, DF = 93, CMIN/DF = 0.707, Probability = 0.985, RMSEA = 0.000, TLI = 1.043, CFI = 1.000, NFI =0.930, GFI =0.948, AGFI =0.925

Key:
Sustainableoper = Exogenous latent construct (sustainable operations management practices)
Product, Material, Manufacturing, Distribution, Use, End = A set of six items to measure SOMPs
PDD4 and PDD5 = A set of two items to measure product design and development
MU2 and MU3 = A set of two items to measure material use
MPI and MP2 = A set of two items to measure manufacturing process

DS2 and DS4 = A set of two items to measure distribution
PU1 and PU2 = A set of two items to measure product use
EL3 and EL4 = A set of two items to measure end-of-life
e4, e5, e8, e9, e13, e14, e21, e23, e25, e28, e33 and e34 = Error in measurement for items PDD, MU, MP, DS, PU and EL.
Compadvant = Endogenous latent construct (competitive advantage)
Cost and differentiation = A set of two items to measure competitive advantage
CA3 and CA4 = A set of two items to measure cost advantage
DA5 and DA6 = A set of two items to measure differentiation advantage
e38, e39, e47 and e48 = Error in measurement for items CA3, CA4, DA5 and DA6
Res1, Res2, Res3, Res4, Res5, Res6, Res7, Res8 and Res9 = Residuals

Model Two

Moderating effect of firm age on the relationship between sustainable operations management practices and firm competitive advantage

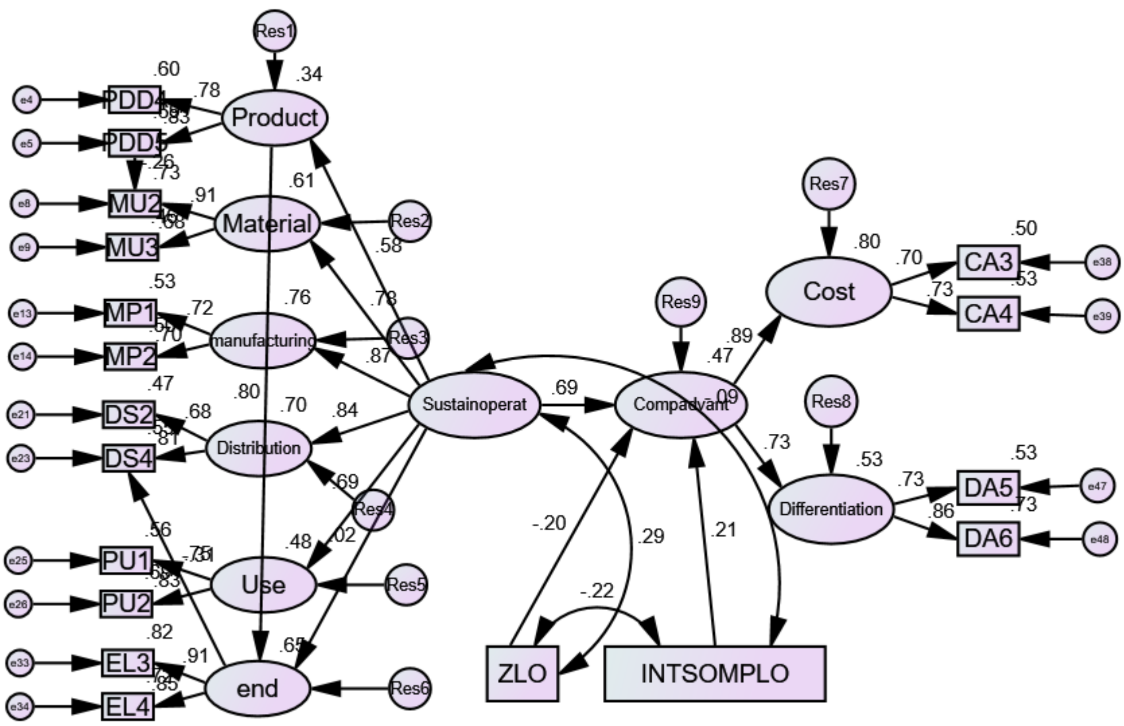

Figure 4.12 Sustainable Operations Management Practices, Firm Age and Competitive Advantage

Chi-square = 94.667, DF = 120, CMIN/DF = 0.789, Probability = 0.958, RMSEA = 0.000, TLI = 1.038, CFI = 1.000, NFI =0.905, GFI =0.936, AGFI =0.908

Key:
Sustainableoper = Exogenous latent construct (sustainable operations management practices)
Product, Material, Manufacturing, Distribution, Use, End = A set of six items to measure SOMPs
PDD4 and PDD5 = A set of two items to measure product design and development
MU2 and MU3 = A set of two items to measure material use
MPI and MP2 = A set of two items to measure manufacturing process
DS2 and DS4 = A set of two items to measure distribution
PU1 and PU2 = A set of two items to measure product use
EL3 and EL4 = A set of two items to measure end-of-life
e4, e5, e8, e9, e13, e14, e21, e23, e25, e28, e33 and e34 = Error in measurement for items PDD, MU, MP, DS, PU and EL.
Compadvant = Endogenous latent construct (competitive advantage)
Cost and differentiation = A set of two items to measure competitive advantage
CA3 and CA4 = A set of two items to measure cost advantage
DA5 and DA6 = A set of two items to measure differentiation advantage
ZLO = Length of operation
INTSOMPLO = Interaction effect of SOMPs and length of operation
e38, e39, e47 and e48 = Error in measurement for items CA3, CA4, DA5 and DA6
Res1, Res2, Res3, Res4, Res5, Res6, Res7, Res8 and Res9 = Residuals

Model Three

Moderating effect of firm size on the relationship between sustainable operations management practices and firm competitive advantage

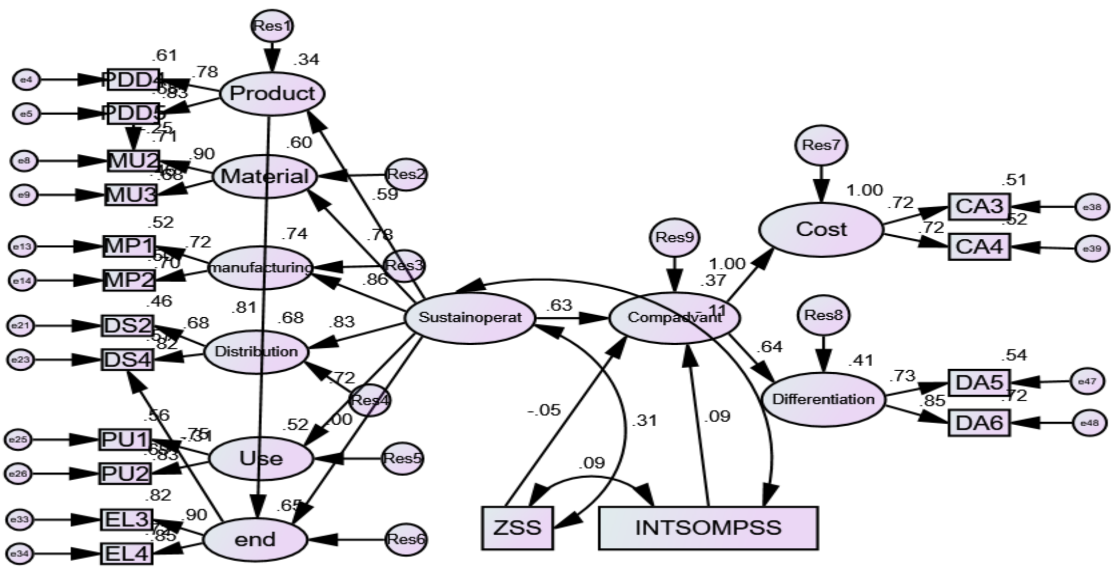

Figure 4.13 Sustainable Operations Management Practices, Firm Size and Competitive Advantage

Chi-square = 93.892, DF = 121, CMIN/DF = 0.776, Probability = 0.968, RMSEA = 0.000, TLI = 1.041, CFI = 1.000, NFI =0.905, GFI =0.936, AGFI =0.910

Key:
Sustainableoper = Exogenous latent construct (sustainable operations management practices)
Product, Material, Manufacturing, Distribution, Use, End = A set of six items to measure SOMPs
PDD4 and PDD5 = A set of two items to measure product design and development
MU2 and MU3 = A set of two items to measure material use
MPI and MP2 = A set of two items to measure manufacturing process
DS2 and DS4 = A set of two items to measure distribution
PU1 and PU2 = A set of two items to measure product use
EL3 and EL4 = A set of two items to measure end-of-life
e4, e5, e8, e9, e13, e14, e21, e23, e25, e28, e33 and e34 = Error in measurement for items PDD, MU, MP, DS, PU and EL.
Compadvant = Endogenous latent construct (competitive advantage)
Cost and differentiation = A set of two items to measure competitive advantage
CA3 and CA4 = A set of two items to measure cost advantage
DA5 and DA6 = A set of two items to measure differentiation advantage
ZSS = Staff size
INTSOMPSS = Interaction effect of SOMPs and staff size
e38, e39, e47 and e48 = Error in measurement for items CA3, CA4, DA5 and DA6
Res1, Res2, Res3, Res4, Res5, Res6, Res7, Res8 and Res9 = Residuals

Model Four

Moderating effect of level of education on the relationship between sustainable operations management practices and firm competitive advantage

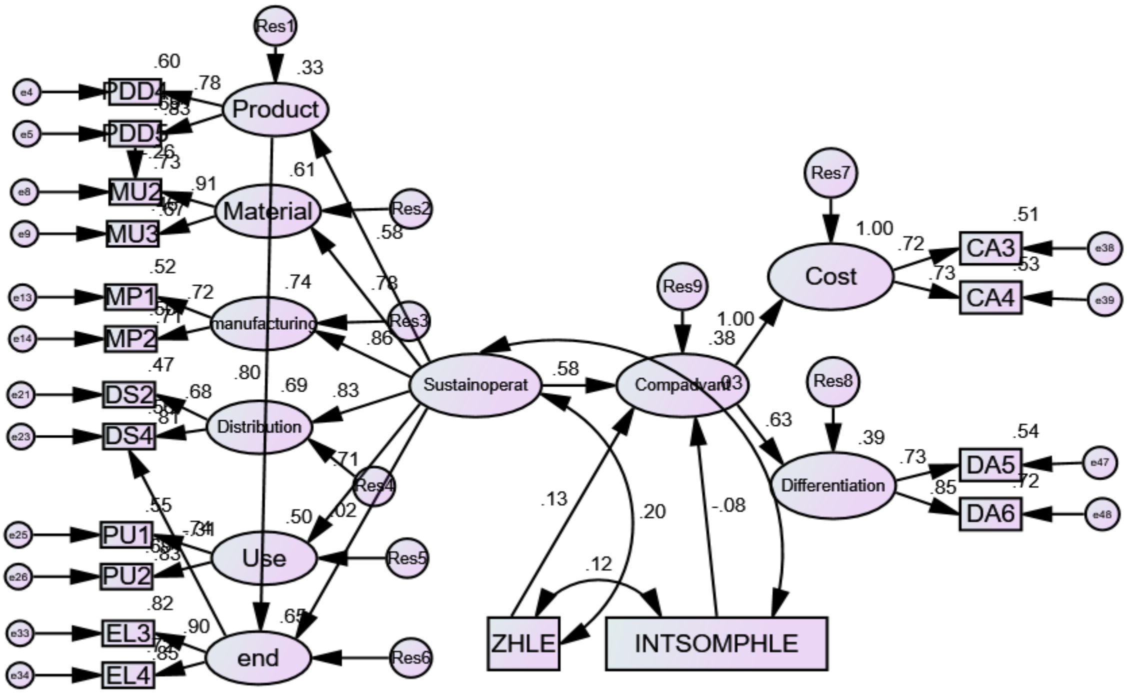

Figure 4.14 Sustainable Operations Management Practices, Employees Level of Education and Competitive Advantage

Chi-square = 96.146, DF = 121, CMIN/DF = 0.795, Probability = 0.953, RMSEA = 0.000, TLI = 1.038, CFI = 1.000, NFI =0.902, GFI =0.934, AGFI =0.907

Key:
Sustainableoper = Exogenous latent construct (sustainable operations management practices)
Product, Material, Manufacturing, Distribution, Use, End = A set of six items to measure SOMPs
PDD4 and PDD5 = A set of two items to measure product design and development
MU2 and MU3 = A set of two items to measure material use
MPI and MP2 = A set of two items to measure manufacturing process
DS2 and DS4 = A set of two items to measure distribution
PU1 and PU2 = A set of two items to measure product use
EL3 and EL4 = A set of two items to measure end-of-life
e4, e5, e8, e9, e13, e14, e21, e23, e25, e28, e33 and e34 = Error in measurement for items PDD, MU, MP, DS, PU and EL.
Compadvant = Endogenous latent construct (competitive advantage)
Cost and differentiation = A set of two items to measure competitive advantage
CA3 and CA4 = A set of two items to measure cost advantage
DA5 and DA6 = A set of two items to measure differentiation advantage
ZHLE = level of education
INTSOMPHLE = Interaction effect of SOMPs and level of education
e38, e39, e47 and e48 = Error in measurement for items CA3, CA4, DA5 and DA6
Res1, Res2, Res3, Res4, Res5, Res6, Res7, Res8 and Res9 = Residuals

Model Five

Moderating effect of length of working in manufacturing on the relationship between sustainable operations management practices and firm competitive advantage

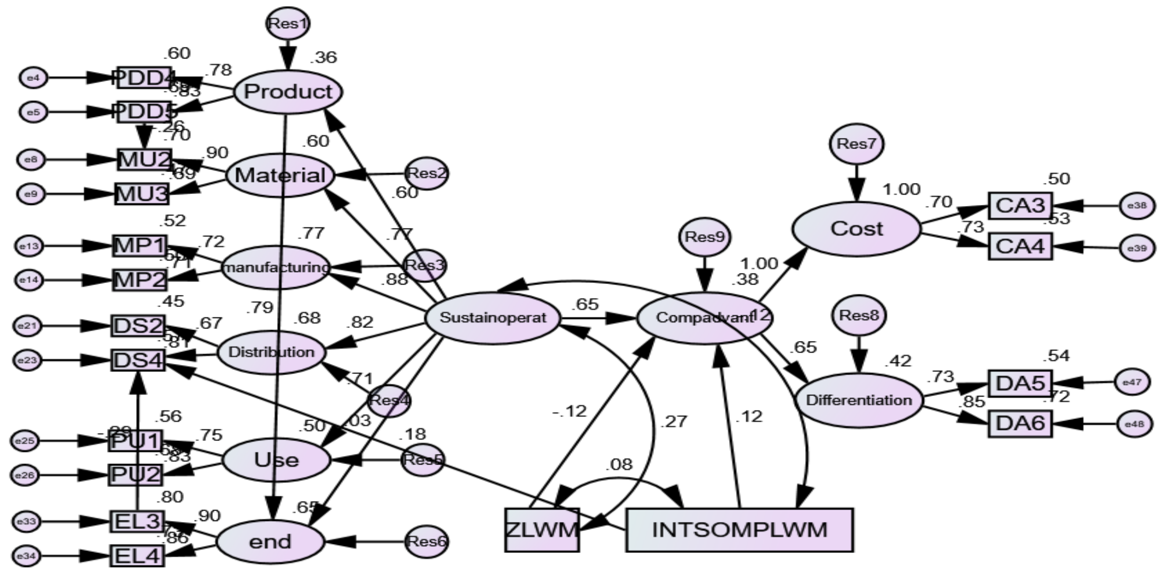

Figure 4.15 Sustainable Operations Management Practices, Employees' Period of Working and Competitive Advantage

Chi-square = 101.175, DF = 120, CMIN/DF = 0.843, Probability = 0.893, RMSEA = 0.000, TLI = 1.028, CFI = 1.000, NFI =0.899, GFI =0.931, AGFI =0.902

Key:
Sustainableoper = Exogenous latent construct (sustainable operations management practices)
Product, Material, Manufacturing, Distribution, Use, End = A set of six items to measure SOMPs
PDD4 and PDD5 = A set of two items to measure product design and development
MU2 and MU3 = A set of two items to measure material use
MPI and MP2 = A set of two items to measure manufacturing process
DS2 and DS4 = A set of two items to measure distribution
PU1 and PU2 = A set of two items to measure product use
EL3 and EL4 = A set of two items to measure end-of-life
e4, e5, e8, e9, e13, e14, e21, e23, e25, e28, e33 and e34 = Error in measurement for items PDD, MU, MP, DS, PU and EL.
Compadvant = Endogenous latent construct (competitive advantage)
Cost and differentiation = A set of two items to measure competitive advantage
CA3 and CA4 = A set of two items to measure cost advantage
DA5 and DA6 = A set of two items to measure differentiation advantage
ZLWM = Length of working in manufacturing

INTSOMPLWM = Interaction effect of SOMPs and Length of working in manufacturing
e38, e39, e47 and e48 = Error in measurement for items CA3, CA4, DA5 and DA6
Res1, Res2, Res3, Res4, Res5, Res6, Res7, Res8 and Res9 = Residuals

Model Six

Mediating effect of organizational performance on the relationship between sustainable operations management practices and firm competitive advantage

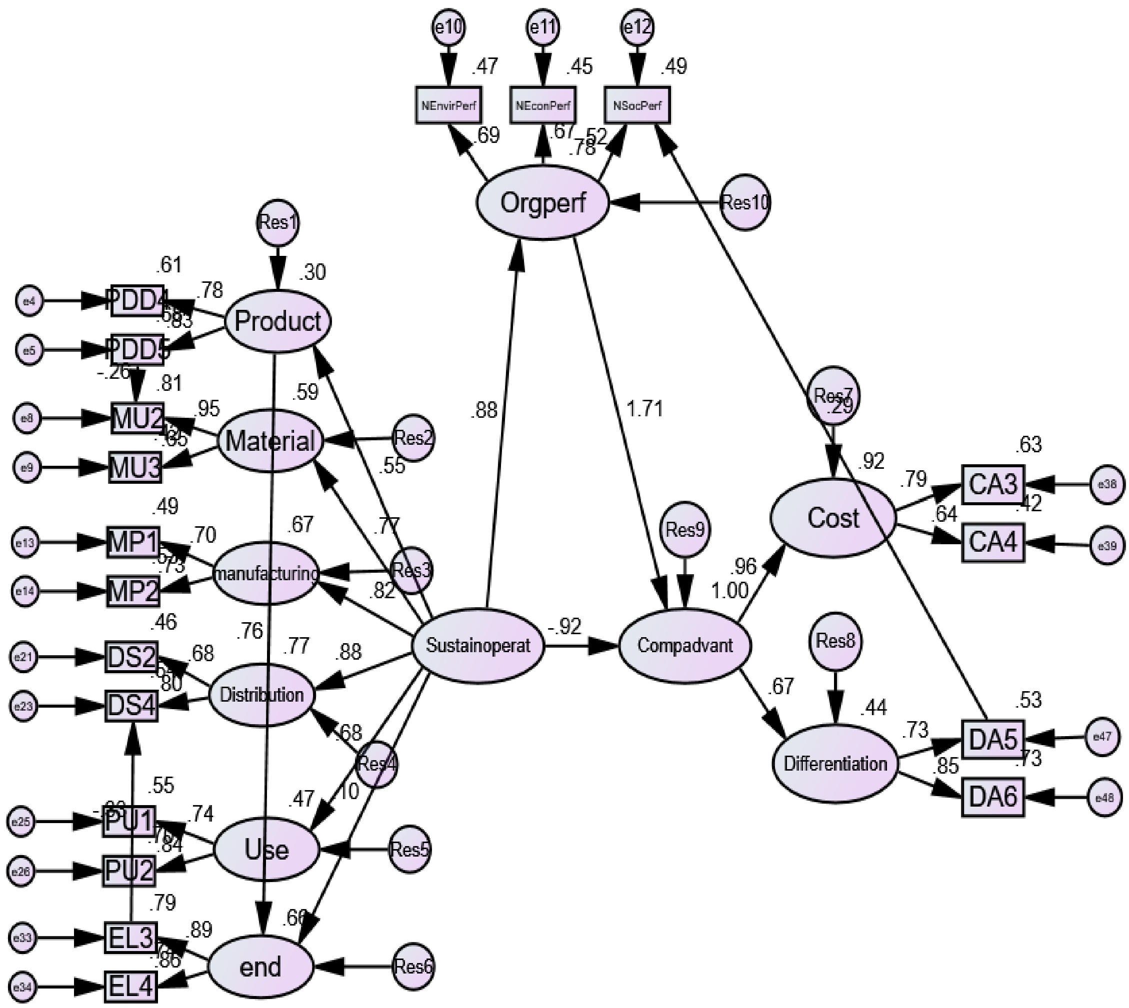

Figure 4.16 Sustainable Operations Management Practices, Organizational Performance and Competitive Advantage

Chi-square = 148.153, DF = 138, CMIN/DF = 1.074, Probability = 0.262, RMSEA = 0.022, TLI = 0.988, CFI = 0.991, NFI =0.882, GFI =0.910, AGFI =0.876

Key:

Sustainableoper = Exogenous latent construct (sustainable operations management practices)
Product, Material, Manufacturing, Distribution, Use, End = A set of six items to measure SOMPs
PDD4 and PDD5 = A set of two items to measure product design and development
MU2 and MU3 = A set of two items to measure material use
MPI and MP2 = A set of two items to measure manufacturing process
DS2 and DS4 = A set of two items to measure distribution
PU1 and PU2 = A set of two items to measure product use
EL3 and EL4 = A set of two items to measure end-of-life
e4, e5, e8, e9, e13, e14, e21, e23, e25, e28, e33 and e34 = Error in measurement for items PDD, MU, MP, DS, PU and EL.
Compadvant = Endogenous latent construct (competitive advantage)
Cost and differentiation = A set of two items to measure competitive advantage
CA3 and CA4 = A set of two items to measure cost advantage
DA5 and DA6 = A set of two items to measure differentiation advantage
e38, e39, e47 and e48 = Error in measurement for items CA3, CA4, DA5 and DA6
Res1, Res2, Res3, Res4, Res5, Res6, Res7, Res8, Res9 and Res10 = Residuals
Orgperf = Mediating variable (organizational performance)
Nenvirperf, Neconperf and Nsocperf = A set of two items to measure organizational performance
e10, e11, e12 = Error in measurement for items Nenvirperf, Neconperf and Nsocperf

Model Seven

The joint effect of sustainable operations management practices, firm characteristics, environmental, economic and social performance on firm competitive advantage.

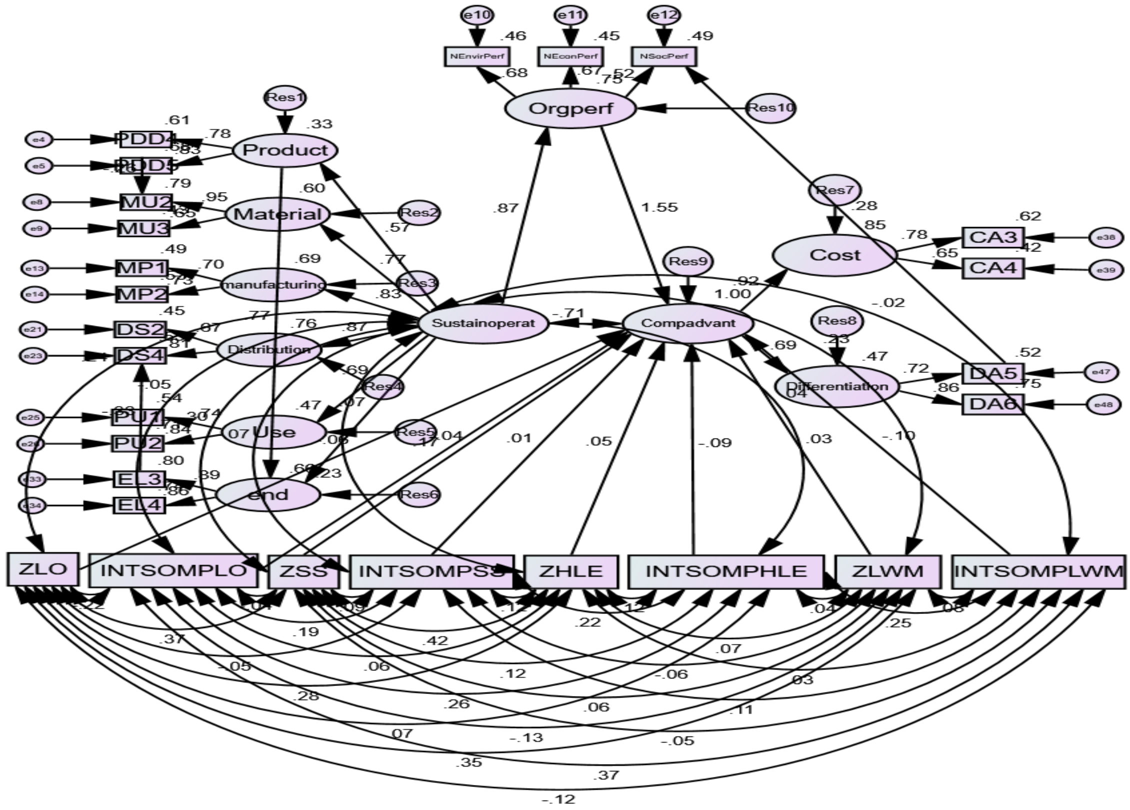

Figure 4.17 Sustainable Operations Management Practices, Firm Characteristics, Organizational Performance and Competitive Advantage

Chi-square = 318.445, DF = 274, CMIN/DF = 1.162, Probability = 0.033, RMSEA = 0.033, TLI = 0.954, CFI = 0.964, NFI =0.800, GFI =0.871, AGFI =0.822

Key:
Sustainableoper = Exogenous latent construct (sustainable operations management practices)
Product, Material, Manufacturing, Distribution, Use, End = A set of six items to measure SOMPs
PDD4 and PDD5 = A set of two items to measure product design and development
MU2 and MU3 = A set of two items to measure material use
MPI and MP2 = A set of two items to measure manufacturing process
DS2 and DS4 = A set of two items to measure distribution
PU1 and PU2 = A set of two items to measure product use
EL3 and EL4 = A set of two items to measure end-of-life
e4, e5, e8, e9, e13, e14, e21, e23, e25, e28, e33 and e34 = Error in measurement for items PDD, MU, MP, DS, PU and EL.
Compadvant = Endogenous latent construct (competitive advantage)
Cost and differentiation = A set of two items to measure competitive advantage
CA3 and CA4 = A set of two items to measure cost advantage
DA5 and DA6 = A set of two items to measure differentiation advantage
e38, e39, e47 and e48 = Error in measurement for items CA3, CA4, DA5 and DA6
ZLO = Length of operation

INTSOMPLO = Interaction effect of SOMPs and length of operation
ZSS = Staff size
INTSOMPSS = Interaction effect of SOMPs and staff size
ZHLE = level of education
INTSOMPHLE = Interaction effect of SOMPs and level of education
ZLWM = Length of working in manufacturing
INTSOMPLWM = Interaction effect of SOMPs and Length of working in manufacturing
Res1, Res2, Res3, Res4, Res5, Res6, Res7, Res8, Res9 and Res10 = Residuals
Orgperf = Mediating variable (organizational performance)
Nenvirperf, Neconperf and Nsocperf = A set of two items to measure organizational performance
e10, e11, e12 = Error in measurement for items Nenvirperf, Neconperf and Nsocperf

Appendices II Introduction Letter

Dear Sir/Madam,

REF: REQUEST FOR PARTICIPATION IN ACADEMIC RESEARCH ON MANUFACTURING FIRMS IN KENYA

I am a student at the University of Nairobi pursuing a PhD in operations management. I am required to do a research in my area of specialization for me to be awarded a degree of Doctor of Philosophy. The topic of my thesis is Sustainable Operations Management Practices, Firm Characteristics, Organization Performance and Competitive Advantage of Manufacturing Firms in Kenya.

I therefore kindly ask you to assist me in this research, by participating in filling the questionnaire attached. I would like to assure you that, this research is purely academic and high degree of confidentiality is assured, only the findings will be made public. Upon completion of the study, a report of the findings will be e-mailed to you on request. Your assistance in this will be highly appreciated. Thank you

Yours faithfully,

REHEMA SWALEHE

University of Nairobi: PhD student

Appendices III Questionnaire

Section A: Characteristics of the Respondents

Please answer the following questions concerning information about your organization.

1. Please select the sector in which your firm belongs (Tick one).

Sector	**Tick**
Pharmaceutical and Medical Equipment	
Metals and Allied	
Textiles and Apparels	
Energy, Electrical and Electronics	
Paper and Board	
Plastic and Rubber	
Chemicals and Allied	
Food and Beverages	
Building, Mining and Construction	
Motor vehicles and Accessories	
Leather and Footwear	
Timber, Wood and Furniture	
Fresh Produce	

2. Is your company registered with any environmental management body? (Tick one).

a) Yes ☐

b) No ☐

3. Does your firm have environmental management department? (Tick one).

a) Yes ☐

b) No ☐

4. Does your firm have an environmental management policy? (Tick one).

a) Yes ☐

b) No ☐

5. How often in a year, do you have meetings on environmental issues?

Frequency of the meetings	**Tick one**
0	
1-2	
3-4	
5 and above	

6. How often in a year, do you get training on environmental management?

Frequency of the trainings	Tick one
0	
1-2	
3-4	
5 and above	

7. How long has your firm been operating?

Range	Tick one
1-5 years	
6-10 years	
11-15 years	
16-20 years	
Above 20 years	

8. What is the size of the staff of your company?

Number of employees	Tick one
1-50	
51-100	
101-150	
151-200	
Above 200	

9. Please indicate your highest level of education by ticking in one of the rows

Level	Tick one
Certificate	
Diploma	
Bachelors	
Masters level	
PhD level	

10. How long have you been working in the manufacturing industry?

Range	Tick one
1-5 years	
6-10 years	
11-15 years	
16-20 years	
Above 20 years	

Section B: Sustainable Operations Management Practices

11. Please tick the extent to which your organization has implemented the listed sustainable operations management practices using the following scale:

(1) No extent at all (2) Small extent (3) Moderate extent (4) Large extent (5) Very large extent

	Product Design and Development	**1**	**2**	**3**	**4**	**5**

1.	Design that reduces or eliminates hazardous materials					
2.	Design that minimizes wastes					
3.	Design that improved resource efficiency/preservation					
4.	Design that improve resource recovery					
5.	Designing for reuse/remanufacturing					
6.	Design that increases sustainability aspect					
	Material Use					
1.	Assortment of materials of low impact					
2.	Use of non-exhaustible supplies					
3.	Assortment of materials of low energy content					
4.	Use of recyclable and recycled materials					
5.	Material weight and volume reduction					
6.	Use of replenishable materials					
	Manufacturing Process					
1.	Production techniques optimization					
2.	Use of alternative techniques of production					
3.	Use of low/clean energy					
4.	Generation of low waste					
5.	Few/clean consumables					
6.	Minimized utilization of auxiliary materials					
7.	Fewer production processes					
8.	Reduce air emissions					
	Distribution					
1.	Efficient system of distribution					
2.	Efficient product transportation					
3.	Less/clean packaging					
4.	Efficient logistics					
5.	Optimization of the weight/volume of the product					
	Product Use					
1.	Low energy consumption					
2.	Use of few/clean consumables					
3.	No energy use					
4.	Use of components consuming low energy					
5.	Use of clean sources of energy					
6.	Use of renewable energy sources					
	End-of-Life					
1.	Optimizing the end of life					
2.	Clean incineration					
3.	Product reuse					
4.	Materials recycling					
5.	Remanufacturing of items					

Section C: Organizational Performance

Environmental Performance

12. Using the scale below, please assess the decrease in environmental effects below that your organization has experience in the last five years

(1) No extent at all (2) Small extent (3) Moderate extent (4) Large extent (5) Very large extent

	Environmental Performance	**1**	**2**	**3**	**4**	**5**
	Environmental Impact Reduction					
1.	Minimization of air emission					
2.	Minimization of waste water					
3.	Minimization of solid wastes					
4.	Reduction in the use of hazardous resources					
5.	Decrease of environmental accidents					
6.	improved of organization's environmental condition					
	Environmental Cost Saving					
1.	Reduction of cost for materials procured					
2.	Reduction of cost for energy intake					
3.	Reduction of fee for waste ejection and					
4.	Reduction of fee for waste treatment					
5.	Reduction of investment					
6.	Decrease of training cost					

Economic Performance

13. Using the scale below, please rate the extent to which you agree with the increase in the economic outcomes below that your organization has experience in the last five years

(1) No extent at all (2) Small extent (3) Moderate extent (4) Large extent (5) Very large extent

	Economic performance	**1**	**2**	**3**	**4**	**5**
	Profitability					
1.	Increased gross profit					
2.	Increased net profit					
3.	Increased return on assets					
	Productivity					
1.	Increased in output					
2.	Increased revenue					
3.	Low levels of inventory					
4.	Low operation cost					
5.	Low number of employees and working hours					
	Operations efficiency					
1.	Decreased equipment failure					
2.	Decreased setup and adjustment time					
3.	Decreased idling and minor stoppages					

4.	Increased production speed					
5.	Decreased defects in process					
6.	Increase production yield					

Social Performance

14. Using the scale below, please indicate the extent to which you agree that the following social outcomes have been enhanced in your organization in the last five years

(1) No extent at all (2) Small extent (3) Moderate extent (4) Large extent (5) Very large extent

	Social performance	**1**	**2**	**3**	**4**	**5**
	Health and safety					
1.	Advanced health status					
2.	Rise in life expectancy					
3.	Rise in health life years					
	Employment					
1.	Retention and recruitment of staff					
2.	Good staff relation					
3.	Employees productivity levels					
	Education					
1.	Human capital development					
2.	Training and improvement of employees					
3.	Availability of education funding for sustainability courses					
	Well- being					
1.	Improved employee satisfaction					
2.	Conducive working environment					
3.	Decent wages for the employees					
4.	Improved welfare programme					
5.	Improved community relation and involvement					
6.	Improved employee motivation					

Section D: Competitive Advantage

15. Please indicate the extent to which you agree with the following competitive advantage measures that your organization has experience in the last five years

(1) No extent at all (2) Small extent (3) Moderate extent (4) Large extent (5) Very large extent

	Competitive Advantage	**1**	**2**	**3**	**4**	**5**
	Cost advantage					
1.	Increased level of experience engineering of manufacturing process					
2.	Large scale/efficient supply chain					
3.	Minimized operations time					

4.	Tight cost and overhead control					
5.	Vigorous pursuit of cost reduction in all areas of operation					
6.	High capacity utilization					
7.	Technological advantages					
	Differentiation advantage					
1.	Improved product quality					
2.	High technology and innovativeness					
3.	Improved brand image					
4.	Improved product design features					
5.	Increased firm reputation					
6.	Improved customer service					
7.	Premium prices for the products					

THANK YOU

Appendices IV Manufacturing Firms Registered by Kenya Association of Manufacturers

Sector	**Firm**
Pharmaceutical and Medical equipment	**10**
	African Cotton Industries Ltd
	Alpha Medical Manufacturers Ltd
	Autosterile (EA)
	Elys Chemical Industries Ltd
	Glaxo Smithkline Kenya Ltd
	Medivet Products Ltd
	Osschemie (K) Ltd
	Pharmaceutical Manufacturing Co. (K) Ltd
	Revital Healthcare (EPZ) Ltd
	Vetcare Kenya Ltd
Metals and Allied	**32**
	African Marine & General Engineering Co. Ltd
	Agro-Irrigation & Pump
	Allied East Africa Ltd
	Alloy Steel Casting Ltd
	Apex Steel Ltd

	ASL Ltd- Steel Division
	ASP Company Ltd
	Athi River Steel Plant Ltd
	Brollo Kenya
	Container Technology Ltd
	Cook 'N Lite Ltd
	Corrugated Sheets Ltd
	Doshi & Company Hardware Ltd
	East Africa Spectre Ltd
	East African Foundry Works (K) Ltd
	Friendship Container Manufacturers Ltd
	Insteel Ltd
	Iron Art Ltd
	Kaluworks Ltd
	Load Trailers
	Nail & Steel Products Ltd
	Naline Steel Works
	Narcol Aluminium Rolling Mills Ltd
	Southern Engineering Co. Ltd
	Standard Rolling Mills Ltd
	Steel Structures Ltd
	Tarmal Wire Products Ltd

	Technosteel Industries Ltd
	Tononoka Steel Ltd
	Vicensa Investments Ltd
	Warren Enterprise Ltd
	Wire Products Ltd
Textiles and Apparels	**24**
	Adpack Ltd
	Brilliant Garments EPZ Ltd
	Chalange Industries Ltd
	Fantex (K) Ltd
	Kapric Apparels EPZ Ltd
	Ken- Knit (Kenya) Ltd
	Kenya Trading (EPZ) Ltd
	Kikoy Mall
	Le Stud Ltd
	Leena Apparels Ltd
	Mills industries Ltd
	New Wide Garments (K) Ltd
	Oriental Mills Ltd
	Panah Ltd
	Penny Galore Ltd
	Simba Apparels EPZ Ltd

	Soko EPZ Ltd
	Long- Yun Ltd
	Straightline Enterprises
	Summit Fibres Ltd
	Sunam Shakti
	Tarpo Industries Ltd
	United Aryan (EPZ) Ltd
	World of Kikoys
Energy, Electrical and Electronics	**19**
	Asano International Ltd
	Assa Abloy East Africa Ltd
	Avery East Africa Ltd
	Biogas Power Holdings (EA) Ltd
	Daima Energy Service Ltd
	East Africa Cables Ltd
	Kenwest Cables Ltd
	Manufacturers & Suppliers (K) lTD
	Marshall Fowler (Engineers)
	Metsec Cables Ltd
	Optimum Lubricants Ltd
	Schneider Electric Ltd
	Powerex Lubricants Ltd

	Protel Studios
	Roka industries Ltd
	Siera Cables East Africa
	Sollatek Electronics (Kenya) Ltd
	Solimpexs Africa Ltd
	Synergy Lubricants Solutions
Paper and Board	**27**
	Allpack Industries Ltd
	Bag and Envelope Converters
	Carton Manufacturers Ltd
	Chandaria Industries Ltd
	Colour Packaging Ltd
	Colourprint Ltd
	Digital Hub Ltd
	Dodhia Packaging Ltd
	East Africa Packaging Industries Ltd
	Economic Industries Ltd
	Elite Offset Ltd
	General Printers Ltd
	Guaca Stationers Ltd
	International Paper & Board Supplies Ltd
	Kartasi Industries Ltd

	Kenafric Diaries Manufacturers Ltd
	MFI Ultra Print Ltd
	National Media Group Ltd- Printing Plant
	Packaging Manufacturers (1976) Ltd
	Paperbags Ltd
	Printpak Multi Packaging Ltd
	Ramco Printing Works Ltd
	Rushabh industries Ltd
	Skanem Interlabels Nairobi Ltd
	Taws Ltd
	The Rodwell Press Ltd
	Tissue Kenya Ltd
Plastic and Rubber	**30**
	Africa PVC Industries Ltd
	Canaaneast Company Ltd
	Coninx Industries Ltd
	Dynaplas Ltd
	Eslon Plastics of Kenya Ltd
	Flair Kenya Ltd
	Jumbo Quality Products
	Kenya Suitcase Manufacturers Ltd
	Kwality Packaging House Ltd

	L.G Harris & Co. Ltd
	Malplast Industries Ltd
	Nakuru Plastics
	Packaging Masters Ltd
	Polythene Industries Ltd
	Pyramid Packaging
	Raffia Bags (K) Ltd
	Rubber Products Ltd
	Sammer Africa Ltd
	Sanpac Africa Ltd
	Shiv Enterprises (E) Ltd
	Signode Packaging Systems Ltd
	Silafrica Kenya Ltd
	Silpack Industries Ltd
	Singh Retread Ltd
	Torrent East Africa Ltd
	Umoja Rubber Products Ltd
	Uni-plastics Ltd
	Vectus Kenya Ltd
	Vyatu Ltd
	Zaverchand Punj Ltd
Chemicals and Allied	**30**

	Basco Products (K) Ltd
	Beiersdorf East Africa Ltd
	BOC Kenya Ltd
	Canon Chemicals Ltd (Former United Chemicals) Ltd
	Carbacid (CO2) Ltd
	Cooper K- Brands Ltd
	Coral Paints Ltd
	Crown Paints (Kenya) Ltd
	Darfords Enterprises Ltd
	Desbro Kenya Ltd
	Diversey Eastern & Central Africa Ltd
	Eastern Chemicals Industries Ltd
	Elex Products Ltd
	Enviro-Hub Holdings Ltd
	Henkel Polymer Company
	Interconsumer Products Ltd
	Kamili Packers Ltd
	Kuza Project
	Kel Chemicals Ltd
	Maroo Polymers Ltd
	MEA Ltd

	Pan Africa Chemicals Ltd
	Rok Industries Ltd
	Shreeji Chemicals Ltd
	Superfoam Ltd
	Tropikal Brand (Afrika) Ltd
	Unilever East Africa
	Vitafoam Products Ltd
	Westminister Paints and Resins Ltd
Food and Beverages	**78**
	Agro Chemical and Food Company Ltd
	Almasi Beverages Ltd
	Alpha Grain Millers Ltd
	Alpine Coolers Ltd
	Aquamist Ltd
	Bakers Corner Ltd
	Beverage Service (K) Ltd
	Bidco Africa Ltd (Formally Bidco Oil Refineries Ltd)
	British American Tobacco Kenya Ltd
	Brookside Dairy Ltd
	Brown Biashara Ltd
	Bunge East Africa Ltd

	C. Czarnikow Sugar East Africa Ltd
	Cadbury Kenya Ltd
	Capel Food Ingredients
	Chai Trading Company Ltd
	Chemelil Sugar Company Ltd
	Chirag Kenya Ltd
	Coastal Bottlers Ltd
	CoffTea Agencies Ltd
	Tropical Heat Limited (formerl Deepa Industries Ltd
	Del Monte Kenya Ltd
	Dutch Water Ltd
	East African Breweries Ltd
	East African Sea food Ltd
	East African Seed Co. Ltd
	Eldoret Grains Ltd
	Elle Kenya Ltd
	Erdemann Co. (K) lTD
	Global Tea & Commodities (K) lTD
	Gold Crown Foods (EPZ) Ltd
	Gonas Best Ltd
	Highlands Canners Ltd

	Italian Gelati and Food Produce Ltd
	Juja Coffee Exporters
	Kabianga Dairy Ltd
	Kedsta Investment Ltd
	Kenafric Industries Ltd
	Kenchic Ltd
	Kenya Nut Company Ltd
	Kenya Seed company Ltd
	Kenya Tea Development Agency
	Kenya Wine Agencies Ltd
	Kevian Kenya Ltd
	Koba waters Ltd/ Bromhill Springs Water
	Kuguru Food Complex Ltd
	Manji Food Industries Ltd
	Mastermind Tobacco (K) Ltd
	Menengai Oil Refineries Ltd
	Milly Fruit Processors Ltd
	Miritini Kenya Ltd
	Mombasa Maize Millers
	Mzuri Sweets Ltd
	Nairobi Bottlers Ltd
	Nairobi Flour Mills Ltd

	NesFoods Industries Ltd
	Norda Industries Ltd
	Pearly LLP
	Pearl Industries Ltd
	Pembe Flour Mills Ltd
	Pride Industries Ltd
	Proctor & Allan (E.A) Ltd
	Promasidor Kenya Ltd
	Pwani Oil Products Ltd
	Razco Ltd
	SBC Kenya Ltd
	Supa Snacks Ltd
	Supa Sweets Ltd
	Sweet Rus Ltd
	Trufoods Ltd
	T.S.S Grain Millers Ltd
	Unga Group Ltd
	United Distillers and Vintners
	Valuepak Foods
	Vava Coffee Ltd
	W.E. Tilley (Muthaiga) Ltd
	Wringley Company (E.A) Ltd

	Zheng Hong (K) Ltd
Building, Mining and Construction	13
	ARM Cement Ltd
	Bamburi Cement Ltd
	East African Portland Cement Company
	Flamingo Tiles (Kenya) Ltd
	Kay Salt Ltd
	Kemu Salt Packers Production Ltd
	Kenya Builders & Concrete Ltd
	Kurawa Industries Ltd
	Mombasa Cement Ltd
	Saj Ceramics Ltd
	Savannah Cement Ltd
	Space and Style Ltd
	Tile & Carpet Centre Ltd
Motor vehicles and Accessories	**20**
	Alamdar Trading Company Ltd
	Associated Battery Manufacturers (EA) Ltd
	Associated Vehicle Assemblers Ltd
	Auto Ancillaries Ltd
	Banbros Ltd

	Bhachu Industries Ltd
	Choda Fabricators Ltd
	Cica Motors
	Foton East Africa Ltd
	General Motors East Africa Ltd
	Impala Glass Industries Ltd
	Kenya Coach Industries Ltd
	King- Bird (K) Ltd
	Mann Manufacturing Co. Ltd
	Megh Cushion Industries Ltd
	Mustsimoto Motor Company Ltd
	Pipe Manufacturers Ltd
	Theevan Enterprises Ltd
	Toyota Tshusho East Africa Ltd
	Transtrailers Ltd
Leather & Footwear	**3**
	C & P Shoe Industries Ltd
	Macquin Shoes Ltd
	Umoja Rubber Products Ltd
Timber, Wood & Furniture sector	**10**
	Budget Furniture Ltd
	Economic Housing Group Ltd

	Furniture International Ltd
	Little Cribs Ltd
	Major Furniture
	Rosewood Furniture Manufacturers Ltd
	Shamco Industries Ltd
	Timsales Ltd
	Wood Makers (K) Ltd
	Woodtex Kenya Ltd
Fresh produce	**4**
	Aquila Development Co. Ltd
	Fontana Ltd
	Groove Ltd
	Rainforest Farmlands (K) Ltd