



UNIVERSITY OF NAIROBI

**Faculty of Built Environment and Design
Department of Art and Design**

**Designing Sustainable Product-Service System (S.PSS) framework for SME's
in Kenya's fashion industry.**

By:

Teresa Nanjala Lubano

B51/40950/2021

Supervisor:

Dr. Francisca Odundo

Nairobi University, Faculty of Built Environment, Department of Art and Design

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to the Department of Art and Design, University of Nairobi.

Declaration

This thesis is my original work and has not been presented for a degree in any other University.

Signature:



Date:

08.08.2023

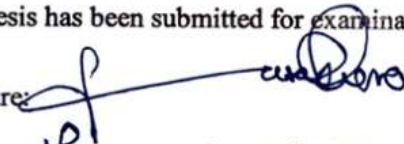
Name: Teresa Nanjala Lubano

Registration number: B51/40950/2021

Supervisor's Approval

This thesis has been submitted for examination with our approval as university supervisors.

Signature:



Date:

8th August 2023

Supervisor: Dr. Francisca Odundo

Signature:



Date:

8th August 2023

Supervisor: Joan Ogake Mosomi

Dedication

I dedicate this thesis to my parents and loving family who have always been there for me and encouraged me along the way.

Col. (Rtd) Nicholas P.M. Lubano and Mrs. Rose Lubano, thank you for your unwavering love, guidance, and sacrifices. You have both called to check on me, offered encouragement, support, and have been the driving force behind my accomplishments. You mentioned that it is never too late to return to school for a Master's degree. I will be always grateful for the values you instilled in me, the opportunities you provided, and the numerous sacrifices you made to ensure my success. This thesis is proof of your unfailing faith in me.

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List of Abbreviations

The table below describes the various abbreviations used thorough out this research project. The listing is in alphabetic order.

Abbreviation	Meaning
BMC	Business Model Canvas
CE	Circular Economy
CSR	Corporate Social Responsibility
DT	Design Thinking
FGD	Focus Group Discussion
KI	Key informant
MSDS	Methods for System Design for Sustainability
MSME	Micro, small and medium enterprises
PSS	Product Service-System
SDGs	Sustainable Development Goals
SDOS	Sustainable Design Orienting Scenario
SME	Small and medium enterprises
S.PSS	Sustainable Product-Service System
ST	Systems Thinking
TAF	Textile, apparel and fashion
WDO	World Design Organization

Definitions

For a better understanding of the study, the following terms are defined in context of this research.

Circular Economy: refers to a framework for developing a resilient economy that provides both long-term prosperity and a way of addressing global concerns. From the fashion point of view, it would mean that the life cycle of the resultant products and services is ‘circular’, meaning that processes such as ‘long lasting design, maintenance, refurbishing (Camilleri, 2018)’, recycling, reuse, repurposing, repair, or downcycling are performed without any environmental harm.

Clothing Life Cycle: refers to the various stages that a garment goes through from its production to its eventual disposal. Normally there are 6 stages which are, the production of fibre, the production of fabric, the production of apparel, retail, transport and distribution, use of the clothing and the end-of-life stage.

Design Thinking: The term was first pioneered by IDEO’s co-founders David Kelley and popularized by Tim Brown. Design Thinking is a human-centered design philosophy and approach to problem-solving and innovation.

Design for sustainability transitions: focuses on the transformation of socio-technical systems through technological, social, organizational and institutional innovations (Ceschin, Gaziulusoy, 2020)

Eco-efficiency: We define an eco-efficient business model as one that delivers more value through technological and process innovations and at the same time decreases resource use and environmental effect across the product or service's life cycle. The word is associated with design management and sustainability.

Ecological Impact: refers to the consequences that human actions and natural occurrences have left behind on living things and their environment (Glossary of Environment Statistics, 1997).

Life Cycle Design: Refers to;

The environmental goal to reduce material and energy consumption while mitigating the negative effects of emissions and waste, both in quantity and quality. This includes assessing the environmental impact of a product's complete life cycle at each stage using tools such as Life Cycle Assessment (LCA) in relation to a given functional unit. (Vezzoli 2018; Azzi et al. 2020).

Social ethical (also a substitute for social cohesion and equity): refers to a collective's social cohesiveness and collaboration, as shown by the attitudes and actions of its members. Resilient

social ties, a strong emotional bond between individuals and the community, and a clear emphasis on the good of the whole are traits of a cohesive society (Dragolov et al. 2016: 6; as cited by Delhey et al, 2018).

Sustainable Fashion: a business that encompasses social issues, such as improvements in working conditions and remuneration for workers, as well as environmental ones, including the reduction of the industry's waste stream, and decreases in water pollution and contributions to greenhouse gas emissions (UN Alliance for Sustainable Fashion, 2022 (SDG 6, 8, 12)).

Sustainable Product-Service System (S.PSS): refers to;

An offer model providing an integrated mix of products and services that are together able to fulfil a particular customer demand (to deliver a “unit of satisfaction”), based on innovative interactions between the stakeholders of the value production system (satisfaction system), where the ownership of the product/s and/or its life cycle responsibilities remain by the provider/s, so that the economic interest of the providers continuously seek new environmentally and/or socio-ethically beneficial solutions (Vezzoli et al., 2018).

Sustainability: Adopted from the UN in its Agenda for Development (1997), sustainability is linked to three dimensions; economic development, social development and environmental protection. It refers to a multidimensional undertaking to raise the standard of living for everyone in society.

Systems Thinking: Refers to a method of problem-solving that enables designers to adopt a holistic viewpoint in which parts of bigger systems are seen as interconnected portions rather than separate entities. Therefore, it is a strategy for solving problems that can deal with the inherent complexity of societal issues.

Designing Sustainable Product-Service System (S.PSS) framework for SME's in Kenya's fashion industry.

Abstract

The fashion industry value chain activities are having a significant negative environmental and social impact across the globe. In order to effectively reduce their environmental harm, a new breed of small and medium-sized enterprises (SMEs) in Kenya's fashion sectors are designing business models that are more conscious of the impact on the environment and human rights. This study is inspired by systems thinking and design thinking. The study looks at how Kenyan SMEs in the fashion industry are orienting their businesses toward sustainable goals through the use of a Sustainable Product-Service Systems (S.PSS) approach. There is currently a lack of understanding regarding how SMEs are adopting and applying S.PSS, particularly in the African context. To shed light on this gap, the researcher uses multiple case design to study the system innovations of three Kenyan fashion-based SMEs. Using descriptive qualitative research methods, the researcher administers a Business Model Canvas and applies the *Methods for System Design for Sustainability (MSDS)* (Vezzoli et al., 2022) design steering tools to determine their eco-efficient and social ethical orientation to bring to light the systemic relationships between stakeholders, economic activities, material & technical resources and information flow that deliver sustainable outcomes. The resultant was the development of an S.PSS framework. The research was conducted in Nairobi, Kenya. The main contribution of this study was to holistically provide the necessary understanding of how managers of SME fashion companies - in emerging, low to middle-income economies, system designers, engineers, and allied practitioners can adopt and implement a system innovation approach that reduces environmental impacts, unlocks opportunities within fashion value chains and the transition to a more sustainable future.

Keywords: Sustainable Product-Service System, fashion, eco-efficiency, social ethical, business model, Kenya

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1.0 Introduction

Various scholars and experts have proven that the fashion industry contributes significantly to global environmental pollution at every point of the supply chain (Azzi et al., 2019; Abbate et al., 2022). Accelerated production and consumption of clothing can be attributed to rapid population growth, increasing global incomes, and higher living standards (Shirvanimoghaddam et al., 2020). Particularly in the Global North with the ripple effect being felt in the Global South, clothing firms are developing and producing for 'fast fashion' through obsolescence and early disposal, allowing for quick profits, rather than addressing how design and production might take client wants and sustainability into account (Kozłowski et al., 2018). Because of this business strategy, the textile, apparel, and fashion (TAF) industries are among the most polluting in the world (Grazzini et al., 2021), generating a massive amount of clothing waste (Chan et al., 2020). With climate change being a worrisome phenomenon, scientists are proposing that action must be taken now and be accelerated by a factor of ten in the next 50 years for us to reach efficiencies of the general industrialized production and consumption systems. A revealing report (WBCSD, 1996; as cited by Vezzoli et al. 2022, p. 27) suggests that by 2050 the production and consumption systems in industrialized contexts should use 90% less resources than they are doing today.

As a reaction to this, we are starting to witness emergent fashion businesses across the globe that are establishing initiatives and business models that are orienting their business toward sustainable fashion practices. This specific model is known as the Sustainable Product–Service System (S.PSS) model. S.PSS has a growing body of literature driven by the desire to combine economic prosperity and sustainable resource management (Reim, et al. 2015). These approaches are frequently connected with a range of benefits, including reduced environmental impact, increased competitiveness, and increased user value (Monticelli & Costamagna, 2022).

However, knowledge about how companies can adopt and implement S.PSS has remained limited (Reim et al. 2015; Franco, 2017; Vezzoli et al., 2018), especially in the African context, and which is yet to be documented. Furthermore, there is a lack of studies examining the circular business model innovations in the textile, apparel and fashion industries (Henry et al., 2020; Abbate, et al. 2022).

1.1 Background of the study

In today's highly competitive market, fashion production companies are striving to achieve higher user stickiness, profitability and sustainability with more environmental concerns for example a low-carbon strategy (Ma et al., 2017) by providing personalized

products with value-added services (Parida et al., 2014). These companies base their operations on system innovations, commonly referred to as Product-Service Systems (PSS). According to Moro et al (2022), PSS is a business strategy used by firms with the goal of increasing profitability, competitiveness, and sustainability.

Carlo Vezzoli (2007) ‘a godfather of systems thinking’, contends that modern organizations must have a systems perspective for individuals to make the transition to sustainability. Meaning that organizations today need to develop sustainable product and service delivery systems that can simultaneously fulfill unique client wants and aspirations as well as innovative stakeholder interactions that result in eco-efficiency, social equity, and cohesion (pp.8-9). Of note is that S.PSS sits in the constantly evolving design research area called *design for sustainability transitions* (Vezzoli et al., 2008; Ceschin & Gaziulusoy, 2019).

Locally, within the fashion production and consumption industries, Kenya is also starting to witness design for sustainability transitions in practice, particularly driven by small and medium enterprises (SMEs). According to the Ethical Fashion Initiative (2022^a), there are small Kenyan businesses that have sustainable practices built into their value chain and ensure that their production procedures are minimal waste and ecologically conscientious. These businesses are referred to as circular economy (CE) ecosystems. These CE ecosystems significantly increase sustainability in the way ‘fashion and textile items are created, used, and disposed of (Staicu & Pop, 2018)’ over time.

1.2 Problem Statement

From a global point of view, the fashion industry's business methods have extremely detrimental environmental consequences (Pal, Gander, 2018). Moreover, the fashion industry consumes the second most amount of water (Padzior et al., 2017) and accounts for 10% of global carbon emissions, more than the shipping and aviation industries combined (Shrivastava et al., 2021; UN Climate Change, 2018). Despite being valued at \$2.4 trillion (Kongelf, Camacho-Otero, 2020), the fashion sector loses around \$500 billion in value each year due to a lack of collection, limited recycling infrastructure, and the overproduction of clothes (UN Environment, 2019; impacc, 2022).

Kenya alone imports more than 200 million kilograms of used textiles (‘pre-loved’ clothing) each year from Europe, Asia and the USA. Of these imports, 40 percent which is about 74,000 tonnes, ends up being dumped (AfricaNews, 2022a;2022b; texfash, 2022), polluting soils and causing toxic gas emissions (P4G, 2023). Considered textile waste, these imports endanger locally produced goods and textile industries. Furthermore, the report *Poisoned Gifts* by Greenpeace (2022; as cited in texfash, 2022) highlights the various

environmental issues textile waste poses in the country which include; apparel waste clogging waterways, decomposed cloths releasing harmful greenhouse gas such as methane that contributes to climate change and the cheap poly-based fabrics can take hundreds of years to biodegrade.

Therefore, like other industries, fashion sector require a systemic transformation. The consumption and manufacturing methods of the fashion industry must radically change (UNEP, 2019). In a recent Fashion Accountability report, Chernavsky (2022) posits that:

‘...the industry’s efforts have done little to move the needle when it comes to sustainable fashion. Smaller brands could offer some solution... and are leading fashion towards ‘a true systems-change approach’, the only viable way to a sustainable future.’

1.3 Objectives

The research project seeks to achieve its general objective of demonstrating the system innovation interactions and configurations in Kenya’s fashion SMEs that are prioritizing sustainability in their business. Specifically, the project aims:

- 1.3.1 To determine the nature of Sustainable Product-Service System business models, strategies, tactics and glocal exemplars.
- 1.3.2 To examine how Kenyan SMEs in the fashion industry are orienting their businesses towards sustainable fashion, that is, have eco-efficient and socio-ethical benefits.
- 1.3.3 To design and propose a Sustainable Product-Service System framework for Kenyan SME’s in the fashion industry.

1.4 Research Questions

- 1.4.1 How are S.PSS models oriented towards sustainable outcomes?
- 1.4.2 Who are the global exemplars of S.PSS models that operate within the textile and apparel industry?
- 1.4.3 How have Kenyan fashion SME’s oriented their business models towards eco-efficient and socio-ethical design priorities?
- 1.4.4 What can we learn from these sustainable fashion enterprises, the industry, and best practices to inform on the design of a S.PSS framework fit for Kenya’s fashion SMEs?

1.5 Significance of the study

- 1.5.1 ‘Change is the only constant in life’. The designer's role has recently and rapidly evolved in response to the increasing complexity of societal challenges; designers must now become systems thinkers. Systems thinkers deal with transdisciplinary

design issues, such as design strategy, design management, technology management, system innovation, social innovation, as well as sustainability.

1.5.2 The research demonstrates the value that systems design, design thinking and design management bring to innovation in practice.

1.5.3 The research findings can assist designers, entrepreneurs/founders/owners, senior managers, engineers, and associated professionals who are committed to sustainability and socioeconomic development in designing, adopting, and implementing a systems design for sustainable transitions in the fashion sector. This research will enable them to conceptualize and develop business models that transmit the most appropriate value and attractive system design that benefits all stakeholders involved in the value chain.

1.6 Expected solution

This study interrogated the business models of innovative SMEs that seek to champion sustainability and socio-economic development in Kenya's fashion industry. The researcher goes further to utilize the principles, tools and best practices of S.PSS as a yardstick to visualize and evaluate the orientation of these Kenyan SME systems' design. The resultant, was the creation of a system innovation framework for the fashion industry that proposes mechanisms of how to design and implement S.PSS - that unlocks opportunities across the value chain and sustenance.

2.0 Literature Review

“We must use systems thinking based on what we see in nature because it is a proven success. Also since the environmental challenges we face are, in many cases, products of human system failures, thereby requiring a systems view to solve.” – WDO (2022)

2.1 Theoretical background

Systems thinking is one of the most recent and effective frameworks that designers, innovators, and disruptors have begun to use to address complex environmental concerns (Speck Design, 2022^a). Inspired by this, our theoretical framework presents both a Design Thinking (DT) and Systems Thinking approach. Design Thinking approach is a human-centered approach to problem-solving and innovation that emphasizes empathy, experimentation, and iteration. It is a process that begins with understanding the needs and desires of the end-user and then moves through ideation, prototyping, and testing to arrive at a final solution (IDEO). Today, DT approach has become ubiquitous in designing business

model innovations. Whereas, on the other hand, the Systems Thinking approach is a ‘purposeful system (Russell, 2010)’ that seeks to solve problems by understanding the relationships and interactions between the components of a system rather than isolating and studying individual pieces in isolation. Systems thinkers support this method as a useful way to manage complexity in business modeling.

Therefore, this chapter discusses both paradigms. There are four distinct sections. The first section sets precedence to understanding the significance of design, design practice and their convergent relationships with system design and design management — as a potent catalyst for fostering innovation.

Secondly, the researcher then moves to systems design by offering relevant definitions of Sustainable Product-Service System (S.PSS) and comprehensively defining its various orientations, benefits and limitations.

Thirdly, the researcher presents an overview of the ‘wicked problem’ within the fashion industry from both a local and global perspective.

At the end of this chapter, case studies of successful organizations that have adopted and implemented Sustainable Product-Service System innovations are highlighted. These model enterprises will highlight the vast disparities in system design approaches and design for sustainable fashion strategies between the Global North (what is known) and the Global South (what is mainly unknown and where Kenya is situated).

2.2 Significance of design and systems thinking in shaping a better world

Technological breakthroughs in the twenty-first century have opened up new avenues for addressing humanity's concerns. Along with these improvements, designers, engineers, and associated professionals are faced with increasingly complex, broad, and far-reaching “wicked problems” (Vezzoli et al., 2018, p. xvii). As custodians of the innovation process, designers, inventors, engineers, and entrepreneurs must be acutely aware of the environmental ramifications of their products and outputs.

Stressing the significant role that design and systems thinking plays in promoting a better world and particularly in low and middle-income economies, Prof. Mugendi M’Rithaa, the President Emeritus of the World Design Organization, transdisciplinary industrial designer and educator (Vezzoli et al., 2018 p. xviii) stated:

The opportunity to ideate and develop product-service system solutions significantly contributes towards Africa’s aspirations of producing well-informed future designers, engineers and allied professionals who are committed to sustainability and socioeconomic development in the broadest possible sense.

In retrospect, this is a clarion call for a widespread mindset shift for designers to not only concern themselves with ‘designerly way of thinking’ but also become systems thinkers so as to be able to problem solve for modern-day problems.

2.3 Designing systems for a changing world

In a fast-changing world where change is becoming more intense and complex, our ability to actively influence the intentional evolution of our systems, communities, and society, rather than being passive victims or just observers, is essential (Banathy, 1996). Our ability to steer this revolutionary process and willingness to do so become critical variables in determining the future. Systems design involves collective design participation, ‘requires environmental empathy, is complex and necessary, has do-or-die constraints (Speck Design, 2022^b)’. Since the late 1990s, Banathy (1997) has drawn attention to the often underestimated influence of systems design. She emphasizes that design seeks to visualize the ideal structure of various systems, which can appear in a variety of forms such as abstract systems, physical systems, hybrid systems, man-machine systems, and human activity systems (p. 26), which include organizations and social systems. Notably, human-centred system design is of particular relevance since it encompasses all of these design system kinds and allows people to actively make decisions that affect their daily lives. This approach directs efforts that improve the quality of life and add value to the systems in which we live. According to Papanek (1997; as mentioned on p. 13), design is an essential component of all aspects of life and human activity.

Therefore, it is essential that today’s designers’ hybridize to be design thinkers and systems thinkers. What follows expounds on these constructs offering a description of design practice as it manifests in the contemporary world – as a transdisciplinary construct that cuts across intelligence, analysis, synthesis, choice, communication and interpretation (Warfield, 1990 as cited in Banathy, 1996), empathy, creativity (p. 34) and technological acumen.

2.4 The design practice for tomorrow

At its core, design is about “communication,” which includes not just the objects, services, and experiences themselves, but also the larger context in which these elements exist. Designers undertake actions to communicate or promote the attitudes and views of others in order to achieve good outcomes (Pei, 2016). As a result, people with design expertise and knowledge can actively contribute to the development of new ideas, better solutions, and comprehensive frameworks (Blankenship, 2005). Pei elaborates that;

...designers and design thinkers are able to solve problems, or it can be said that they are more sensitive to detect the needs to change, and they have a better perspective to

look into the possible trends. Finally, they are more capable to communicate and realize these solutions into reality in accordance with modern social and culture contexts. Moreover, (they are able) to promote a new culture of living and acting, which is considered to be more sustainable (2016).

Hence, designers possess an ‘intuitive creative lens’ when viewing the world and therefore are best suited to problem-solving. They have the power to create positive outcomes for all. With the ongoing climate crisis triggering economic shocks, it is imperative that today's designers align themselves to become more strategic, and careful in how they address issues and at the same time keep in mind their designs’ short, medium and long-term ecological impact.

Most important to this discourse is the acknowledgment that the researcher bases her research on this *extended meaning(s) of design* in relation to system innovation. Human-centered design, inclusive design, product design, service design, system design *for sustainability*, strategic design, business modeling, design management, fashion design, and experience design are some of the design domains within design management, design thinking and systems thinking that inform this research.

2.5 Design strategy as a catalyst for innovation

In relation to the research topic, there are three potential avenues through which design strategy can foster innovation. The first is strategic design, which finds chances to create more inventive ‘access to market’ solutions by exploiting the globally interconnected network while also leveraging the rich cultural contexts strongly embedded in local communities to better cater to their demands (Pei, 2016).

Secondly, the human-centered design approach empowers designers to act as catalysts, facilitating business leaders, local communities, and even engaged citizens to embark on innovative initiatives from both local and global standpoints (Pei, 2016).

Third, strategic design is considered a helpful strategy for managing the corporate innovation process because it effectively resolves the delicate balance between exploration and exploitation (Verganti, 2003; as cited in Pei, 2016).

All three strategies are necessary and ought to be applied by system designers for the promotion of new, intuitive innovations, that engage, listen and contextualize various users’ needs that deliver meaningful outcomes for all stakeholders within an ecosystem.

2.6 Relationships between Design, Design Management and Design Thinking

In order to appreciate the *extended design paradigm*, and its associated relationships in business (and innovations within it), a thorough understanding of its relationships with design management and design thinking is necessary.

Since the 1960s, design management (DM) has been generally acknowledged as a strategic resource in business, enabling product differentiation, effective design project management, and the production of brand value (Farr, 1965; Kotler & Rath, 1984; Cooper & Press, 1995). With the growth of Industry 4.0, characterized by the metaverse, and the rise of climate change concerns, technical advancements have gained significance, with creativity and knowledge playing crucial roles (Manzakoglu, Oraklibel, 2021). Cooper et al. (2009) underline the importance of design management and design thinking in developing new goods, services, and business models to attain global market competitiveness.

According to the Design Management Institute (DMI, 2021^b), design management traditionally applies a design thinking approach to produce appealing goods and services that engage with customers, resulting in financial rewards and brand loyalty. Specifically, “thinking of design,” “thinking about design,” and “thinking through design” refer to several actions within the field of design thinking and design management (Cooper et al., 2009).

Figure 1 depicts how modern designers should progress from an educational understanding of the scope of design (and its principles) to a more integrated and transformative level; design management in practice. From a practical standpoint, design management can be defined as the incorporation of design into management processes, the importance of design in product development, and the designer's role in improving communication between engineers and marketers (Manzakoglu & Oraklibel, 2021).

This integrated approach again, demonstrates the marriage between design thinking, design management, and emergent design disciplines (such as experience design, service design), signals the necessity for today's designers, innovators and business leaders to become ‘hybrid’ activators of innovation in order to be frontline responders in addressing real business problems.

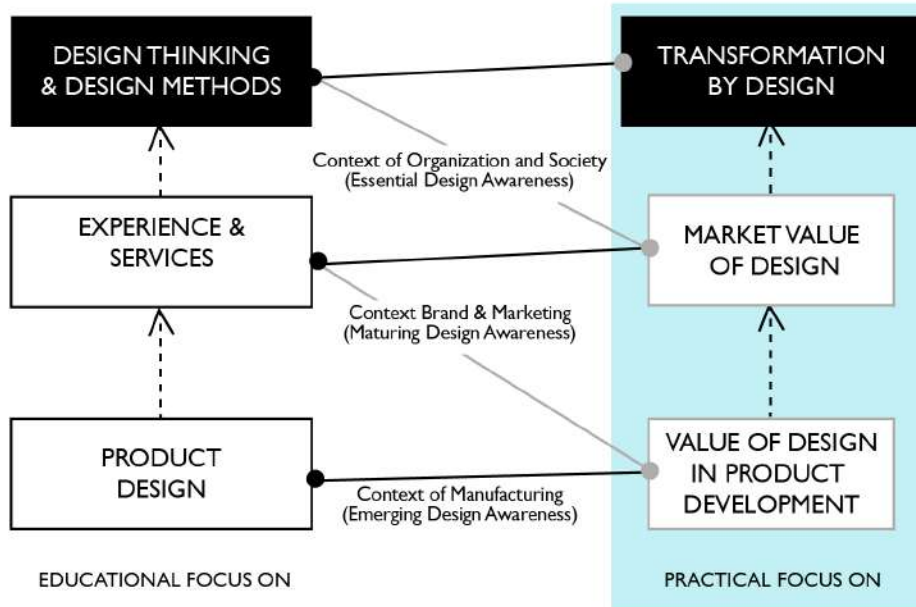


Figure 1: Integration of product design, experience and service design and design thinking in design management research (Adapted and redrawn from Cooper et. al., 2009; as cited in Manzakoglu & Oraklibel, 2021).

2.7 Design Thinking and its relationship with systems design

It is critical to distinguish between two major discourses within design thinking in order to establish clarity and avoid confusion. There are now two major perspectives: management discourse and design discourse (Johansson-Sköldberg et al., 2013, pp. 123-124; as cited in Kupetz, 2019). It is critical to emphasize that this study will address and integrate both of these discourses.

Herbert Simon's "Sciences of the Artificial" (1969; as cited in Kupetz, 2019) served as the foundation for the design discourse in the 1960s. The emphasis is mostly on research and scientific investigation within the discipline of design itself, including topics related to the arts, craftsmanship, and object aesthetics. According to Johansson-Sköldberg et al. (2013), this is referred to as “designerly thinking,” which entails theoretical reflection and interpretation of practical design work. It entails learning how designers think, address challenges, and use their expertise during the design process.

Furthermore, designers are expected to consider three critical aspects simultaneously in traditional design thinking: 1) understanding human needs and envisioning improved ways of living, 2) utilizing available material and technical resources, and 3) navigating the constraints and opportunities associated with a project or business (Tschimmel, 2012). This cognitive

process, known as "abductive thinking," entails combining these three elements. It requires designers to demonstrate a blend of analytical and sympathetic thinking, rationality and emotionality, methodical and intuitive approaches, and the capacity to transition between planned tactics and spontaneous actions (Pombo & Tschimmel, 2005; as cited in Tschimmel, 2012). This means that design thinking has much to offer when it comes to innovation management. But what had largely remained unknown (to managers) was the value that design thinkers (or thinking) brought to innovation in practice.

In the present context, Design Thinking is recognized as a multifaceted thinking process that involves the generation of new possibilities and the incorporation of design culture and methods into domains such as business innovation (2012). It is now written in uppercase to indicate its status as a management discourse. Design Thinking (Figure 2) is characterized as "a system that utilizes the designer's sensibility and methods to align people's needs with what is technologically feasible and can be converted into consumer value and market opportunity" (Brown, 2008, p. 86). In the contemporary Design Thinking Movement, it is described as a holistic, problem-solving approach that is nonlinear, (evidenced in works by Brown, 2009; Martin, 2009; Liedtka & Ogilvie, 2011), characterized as a "system of overlapping spaces" (Brown & Wyatt, 2010: 33) and an iterative process (Stickdorn & Schneider, 2010: 122; as cited in Tschimmel, 2012).

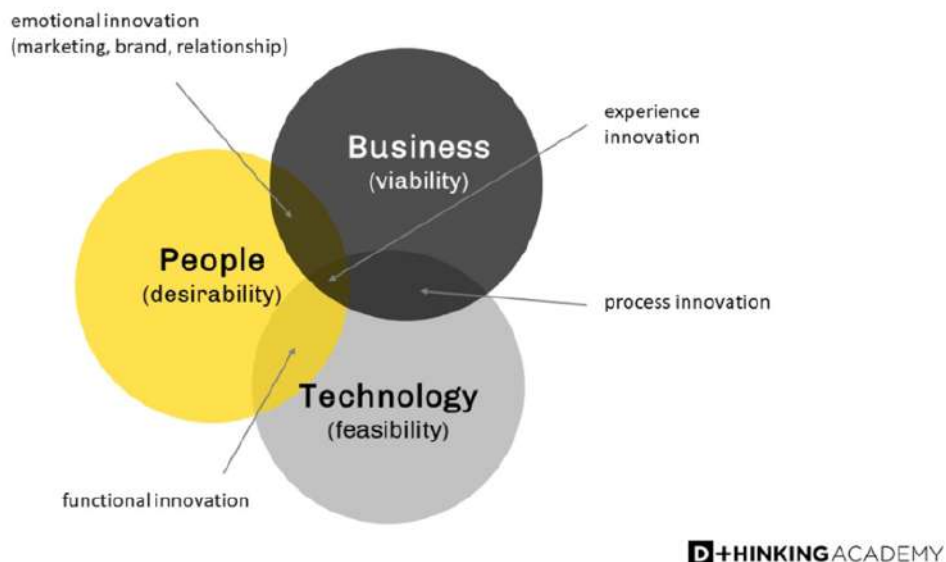


Figure 2: The Design Thinking framework by Tim Brown (2009). Source: D.Thinking Academy (<https://www.dthinking.academy/blog/the-approach-to-innovate-design-thinking>)

In summary, Design Thinking can be an effective and holistic tool for designing for 1. innovation and 2. business success. It is a catalyst for innovation processes (Tschimmel, 2012). This results in business transformation, evolution, and the development of new products and services. Understanding the relationships of these three disciplines; design, its strategies, Design Thinking and design management enables us to now analyze *systems design for sustainability*. This is really where innovation in practice lies.

2.8 Introduction and definitions of system design for sustainability

2.8.1 Defining sustainability

Sustainability has been associated with the pillars; People, Planet and Profit. It is acknowledged as an important concept in supporting the integration of the United Nations' 17 Sustainable Development Goals (SDGs) outlined by the United Nations Development Programme (UNDP, 2015; as cited in Silveria, Reis, 2022). In the open paper by Kuhlman and Farrington (2010) they define sustainability as:

“A multidimensional undertaking to achieve a higher quality of life for all people. Economic development, social development and environmental protection are interdependent and mutually reinforcing components of sustainable development (United Nations, Agenda for Development, 2015).”

In the realm of sustainability, innovation is defined as the result of company-wide innovation activities aiming at the sustainable design of products, processes, and services (Rauter et al., 2019; Tsai and Liao, 2017; as referenced in Galatti, Baroque-Ramos, 2022). Achieving key sustainability goals requires research and innovation at both technological and social levels (Stahel, 2016).

Therefore, *system design for sustainability* (Vezzoli, 2022) involves;

The design of Systems of Products and Services that create a holistic approach that delivers a satisfying experience through innovative interactions among local stakeholders. In this approach, the ownership of products or life cycle responsibilities and costs remains with the providers, incentivizing them to continually seek environmentally and socially beneficial solutions that are accessible to all while also providing economic benefits.

Therefore, the three components of sustainability; “S.E.E”, are evidently interrelated and mutually reinforcing for one to say that their business is a sustainable systems innovation.

2.8.2 Defining a Product-Service System (PSS)

The initial and widely referenced definition of Product-Service Systems (PSS) is put forth by Goedkoop et al. (1999), who asserts that “PSS is a marketable set of products and services capable of jointly fulfilling a user's need” [emphasis added]. Manzini and Vezzoli (2003) conceptualize PSS as:

an innovative approach that shifts the focus from solely designing and selling physical products to designing and selling a comprehensive system of products and services. This system aims to collectively meet specific customer demands, where customer satisfaction is achieved through the provision of services rather than just the supply of a product.

According to Pan et al. (2019), the definition of Product-Service Systems (PSS) has since undergone substantial development and is now associated with sustainability, dematerialization, and strategic or business model innovation aimed at boosting competitiveness. The importance and difficulties of developing sustainable business models that successfully handle environmental, economic, and social issues were highlighted by Bocken et al. (2014). These triple bottom lines are essential for assessing the PSS's overall advantages and emphasize how important it is for all three components to work together (Lee et al., 2012).

Figure 3 indicates the five tactics that are used to implement PSS effectively, namely, contracts, marketing, product and service design, sustainability, and networks (Reim et al., 2015). Tactics are the final operational decisions that a corporation makes after determining its business model (Casadesus-Masanell, Ricart, 2010). While business models outline the process of creating, delivering, and collecting value, tactics determine how much value is generated and collected when a certain business model is implemented.

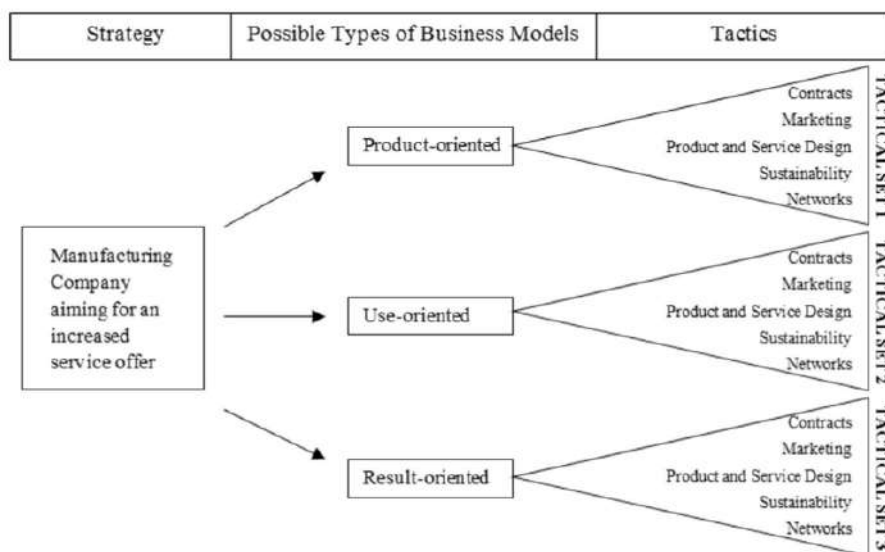


Figure 3: Relationships among strategy, business models, and tactics for PSS. Source; Reim et al., 2015.

In as much as PSS reveals high potential for balancing economic, social, and environmental benefits (Sundin and Bras, 2005; Tukker, 2004; Mont, 2002), not all PSS are sustainable (Reim et al, 2015; Franco, 2017; Vezzoli et al, 2018).

Therefore, what follows is a definition and interrogation of Sustainable Product-Service Systems, and how they are implemented.

2.8.3 Defining Sustainable Product-Service Systems (S.PSS)

Dr. Vere, head of Design Brunel University, London (Vezzoli et al, 2018), touts S.PSS as an economically viable, environmentally and socio-ethically sustainable business model. A Sustainable Product-Service System (S.PSS) can be defined as;

“...an offer model providing an integrated mix of products and services that are together able to fulfil a particular customer demand (to deliver a “unit of satisfaction”), based on innovative interactions between the stakeholders of the value production system (satisfaction system), where the ownership of the product/s and/or its life cycle responsibilities remain by the provider/s, so that the economic interest of the providers continuously seek new environmentally and/or socio-ethically beneficial solutions’ (Vezzoli et al 2018).”

Valued for its dynamism and applicable relevance within emerging and developing contexts, the merits of the S.PSS value network cannot be underestimated. Furthermore, Sustainable Product-Service Systems (S.PSS) models hold the potential of enabling genuine sustainable production and consumption while easing the transition to a circular economy (CE). According to the Ellen MacArthur Foundation (2021), circular concepts include designing to avoid waste and pollution, regenerating natural systems, and extending the lifespan of materials.

Revered for being the most promising of business models (Bretz et al, 2001; Charter, Tischuner, 2001; Cooper, Sian, 2000; Mazini, Vezzoli, 2001; Mont, 2004; Zaring, 2004 as cited in Vezzoli et al, 2018), S.PSS enables the expansion to access of goods and services to low- and middle-income contexts, thereby improving social equity and cohesion.

Figure 4. describes how S.PSS moves from the traditional product offer by presenting relevant innovations happening at various stages. The first value proposition is a shift from offering just the sell of a specific product to one that enjoins both products and services as the final user satisfaction, otherwise known as a ‘unit of satisfaction’. Second, it shifts the emphasis of innovation away from technological developments and toward improvements in stakeholder

interactions. These interactions are categorized into three main types: product-oriented, user-oriented and results-oriented.



Figure 4: S.PSS: a paradigm shift from traditional product offer. Source designed by Vezzoli et al, 2018

We can therefore conclude that a sustainable S.PSS offers both unique client wants and aspirations coupled with innovative stakeholder interactions that result in eco-efficiency, social equity, and cohesion (pp.8-9, 2007).

2.8.4 Benefits of Sustainable Product-Service System models

Below (Table 1) is a summary of the opportunities and benefits offered by both eco-efficient and socio-ethical product-service systems. S.PSS delivers goods and services that are easily accessible (social-ethical) to even low and middle-income people due to its inherent lower cost-benefit (economic) offering. 7 benefits are cited for eco-efficient system design and 8 benefits are cited for social-ethical system design models with the latter being proposed as a favourable and a feasible model for design and implementation in developing economies.

Type of S.PSS model	Topologies/ Characteristics	Advantages/Benefits
Systems design for eco-efficiency	<ol style="list-style-type: none"> 1. Product-oriented 2. Results-oriented 3. Use-oriented 	<ol style="list-style-type: none"> 1. provides environmental and economically winning solutions (2007, p. 79) 2. design (offer) for the extended lifespan of a product 3. design for heavy use/ durability; 4. design (offer) products that consume the fewest resources while in use; 5. interests to design (offer) that prioritize the efficient and effective utilization of passive and renewable resources;

		<p>6. design prolongation of the useful life of materials through recycling, energy recovery, or composting;</p> <p>7. design (offer) for reduction or elimination of toxic or harmful substances (2018, pp. 46-48);</p>
System design for social equity and cohesion	<p>1. “Satisfaction-system” approach, such as satisfaction design</p> <p>2. “Stakeholder interactions” approach</p> <p>3. “Sustainability-oriented” system approach (2007, p.157)</p>	<p>1. makes goods and services readily accessible to low- and middle-income people;</p> <p>2. design (offer) supporting and enabling the establishment of new businesses in regions or communities with lower income levels;</p> <p>3. design (offer) of durable products that can be used continuously and without unexpected interruptions or failures;</p> <p>4. design (offer) that uses less resources in the use phase;</p> <p>5. reduces/avoids running cost for equipment maintenance, repair, upgrade;</p> <p>6. empowering locally based economies and improving quality of life (2018, pp. 46-48)</p> <p>7. sustainable enterprises that are rooted in local communities and operate within collaborative network structures;</p> <p>8. “facilitates participatory design among different stakeholders to define their relationships and offer systems</p>

		(product, services and communication)” (2007, p. 157)
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Table 1: Summary of benefits of Product-Service System for eco-efficiency, social equity and cohesion. Adapted by author from Vezzoli, 2007; Vezzoli et al, 2018. (2022)

In conclusion, Table 1 demonstrates that S.PSS is a holistic model design system for sustainability with two priority constructs; eco-efficiency and socio-ethical, and may vary from organization to organization depending on the nature of the business. Most importantly, the nature of these system innovations intrinsically promotes winning economic efficiency enjoined with environmental considerations, and/or social cohesion and equity and in so doing encourage local-based sustainably sound outcomes for all stakeholders within its value chain.

2.9 Not all Product-Service System models are sustainable

Although the concept of Product-Service Systems (PSS) is well-documented in academic literature, the sustainable value proposition from a system perspective has not received widespread investigation and understanding (Krissten, Remmen, 2019; Annarelli et al., 2016, Bocken et al., 2014, Kuijken et al., 2017). Various researchers have also cautioned that not all systems of innovation are sustainable (Vezzoli, 2007, p.36; Reim et al., 2015; Vezzoli et al, 2018). This simply means that designers, engineers and managers may model businesses around PSS but not necessarily drive a sustainable agenda within its business. Furthermore, its adoption and implementation are not well-researched.

Table 2 below posited by Yeung and Tielemans (2020) summarizes PSS benefits and drawbacks that one needs to be aware of when studying these system innovations. Further emphasising that PSS’s are not inherently more economically or environmentally sustainable than traditional business models.

Table 2: PSS benefits and drawbacks				
Consumers	Companies	Producers	Employees	Environment
(+) Flexibility (offer on demand) (+) Savings (-) Loss of ownership rights (-) Loss of convenience	(+) Customers attraction (+) Customers loyalty (+) Opportunities for Innovations (-) Additional costs from new activities (-) Extra risks of product deterioration (-) High capital investment	(+) Costs reductions (+) Unique expertise (-) Volume reduction	(+) New jobs for highly skilled people (+) Local employment (-) Dismissal of workers	(+) Reduction and efficiency in production (+) Optimisation of products' usage (+) Reduction in consumption (+) Reduction of psychological obsolescence (-) No direct influence on product design (-) Affordability exacerbating consumption (-) Extra risk of product deterioration

Table 2: PSS benefits and drawbacks. Note: (+) means its a 'positive outcome' and (-) means it's a 'negative outcome'. Source: Yeung, Tielemans (2020, p.11).

As a result, the research will focus solely on the ideal configuration and potential of a *sustainable* PSS model, as they create win-win solutions that enable paired economic development and sustainable resource management while dematerializing economies.

2.10 The textile and fashion industry – An overview

There is consensus across the board that the 'fast-moving, trend driven' (Ciarniene, Vienazindiene 2014; Pal, Gander 2018) textiles, clothing and fashion business are one of the world's most unsustainable industries. The established global production processes cause damaging environmental impacts, significant air pollution, high water consumption (Pal, Gander 2018) as well as contamination, employ high-impact chemicals, generate hazardous waste and violate animal welfare (Pedersen et al., 2018; as cited in Hoffman et al., 2022) are strongly associated with child labour and unsafe working environments (Guardian, 2017; CITI IO, 2017; as cited in Pal, Gander, 2018); and underpayment (Reichart & Drew, 2019). Despite having a \$2.4 trillion market value (Kongelf, Camacho-Otero, 2020), the fashion sector loses \$500 billion annually due to insufficient recycling of clothing and excessive production (UN Environment, 2019).

Furthermore, according to UNEP, the fashion industry is the second-biggest consumer of water and is responsible for 10% percent of global carbon emissions, more than shipping and aviation combined (UN Climate Change, 2018). In a recent Fashion Accountability report,

Chernavsky (2022) wrote, ‘The industry’s efforts have done little to move the needle when it comes to sustainable fashion.’ Smaller enterprises, she claims, can offer some solutions and are moving fashion toward a “true systems-change approach” — the only possible path to a sustainable future. But what does sustainability in fashion mean?

According to Fletcher (2008); Mukendi et al. (2020) respectively;

Sustainability in fashion and textiles fosters ecological integrity, social quality and human flourishing through products, action, relationships and practices of use. [...] it includes the variety of means by which a fashion item or behaviour could be perceived to be more sustainable, including (but not limited to) environmental, social, slow fashion, reuse, recycling, cruelty-free and anti-consumption and production practices.

Various smaller enterprises and emerging fashion brands in both developed markets and developing markets (Nayak et al., 2019) are considering such options available to design green manufacturing processes for their products. Hoffman et al. (2022) argue that these initiatives are typically characterized by their small size, youthfulness, and independence. They disrupt the traditional players in the fashion industry by introducing novel business models and employing innovative production methods, including artisanal craftsmanship and the utilization of sustainable fibres such as organic hemp, cotton, silk.

Various movements and approaches to sustainability in the fashion industry, such as eco-fashion, slow fashion, green fashion, ethical fashion, and sustainable fashion, are gaining traction (Thomas, 2008; Fletcher, 2008). Furthermore, circular economy business models are becoming ubiquitous in developed economies, contributing significantly to the fashion industry's sustainability. For example in Norway, we have brands such as Finn, Prisløs; Italy; Orange Fiber and in the United Kingdom – ContradoUK, PatternBank, and in ‘Northern America – Patagonia, Spoonflower, Society66 (Lubano, 2022)’ and Everlane are some good examples. All these fashion brands have one thing in common, their strategies and system innovations associated with the circular economy aim to eliminate waste and pollution and transition their production practices towards a closed-loop system (Kongelf, Camacho-Otero, 2020).

On the other hand, system innovations such as the S.PSS model are just but emergent in developing markets (Africa). Therefore, this research provides an important yet stimulating discourse that will inform on how system innovations are being adopted and implemented within the African continent. This study specifically looks at the Kenyan market.

2.10.1 The Kenyan textile and fashion industry

According to Osanjo (2020), despite the local government's efforts to spark interest in and consumption of African clothing through a national dress contest, Kenya's fashion sector has not been able to develop and thrive. Kenyans were also supposed to dress in African attire every Friday in order to promote cultural diplomacy through their fashion, (Amolo, 2019). however, these attempts were generally ignored. The majority of Kenyans primarily wear second-hand clothing that enters the market from the Global North and imported ready-to-wear clothing (Lubano, 2023; Infinite Insight, 2022).

Locally, we are seeing a breed of local entrepreneurs who provide high-quality, locally manufactured clothes to supplement these imports. They often cater to customers that value African-inspired attire and well-tailored clothing to be worn during special occasions. These entrepreneurs are the backbone of sustainable fashion (Hoffman et al, 2022). Worth noting is that a few of them are renowned Kenyan fashion entrepreneurial designers who are at the forefront of sustainable fashion who trade locally and abroad. They include, *Katush* by the ethical fashion designer Katungulu Mwendwa (Haute Fashion Africa, 2021), Ruth Abade's fashion brand, *BlackFly* that promotes a social-ethical Pan-African handmade fashion agenda (Konrad Adenauer Stiftung Kenya, 2020) and the transcendent Kenyan fashion brand *KikoRomeo* by Anne McCreath (Reed, 2021). These design houses highlight specific characteristics that begin to establish a Kenyan distinctive fashion aesthetic, such as fabric that is of high quality, has African prints, is versatile and colourful, has a story, and is inspired by locally available cultural artefacts (Osanjo, 2020). They are also small, formal/legitimate businesses that are wholly owned by Kenyans, and locally based in the country that tend to cater to both a local and global market.

However, Kolapo acknowledges that there are problems impeding the growth of the African fashion industry, and more can be done in infrastructure, supply chain and international partnerships. In as much as the textile and fashion industry is rife with issues, it is worth celebrating and promoting the efforts being undertaken (Kolapo, 2017). Some of these developments include the government upgrading textile mills (Nation Media, 2016) such as the Thika Cloth Mills (TCM Company Profile, 2020) and the Kenya Fashion Council emerging as a strong entity mobilizing the fashion industry players towards the realization of a vibrant Kenyan fashion industry (Osanjo, 2020).

2.10.2. Kenya's potential for promoting sustainable textiles and design

From a local point of view, virtually across all demographic groups, 9 out of 10 Kenyans buy *mitumba* (second-hand clothing) (Infinite Insight, 2022). Unlike in West Africa where African-inspired fabric designs are worn on every occasion, Kenya is the opposite. The

norm for Kenyans leans towards purchasing imported ready-to-wear and second-hand clothes, also known as *mitumba*.

What is worrisome is that 40% of these total imported *mitumba* are in such poor condition to resale and therefore ends up in landfills, releases polluting gasses and clogs up waterways. Evidence suggests that a staggering 200 tonnes of textile waste per day gets dumped in Kenya and only a small fraction of this is recycled (texfash, 2022; impacc, 2022).

However, there are some emerging organizations that are championing a circular economy for textile waste in Kenya. *Africa Collect Textiles* is a social enterprise that installs business units for the collection, sorting, recycling, upselling, and reselling of used textiles and footwear in order to create an inclusive textile value chain (impacc, 2022).

In a recent omnibus survey by Infinite Insight (2022) the study revealed that natural cotton fabrics and designs from sub-Saharan Africa are increasingly in demand internationally (Ellen Macarthur Foundation). This is proof that there are some fashion designers/entrepreneurs running SMEs that are producing premium, sustainable textiles and fashion, promote, and ship their products to a global audience.

Furthermore, the Ethical Fashion Initiative (2022^a) verifies that some of the Kenyan fashion-based SMEs mentioned earlier have already incorporated sustainable practices into their value chains, prioritizing low waste and environmentally conscious production processes. These brands are embedding in their businesses sustainable priorities such as energy efficiency, use natural fibres, upcycle/recycle fabrics, connecting to African artisanship & heritage, have a strong commitment to responsible sourcing and traditional sourcing practices (Ethical Fashion Initiative, 2022^b).

Aside from these few professional fashion designers, tailors and eco-conscious fashion SMEs advocating for responsible consumption and production of Kenyan textiles and fashion, little if any academic literature and research exist to suggest how these businesses are set up for scaling sustainable fashion within the region. Therefore, the study of developments in systems innovation for sustainability in Kenya's fashion and textile industry remains a new area open for exploration and interrogation.

2.11 S.PSS model exemplars from the textile and fashion industry

This section describes scenarios and exemplars shaping new narratives and modern business practices in the textile and fashion industry. They are all based on sustainable production and consumption systems, as evidenced by the use of the promising concept of Sustainable Product-Service Systems (S.PSS). Three brands that are spotlighted in this study include: SHOKAY, LIVID and Orange Fiber.

2.11.1 Sustainable fashion social enterprise: SHOKAY

SHOKAY's (Figure 5) business model is an example of a successful and sustainable product-service system within the textile and fashion industry that is driving expressions of cultural sustainability (Pei, 2016). Its business encompasses a huge scale of design domains: product design, service design, business model, design, branding, and experience design. Table 3 gives a summary of the business nature and S.PSS orientation of the brand.



Figure 5: SHOKAY's sustainable fashion enterprise. (left) Tibet herders with raw yak wool, (middle) SHOKAY's logo, (right) model wearing a luxury yak sweater in pink. Source: SHOKAY (2022).

Textile, Apparel and Fashion Business Description	
Brand Name	SHOKAY
Co-founders	Carol Chyau and Marie So
Established	2007
Business Category	Fashion and Textiles
Nature of Business	Product(s) Products: premium/luxury knitwear, yarn, fabric from 'yak' down wool
Provider/s	SHOKAY community-managed enterprise
Customers	International audience
Location	Shanghai & Taipei (Asia)
Website	www.shokaytextiles.com
S.PSS Orientation	
Business Model Type	Product-oriented

Eco-efficient orientation	1. SHOKAY provides environmental and economically winning solutions through the manufacture of high-quality natural ‘yak’ wool fibre, reducing poverty of the local ‘yak’ herders
Social ethical orientation	<ol style="list-style-type: none"> 1. By working with ‘yak’ herders from remote Tibet, the brand provides an enabling environment that supports the establishment of new business opportunities in regions or communities with lower income levels; 2. i) The brand empowers local economies through the preservation of traditional and local skills of communities in Qinghai, China, by ensuring a high quality of combing, cleaning, and sorting the fibre, and ii) enhances the living conditions of remote communities in Qinghai, China; 3. SHOKAY encourages the establishment of new, sustainable enterprises that are rooted in local communities and adopt a network-based organizational structure. These “networked decentralized systems” engage in the collaborative development of scenarios and partnerships among diverse stakeholders, fusing the rich traditional capabilities of the Qinghai communities with cutting-edge design concepts and tactics to support cultural sustainability

Table 3: Concept Description of SHOKAYs S.PSS model. Adapted by author from Pei (2016) and informed by Vezzoli et al. (2007 & 2018).

2.11.2 Clothing designed for long life and sufficiency: LIVID Jeans

LIVID Jeans (Figure 6) is a Norwegian business example that has adopted the product-oriented -service systems design. It has modelled its cycling of resources around the closed-loop resourcing line. Table 4 shares a summary of their S.PSS orientation that are focused on both eco-efficient and social ethical priorities. LIVID describes their brand as a ‘Norwegian cloth brand inspired by Japanese finesse.’ (@lividjeans, 2022).



Figure 6: Livid Jeans label (left); Photo of a LIVID worker sewing jeans. (middle) LIVID finished products (right). Image sources: Nick (2014) www.welldressedad.com. Retrieved 01/12/2022.

Textile, Apparel and Fashion Business Description	
Brand Name	LIVID (Jeans)
Founders	Jens Olav Dankersten
Established	May 2010
Business Category	Clothing label
Nature of Business	Product(s) Products: ethical apparel, classic silhouettes of contemporary Scandinavian designs with two lines; ‘Made in Norway’ and ‘Made in Portugal’. (Robin Denim, 2017)
Provider/s	LIVID, private company
Customers	International audience
Location	Trondheim, Norway, Europe
Website	www.lividjeans.com
S.PSS Orientation	
Business Model Type	Product-oriented
Eco-efficient orientation	<ol style="list-style-type: none"> 1. provides environmental and economically winning solutions (2007, p. 79); offer high quality, products made from 100% ethical fibres (cotton, leather); 2. Source denim fabric from “American and Japanese, English and European mills that produce the highest quality cotton” saving the consumer costs to repair and upgrade frequently;

	<p>3. design (offer) for lifespan extension of product; i) The brand offers first-time repairs as value adds when purchasing jeans (Kongelf, Camacho-Otero, 2020) ii) highest quality workmanship saving the customer damage due to wear and tear and garments that last long before a repurchase is done;</p> <p>4. design for intensive use of product; i) brand sell vintage clothing and provide repair services in their retail locations ii) cycling of resources around closed-loop resourcing line</p>
Social ethical orientation	<p>1. LIVID have only two labels, which are ‘Made in Norway and ‘Made in Portugal’. This provides an enabling environment that supports the establishment of new business opportunities such as outsourcing for community members living within these cities. ii) they also offer trade-in line where one can earn LIVID store credit;</p> <p>2. high quality products guarantee clients sustainable and long-lasting products, that last them a long time. They also offer “three free repairs” and have “limited edition numbering” (Nick, 2014), meaning only small batches of a jeans collection are ever produced;</p> <p>3. The brand workforce resides exclusively within Portugal and Norway borders; a closed-loop model that empowers local communities within the region</p>

Table 4: Concept Description of LIVID’s S.PSS model. Adapted by author from Livid Jeans (2022); Kongelf, Camacho-Otero (2020) and informed by Vezzoli et al. (2007 & 2018).

2.11.3 Producer of ethical fabric from citrus fruit by-products: Orange Fiber

Orange Fiber is an environmentally conscious Italian fashion firm that specialized in designing clothing from citrus juice by-products (Figures 7 and 8). Over 1 million tons of citrus juice is wasted in Italy. Orange Fiber addresses this issue by turning waste juice into cellulose fibers, which are then used to make new innovative fabrics (EIB Institute, 2022; Todeschini et

al., 2017). The brand provides luxurious, high-quality, smooth, silky, lightweight, opaque and shiny textiles to Italian fashion brands and houses (LeNS Europe, 2022). Thanks to their significant investment in innovative bio-based technologies for manufacturing the innovative yarn, Orange Fiber is the world's first and only brand to manufacture a patented material from orange juice by-products (D'Itria & Colombi, 2022). Their dedication to environmental sustainability is admirable.

Table 5 demonstrates a concept description of how Orange Fiber’s business is oriented around sustainable priorities; an exemplar of a product-oriented Sustainable Product-Service System modeled around technological innovation.



Figure 7: Dress made from Orange Fiber’s citrus cellulose yarn. Image source: Smith, 2021



Figure 8: Infographic of Orange Fiber: from orange peel to clothing. Image source: Duarte, 2021.

Textile, Apparel and Fashion Business Description	
Brand Name	Orange Fiber
Founders	Enrica Arena and Adriana Santanocito
Established	May 2014
Business Category	Sustainable fabric brand
Nature of Business	Product(s) Products: woven citrus cellulose yarn and TENCEL™ branded lyocell fibre made of orange and wood pulp
Provider/s	Orange Fiber, private company
Customers	Luxury fashion brands e.g. Concious Exclusive Collection for H&M 2019, Salvatore Ferragamo, and E. Marinella (EIB Institute, 2022)
Awards	Vogue Yoox Challenge, 2021 SIT Social Innovation Tournament by EIB Institute, 2020 Mass Challenge Switzerland, 2016 Global Change Award by H&M Foundation (EIB Institute, 2022)
Location	Italy, Europe
Website	www.orangefiber.it
S.PSS Orientation	
Business Model Type	Product-oriented
Eco-efficient orientation	<ol style="list-style-type: none"> 1. provides environmental and economically winning solutions (2007, p. 79); i) used technology by innovating and producing new yarn (technological innovation) from orange waste; 2. i) by utilizing abundant and renewable orange juice by-products, Orange Fiber's proprietary biobased yarn and textiles are made from sustainably sourced raw materials, promoting a circular bio-based economy. ii) Their production's strength is their ability to amortize expenses and exploit resources by utilizing trash from third-party industries;

	<p>3. 1 kilogram of yarn obtained with Orange Fiber technology requires about 90% less water for irrigation (D'Itria & Colombi, 2022). This suggests that the production process of Orange Fiber yarn involves significantly lower water consumption compared to traditional methods.</p>
Social ethical orientation	<ol style="list-style-type: none"> 1. The brand partners to co-creates and co-design with brands such as H&M to maximize the sustainable performances of the final product; 2. Orange Fiber provides compensation to companies in the agri-food industry that are experiencing challenges in the proper disposal of their waste (D'Itria & Colombi, 2022).

Table 5: Concept Description of Orange Fiber's S.PSS model. Adapted by author from D'Itria & Colombi (2022) and informed by Vezzoli et al., (2007 & 2018).

What is clear is that all of these exemplars are from developed markets. Regardless of the various target audiences and S.PSS business orientations they may have, these examples show Sustainable Product-Service Systems (S.PSS) on the frontline of fostering fashion sustenance in their markets.

What remains to be established is the documentation of the S.PSS innovations within the African context. This research will make an attempt at taking on this research challenge from the Kenya perspective and focus on SMEs in the fashion sector.

2.12 Conceptual framework

Figure 9 displays a conceptual framework based on Systems Thinking and Design Thinking for the research project. It displays the numerous aspects, processes, and tactics under investigation in order to highlight the overarching objective of highlighting system innovation interactions and configurations in Kenya's fashion SMEs that value sustainability

in their business models.

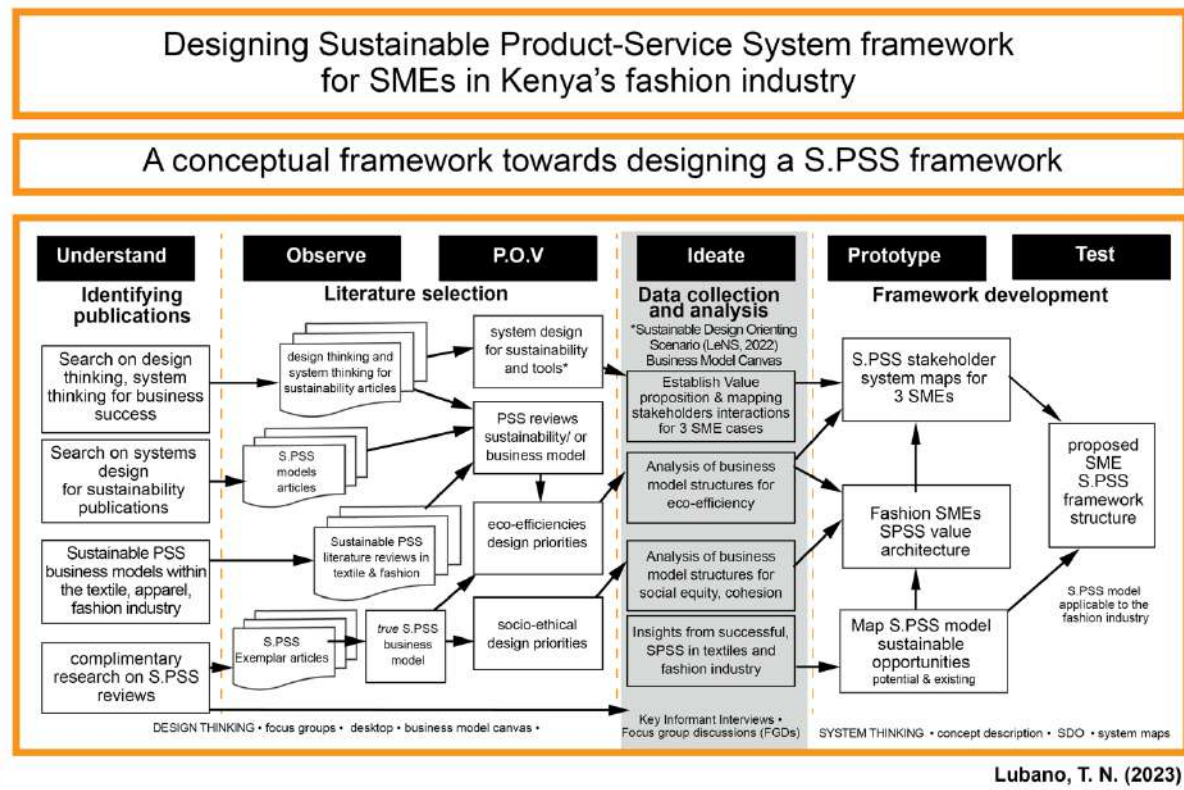


Figure 9: A conceptual framework for designing an S.PSS framework for the Kenyan textile and fashion industry. (2023).

When system designers and thinkers attempt to solve an issue, they utilize a systems approach by methodically (using Design Thinking principles) employing multiple systems skills, strategies, and tools (Jackson 2003 as quoted in da Costa Junior et al, 2019). As a result, in the next chapter, the researcher applies rigor in the selection and application of best practice *systems methodology* oriented toward system design for sustainability for the fashion sector - a model that assumes the best outcomes for this study.

3.0 Methodology

3.1 Research design

Despite increased acknowledgement of the potential benefits of S.PSS, current research indicates a lack of understanding of the sustainable value proposition from a systems viewpoint (Annarelli et al., 2016, Bocken et al., 2014, Kuijken et al., 2017). This knowledge gap is especially visible in Africa, where research in this field is limited. To address this gap, the study will employ a multiple-case descriptive research design. The use of multiple case studies allows for an examination of real-life and contemporary phenomena within their natural settings, aligning with the approach outlined by Yin (1994). The SME cases selected for this

research study will be used to illuminate administrative decisions - expounding on why they were taken, how they were implemented and shed light on what results were achieved in the business so far (Schramm 1971; Yin, 2014). Particularly in the field of S.PSS in the fashion industry, it was thought that a qualitative study design would be appropriate because systems design is still in its nascent years and calls for a more thorough comprehension based on qualitative analysis. (Colucci & Vecchi, 2021; as cited in Abbate et al, 2022).

Pertinent to the study will be to answer these two research objectives/questions:

- 3.1.1 How have Kenyan sustainable fashion SME's oriented their business models towards eco-efficient and socio-ethical design priorities?
- 3.1.2 What can we learn from these sustainable fashion enterprises, the industry, and best practices to inform on the design of a S.PSS framework fit for Kenya's fashion-based SMEs?

The primary data for this study will be gathered through focus group discussions (FGDs). FGDs were selected as the research tool due to their qualitative nature and effectiveness in collecting in-depth data. In an FGD, a small group of participants engages in facilitated discussions led by an external moderator who is trained in guiding the conversation. This approach is preferred by the researcher as it enables the identification and clarification of shared knowledge within the group, which may be challenging to uncover through individual interviews alone. The FGDs are beneficial because they ensure a high level of focus on the topic as well as obtaining shared and diverse narratives from participants. "FGDs use a human-centered approach that is recommended for introducing design culture and its methods into fields such as business innovation" (Tschimmel, 2012). As the researcher interrogated Kenya's fashion SME's business innovations, care was taken to obtain factual and reliable data. The owner/ the entrepreneur, production and operation managers, customers were allowed to participate in the FGDs.

Secondary data was collected from key informant interviews. Key informants inform on broader expert knowledge and experience relevant to the research topic. Individual interviews with key informants was beneficial in this research as they brought rich and specific information that enhanced the quality of the findings for both (i) the localization of the system innovation to suit the Kenyan context and (ii) and give reliable sources of SMEs within Kenya's fashion industry that have adopted, implemented S.PSS and are creating opportunities for all while reducing the negative environmental impacts of this industry.

3.2 Population and sampling

3.2.1 Location of study

The study was conducted in Nairobi, Kenya. The researcher justifies this focus based on two reasons. First, Kenya alone imports more than 200 million kilograms of used textiles each year from Europe, Asia and the USA. Of these imports, 40 percent which is about 74,000 tonnes, ends up being dumped (AfricaNews, 2022a;2022b; texfash, 2022). Considered textile waste, these imports endanger locally produced goods and textile industries. Moreover, as cited in the literature review, textile waste has negative implications in Kenya's environment. Therefore, being that the textile and fashion industry is a significant contributor to textile waste, the researcher demonstrated how businesses (predominantly run by fashion-based SMEs) were working towards a systems approach to transforming this industry. The second justification is that the researcher is physically present in this country enabling her to collect first-hand data through face-to-face interactions which is important when collecting qualitative data.

3.2.2 Unit of analysis

The unit of analysis presents a specific model under study; a Sustainable Product–Service Systems (S.PSS) model. This system innovation aids in orienting the design of business models in a social-ethical and eco-efficient manner.

The study demonstrates how Kenyan fashion S.PSS models are designed and implemented.

By studying how all stakeholders interact within an ecosystem, and the products and service offerings provided and configured in the system, the researcher was able to demonstrate how fashion S.PSS's "improve employment/working conditions, improve equity and justice in relation to stakeholders, enables responsible/ sustainable consumption (and production), favour/integrate the weaker and marginalized social strata, improve social cohesion and empower/valorize local resources" (Vezzoli, et al 2022, p.7).

The resultant will be the creation of an S.PSS framework for the textile and fashion industry that proposes a pathway to sustainability and shared value.

3.2.3 Target Population

This refers to the sample size necessary for the researcher to draw generalized conclusions from the research findings (Borg & Gall, 1989). Within Nairobi City, there exists a population of 400 licensed small and medium-sized enterprises (SMEs) engaged in textile and clothing businesses (Mugo et al., 2019). No factual data exists to confirm how many of these SMEs have sustainable business models.

3.2.3.1 Kenyan SME's prioritizing sustainable fashion

Defining an SME is difficult and its meaning differs from country to country (Cacciollati, Lee, 2015). What is known is that 'fashion designer' micro, small enterprises form a large

constitution in the fashion manufacturing space (Kajilwa, 2022). Furthermore, SMEs are regarded as the backbone of an economy because they play an important role in poverty alleviation, job creation, foreign trade promotion, and technological innovation, while also contributing significantly to the growth of developing economies (Yoshino, Taghizadeh-Hesary, 2019; Luo, Wang, Yang, 2016; Winfred 2006; as cited in Gherghina, et al., 2020). As of 2017, there are 138,190 Kenyan MSME's that are formally registered businesses. Following the Census of Establishment, MSME's are categorized as Micro: 0-9 employees; Small: 10-49 employees; Medium: 50-149 employees (Cruz, Uriz, 2022).

Entrepreneurs are the backbone of sustainable fashion (Hoffman et al, 2022). Selected were three formally registered SMEs that have made significant strides in sustainable fashion either as emerging or have been supported and accelerated by Ethical Fashion Initiative (EFI) through their *Accelerator* program that recognizes leading Kenyan brands that are climate positive. A programme of the United Nations championed by the International Trade Centre (ITC), EFI;

works in emerging economies to establish and empower social entrepreneurs. Its goal is to unite reputable international companies in fashion, interiors, and fine foods with talented local designers, artisans, and micro-producers. The initiative promotes growth and development in emerging economies through these alliances [...] Focused on highlighting brands that are on the path to sustainable fashion, they have been leaders in sustainability from production to mentorship. EFI's core interest is to find 'ethically made' products and seeks to regenerate the social capital in the markets where they work. ((Ethical Fashion Initiative, 2022^c; Vivienne Westwood, 2011).

3.2.4 Sample

This being a multiple case study, the researcher applied purposive sampling to arrive at the selected three fashion SMEs that are deemed sustainable. A more comprehensive definition of sustainability in fashion (UN Alliance for Sustainable Fashion, 2022);

refers to business that encompasses social issues, such as improvements in working conditions and remuneration for workers, as well as environmental ones, including the reduction of the industry's waste stream, and decreases in water pollution and contributions to greenhouse gas emissions.

The sample are SME's focused on reducing their environmental and social impacts within their communities. They are locally owned, managed and operate within Kenyan borders even though they have dealing in both the local and global markets. Three relevant

cases based on the target group articulated in 3.2.3.1 were selected for the data collection and analysis proposed in this research.

Interview w/ FGD ID	FGD / Interview Date & Mode	Position	Location	Year establish	Firm category	Product/ Service / Expertise
KI1	23.03.2023 Online	Kenyan Creative Director, Curator, Fashion Stylist/ Production designer	Nairobi, Kenya	N/A	Individual	Fashion and textile expert, policy maker
KI2	24.03.2023 Online	Kenyan published author, PhD student, textile and fashion designer	Nairobi, Kenya	N/A	Individual	Product development, fashion & footwear
SME1	11.04.2023 BMC Interview FGD On-site	Founder/ Owner + 9 participants	Nairobi, Kenya	2011	Small	Apparel, Accessories, Jewellery
SME2	20.04.2023 BMC FGD On-site	Head of Marketing, Head of Logistics + 12 participants	Nairobi, Kenya	2015	Small	Homeware, Accessories, Toys
SME3	02.05.2023 BMC Interview 08.05.2023 FGD Online	Founder/ Owner + 1 participant	Nairobi, Kenya	2017	Micro	Apparel

Table 6: Characteristics of the Kenyan based sustainable fashion SME's and key informants included in the sample

Table 6 categorizes the identity of the participant, the date and type of data collection method and whether it was online or offline, the nature of the participants, the geographic location, the size of SME and their area of expertise within the fashion industry.

Every business actor, according to systems thinking, is a member of a complex system. Because one person affects all other players, all implications must be considered while making decisions (Ellen MacArthur Foundation, 2015a; as cited by Hedde, 2020). Therefore, to ensure that the researcher had representation from every section of the MSMEs value chain— from the design team, production and manufacture team, and the administrative team (founders/owners), the entire natural group of each SME was engaged. The only participants that were not engaged were users. The study brought together all these key participants as indicated by the stakeholder configuration in its ecosystem. Two expert key informants from the local fashion sector were also engaged to supplement the data obtained.

All participants provided written consent to participate in the research. Furthermore, identification codes were used throughout the study to ensure the anonymity of the individuals.

Across all three SME cases and key informants, a total headcount of 27 participants participated in the study. Each case had certain departmental sections such as, the owner/founder, directors/advisors, manager of production, marketing and communication manager, manager of logistics, a designer (who in most cases is the founder/entrepreneur), logistics team, production/operations team (which mainly comprises of sample makers, pattern cutters, tailors, ironing personnel, weavers, washers, sorters, packers, spinners), communication team and third party integrators/partners. Each SME has a physical premise in Nairobi, Kenya. Across the board, all SMEs rely on energy sources produced by Kenya's main electricity grid which is "harnessed from 86% renewable power" (EPRA, 2023; as cited by Mwangi, 2023).

3.3 Data collection tools and techniques

Data was collected and synthesized in a three-tier format; The first part was to obtain a succinct value proposition and summary of the nature of each business using the Business Model Canvas. Business Model Canvas (BMC) provides the best framework that models out the business in PSS design (Salwin, 2022). This is important as it "helps designers and managers structure the evolving practice-oriented recommendations both when starting a new venture and when improving the operations of an existing one" (Osterwalder, Pigneur, 2010; Hoffman et al, 2022; Hedde, 2020). It aided the researcher to assess the nature of each SMEs business model. The researcher was then able to contextualize the business setup and determine generally where sustainability is being prioritized in the business affairs of the fashion enterprise. This gave the researcher a clear picture of the organization's setup therefore offering guidance on how to proceed with the data collection instruments and/or inform findings. In all

the three SME's, the founders or a senior manager were engaged in a 30 min – 1 hour session in filling in the BMC.

Secondly, the researcher administered focus group discussions (FGDs) or in the case of the key informant, an online interview. The researcher used carefully planned semi-structured FGD and interview formats questioning (see Appendices C and D respectively). Graphic posters with the Clothing Life Cycle (Appendices E) and SDOS tool were also designed and printed (see Appendices F) for use at the FGDs.

Thirdly outcomes from the Business Model Canvas, interviews and focus group discussions are then applied to the *Methods for System Design for Sustainability (MSDS)* design steering tools that are suggested and developed by Vezzoli et al. (2022). Available on www.lens-internation.org, *System Design for Sustainability in Practice*, is a 'golden standard' manual that provides system thinkers, designers, engineers, and associated professionals with design-orienting tools, standards, and best practices for designing Sustainable Product-Service Systems. These tools were instrumental in assessing potential improvements (Vezzoli et al, 2022) and aided the researcher in designing and visualizing the sustainable priorities embedded in the SMEs ecosystem. Consequently, the *MSDS* tools informed the data collection methods and techniques providing a holistic reference in crafting each SMEs S.PSS model.

3.4 Data analysis and presentation

Data from focus group discussions and key informant interviews were collected, audio recorded, transcribed, and processed using the SDO tool before being presented using descriptive statistics. Descriptive statistics enabled the researcher to organize, simplify, and summarize the data from the FGD and BMC. Descriptive statistics also assist the researcher to display the data in a more relevant way, making it easier for any designer, the founder/entrepreneur, senior management, engineers, or S.PSS design teams to interpret the data. These were presented by 'assessment, check and visualization (Vezzoli et al, 2022)' by the researcher. The various instruments used to collect and analyze the data included (see Appendices B. (i)-(iii), C, D, template samples):

3.4.1. Business Model Canvas

3.4.2. Sustainability Design-Orienting Toolkit;

3.4.3. System map

Using these specific descriptive statistics, three sets of scenario visions were developed. Each shares the organization's orientations, and sustainable strategies for the environmental impact reduction and value creation. These descriptive diagrams and maps were reviewed to provide meaningful outcomes reported and recommendations organized in themes and

subthemes. Finally, outcomes aided in underscoring the objective of developing a S.PSS framework relevant for this market.

3.5 Quality control

3.5.1. To guarantee the study's validity and reliability, the researcher selected participants in an inclusive manner. Special care has been taken to guarantee that co-designing or co-researching is facilitated both internally and externally, bringing together various socioeconomic players and end users (Vezzoli et al, 2022. P 173). Consequently, all participants in the organization at the time of the FGD were encouraged to participate. Key informants were also interviewed.

3.5.2. The questions formulated for the focus groups and interview were carefully formulated by reputable S.PSS and design management authorities and experts — and are specific to informing on only three areas: (i) the mapping of the organization's value proposition (ii) the collection of rich data for the SDO measuring tools with a focus on the 2 priorities/dimensions of sustainability; eco-efficiency and (iii) socially ethical.

3.6 Ethical considerations

3.6.1. The study obtained a research permission letter from the Department of Art and Design through the Chair's office.

3.6.2. The researcher conducted the study in an ethical manner ensuring that she obtained informed consent from all the participants. To protect the participants' confidentiality and anonymity, the researcher took steps to delete any identifying information from the transcripts. Participants are identified in the analysis using unique identification codes, which protects their privacy (this will be indicated in the Findings section to identify the source of the quotation such as, 'KI2' represents the second key informant, 'SME3' represents the third small, medium enterprise case and 'P.M' represents the initials of the name of a certain participant, and so on).

3.6.3. Researcher also respected confidentiality and privacy policies as laid out by the SMEs. In relation to this, sensitive information such as information on financial data, were omitted from the study. The case material, and audio-visual material was only retrieved and transcribed only when consent was approved.

3.6.4. Throughout the research and publication process, proper credit for authorship has been adhered to.

3.6.5. The researcher obtained an official research permit from the National Commission for Science, Technology and Innovation (NACOSTI), reference number 4569178.

3.7 Expected results

The researcher expects to underscore goals set out in objectives 3 and 4 of the proposal by:

- 3.7.1 To examine how Kenyan SMEs in the textile, apparel and fashion industry are orienting their business towards eco-efficient and social ethical priorities
- 3.7.2 Design and propose a Sustainable Product-Service System framework for Kenyan SME's in the textile, apparel and fashion industry.

The resultant was a series of diagrammatic maps and descriptive statistics that holistically visualized the configuration of an entire sustainable system innovation of fashion-based SMEs under study. These instruments including an S.PSS framework may then be used to guide designers, engineers and allied professionals on how to successfully design, adopt implement S.PSS models.

4.0 Findings

4.1 Data collected

4.1.1 Key informant interviews summary

The two main informants both agreed to participate in the study. All interviews were held online using Google Meet. The semi-structured interviews were guided by a set of four open-ended questions (see Appendix D). The entire session was also audio recorded. Table 8 shares a summary of the key informants one (KI) interviewed, whereas Table 9 shares data collected and analysed from KI2.

4.1.2 Focus Group Discussions (FGDs) summary

Two of three owners/entrepreneurs running the micro, small and medium-sized enterprises were present in person to participate in the study. SME2 co-founders were unable to participate. For this SME, the researcher engaged senior managers, that is, the head of Marketing and Communications and the Head of Logistics. All the SMEs are young (under a decade old), small and sustainable fashion oriented. Each FGD session ran for not more than 3 hours. Each session was conducted in English and or Swahili as there was a mix of semi-illiterate and literate audiences. FGDs were conducted every week on a Wednesday/Thursday from April 11th – May 8th 2023. Except for one, all FGDs were conducted on-site or at the business premises of the company.

A tentative program of the activities was shared prior to the focus group discussion. Stipulated on the email was; Upon arrival, the researcher sat with the founder/owner of the business for a 20-minute – one-hour meeting to discuss certain aspects of the business model and value proposition in order to better understand the nature of their business and

their sustainability initiatives. In this session, the researcher administered the Business Model Canvas (see. Appendix B (i)).

After that, the participants (who made up the available staff members in the company and the founder/owner) were gathered in the room where the researcher introduced herself and spent 5 minutes explaining the Clothing Life Cycle (see Appendix E). She then began by administering the SDOS tool seeking responses to each line of question. The interactive Focus Group Discussion (FGD) took 90 minutes. SDOS design tools were printed on A3-size posters, hang, and acted as a guide for the FGD session. 38 SDO Scenarios (see Appendices B iii) and F) were posed to the entire team. The first eighteen Scenarios focused on analysing the company's eco-efficiency orientations and the next twenty Scenarios focused on analysing the social ethical orientation of the business. Both sessions were audio recorded. The session concluded with a quick 15-minute tour of their premises. Table 6 shares a summary of the SMEs sampled.

4.2 Data analysis

4.2.1 Sustainable system innovation themes from the key informant interviews

4.2.1.1 Key Informant 1

The study adopts a qualitative research approach to establish whether *sustainable* system innovations (S.PSS) do exist within this market and key themes that are relevant in the Kenyan market. Using insights from the semi-structured interview, a table is crafted to demonstrate recurring themes within the sustainable fashion ecosystem. Information from KI1 (and KI2) was inferred from real examples expressed through ‘entrepreneurial perceptions, experiences and opinions (Creswell & Poth, 2018)’. In keeping with system innovations for sustainability, Table 7 and Table 8 maps the two priorities, eco-efficiency and social ethics and highlights the frequency of the different sustainable themes in the business models K I1 and KI2 spoke about. 12 common system innovation for sustainability themes (Vezzoli et al, 2022) are established and the frequency of (unique) mentions of the related theme are tracked. As shown in Table 7 and 8, the researcher applied an iterative data analysis process of playing back the audio recording, transcribing, moderating and making inferences and assigning the appropriate data in the correct S.PSS priority category.

Key Informant	S.PSS priorities	Macro-categories & Sustainable Themes	Frequency (f)		
K11	Eco-efficiency	Evidence that eco-efficiency priorities exist in Kenyan fashion business: High Priority	Yes		
		Product life span extension & intensification: "life-time guarantee", change of hardware, quality, craftsmanship	12		
		Material life extension (recycle, energy recovery and composting): recycle/reuse of waste, 'DIY lessons'	6		
		Material consumption minimization: "A. M's, once-in-a-year collection", "pre-loved" clothing	2		
		Energy consumption minimization: fairly local manufacturing, using 'slow transport'	2		
		Resources' (materials and energy) renewability/ biocompatibility: new textiles, ethical fabrics (local cotton, silk), end of life care	7		
		Resources' toxicity/ harmful minimization: nature-based dyes, waste management	5		
		K11	Social Ethical	Evidence that social ethical priorities exist in Kenyan fashion business: Very High Priority	Yes
				Social sustainability (focus on good work environment): child-care, bursaries, founder empathy & welfare & support, digital marketing about sustainable practices	8
				Improving equity + justice in relation to stakeholders: hiring local labour, salary advance, medical ins.	3
Enabling responsible consumption; hand-span, locally handcrafted, innovative fibres, recycled packaging	4				
Favouring the low income, weaker and marginalized: women workforce, acknowledgment of staff	4				
Improving cohesion: co-operatives assembly, co-creating & mobilizing supply chains by "super co-operatives"	2				
Empowering the use of local resources: sisal and indigenous dyes, local skills (by tribe/ per region)	3				

Summary: "Sustainability isn't singular across the world, it's just that little has been written about it (from a Kenyan, fashion SME perspective)."
Recommendation: All stakeholders need to be cognisant that the entire fashion industry is unsustainable, and each stakeholder has a role to play. The entrepreneur/ designer sets the tone for their brand and therefore ought to be sensitive to the linearity of the clothing life-cycle and move to circularity; by working with local communities, SMEs secure livelihoods, fosters employee valorization that guarantees the success of the business; listening to the customer's needs, values, price-consciousness, and brand to sensitize them on their role at end-of life of the clothing and propose incentives. Finally, to admit that the fashion industry has been reckless in th caring for the planet & SMEs need to holistically, progressively, look at the entire processes, systems, material sourcing & innovation, waste management methods that are responsible and foster sustainable outcomes.

Table 7: Key Informant 1 (K11) data: System innovation for sustainability priorities, sustainable fashion themes and their frequencies.

*Frequency refers to the number of statements/mentions attributed to a specific S.PSS macro-category that had a related sustainable theme.

The first interview with KI1 was a very detailed and an expansive discussion that highlighted the various roles that the owner/entrepreneur and allied stakeholders in the SME fashion ecosystem should play in pushing forward a sustainable fashion agenda i.e. all stakeholders from owner, business system and processes, members of staff, buyers and the environmental implications are to be considered. The interview began with a consensus that sustainability is not unfamiliar to this market and “*sustainability isn’t singular across the world*” [emphasis added]. In fact, to a large degree, sustainable fashion businesses exist within the continent, it's just that little has been written about it” as it differs from the Global North ideals. In this market, most if not all of the sustainable fashion businesses are small. He mentioned two outliers, one, who is, “in the frontline of converting waste to toys and also new types of textiles”.

The second outlier is “a brand that offers a lifetime guarantee of their leather bags with a promise that they ‘last forever’, offer a ‘life-time guarantee’, and ‘impeccable craftsmanship’”. He drew parallels of this brand with a well-known global ethical brand in the West.

He cited natural materials and dyes are being used in the local industry, he also reflected on a local brand being a sustainable brand and is focused on using “organic dyes, organic materials such as handwoven cotton, hand-spun cotton”. He acknowledged that by and large, Kenyan fashion businesses conduct their businesses in sustainable ways.

He also cited that there are brands that are recognizing the wastefulness that exists within the industry and are starting to think about their own ways of working. Moving away from seasonal collections, “the industry is witnessing brands such as ‘A.M brand’ that are trans-seasonal and launches only one collection a year.”

Focusing on articulating his opinion on the social ethical side, KI1 felt that enough is not said about the powerful social ethical initiatives that exist within fashion -based SMEs. He gave the example of SMEs that are driven by co-operative that would collaborate and co-create to make products rapidly so as to fulfil a huge order. These co-operatives congregate large community workers, artisans dotting the country into reachable “production networks” could describe them as being the “super cooperatives”. They manage large workforce compositions covering various geographies and demographics. KI1 highlighted that these are great example of “how cohesion is built through the assembly of the people/artisans and co-operatives that can be activated – going beyond counties”.

Other social ethical practices mentioned were social good initiatives championed by leadership within these “super cooperatives” such as setting up “a child care/ nursery setup near the factory for the female workforce”.

An interesting insight was that most owners of these businesses are unaware that they are practicing sustainable practices by accommodating their employees and ensuring that they are fairly comfortable. “Helping these marginalized communities and finding a solution for their needs” is often not spoken enough of. From catering to “healthcare needs” through micro-insurance or it could be the company raising “school fees scholarships for team members’ smart children”, KI1 emphasized that owners of these business focusing on employees is imperative to the success of the businesses. These teams inevitably are “loyal and have bought into the owner's vision”. He emphasized the need for Kenyan SMEs to protect this unique social sustainability model and applauded them as these initiatives go untold and undocumented.

End-users too need to be listened and catered for. KI1 mentioned that there seems to be an interest from fashion consumers who want clothes to “last a long time” and are interested in knowing the “end-of-life care” of their garments. Also, end-users are keen to gain more knowledge about simple things, for example, “how to repair a seam/button” and other aftercare services.

To conclude, KI1 spoke of the planet. The planet also requires attention because humans have harmed the environment in which we live. KI1 recommends that SMEs need to look “inwards at their processes” to ensure that the overall health of the entire business “end to end” is environmentally friendly. From “packaging, to the use of organic dyes, to transportation, minimizing waste, innovate around materials, encourage digital digitally to minimize runoffs, being vocal/ “lending a voice” on social media about sustainable practices within business – within reason”.

In summary, the insights were revealing and indicated that product life span extension and intensification, and social sustainability (see Table 7; f12 and f8) came on top of the list as critical sustainability priority areas in this market. This most likely indicates that these sustainable priorities are the most relevant and have greater significance if adopted and implemented by fashion businesses. Instances where the interviewee mentioned themes around energy consumption minimization, improving equity and justice and empowering the use of local resources were least mentioned by KI1 but that doesn’t mean that they are any less significant.

4.2.1.2 Key Informant 2

KI2 responses were largely drawn from personal, professional and research point of view. She first explains that her journey with fashion and textile sustainability started during her undergraduate studies where her project was largely about recycling and reusing textile waste. Her study focused on large manufacturing and production enterprises in Kenya and from smaller Kenyan textile and fashion SMEs. At the time, sustainability was not a major factor being considered by fashion SMEs during the production processes (recycle, reuse, reducing environmental impacts). Key insights are also drawn from her illustrious 9-year career working with a legendary shoe manufacturer and retailer with footprint in Kenya, and other fashion and apparel industries.

A summary of the interview is laid out on Table 8. What was apparent was both eco-efficient and social-ethical priorities were interwoven in all the SMEs operations she spoke of. The interview covered areas of multi-layered sustainability themes, largely involving material life extension, where circularity themes of reuse, recycling, and repurposing of textile waste and socio-cultural sustainability.

She gave the example of a social impact SME she worked with that provides jobs and job training to women within the apparel and fashion industry. They employ female artisans and develop meticulously handcrafted collections using recycled and upcycled shoes, bags, scarves, old leather, and other textile waste. Another brand she mentioned creates authentic children's furniture and accessories. By recycling *vitenge*, khanga, silk, leather and bags, new and versatile African kids product lines were created.

KI2 posited that SMEs that had treated their employees well, paid above minimum wage, paid overtime, and provided professional working conditions atmosphere/ work environments would claim to have some level of sustainability. KI2 cited Bata as a good example of a company that engages in Corporate Social Responsibility (CSR) activities that are primarily sustainability initiatives. This phenomenon of CSR initiatives not really being seen as sustainability initiatives within SMEs is a common occurrence in this market. She defends herself by stating:

“What the Global North has been practicing as sustainability, in Africa, we have been practicing it for years. Phrases like “cost reduction”, and “efficiency” are now being recognized as sustainable outcomes in businesses. The Global North has been very good at telling their stories and best practice, whereas the Global South has been slower at telling their stories [...] and have normally been associated to aid and donations”.

In regards to sustainable innovations, she mentioned the “rebranding of Bata's Patapata” into a range of flip-flops dubbed the “Ashanti” that “tell authentic African stories using

contemporary prints”. These flip-flops are sold in global Bata marketplaces, providing employment for single women and Maasai women craftsmen. She was most likely highlighting the underlying social and cultural sustainability ingrained in the organization's products.

Another initiative mentioned was a “Designers Challenge”, an apprenticeship program that challenged young industrial designers to develop unique collections which were judged and winners won funding to start up their businesses. Part of this “give back to design” program was to train the designers on various aspects of the fashion business, these included, “design workshops, marketing and sales, brand management, story-telling” with celebrity coaches. These designers also gained local and global exposure, worked with global offices across the world and created job opportunities for the designers. As an employee at this organization, she describes her experience as being “remarkable”. As a young designer, she had the privileged to work in multi-diverse teams across markets, and be a part of a team that achieved both local and global impact in the communities they served.

For exemplars in sustainable innovation, KI2 mentioned a female designer who had managed to innovate “clothing for the blind” during a past Nairobi Design Week festival. KI2, highlights that it is the “GenZ who are deliberately focused on sustainability and innovative solutions”. Infusing waste into new fashionable products and using technology to build platforms such as virtual fitting rooms that are connected to Whatsapp (catalogue) shops that reduce time and returns was an example she cited.

KI2 emphasized that sustainability is “complex and may come from a point of privilege”. However, Kenyan SME’s, in the fashion business are mainly driven by basic needs, for them what's of concern for business owners is “reducing running costs” or “having food, and feeling safe is a priority over fashion”. This level of business may be a challenge for most businesses as there is a need to balance the tensions between “cutting costs” (which is how their business can remain sustainable) versus “cutting corners” (which are not sustainable) ideals.

KI2 posits that SME’s in Kenya rarely last long. She advises that it is worth studying the case of one of Kenya’s luxury leather bags and accessories brands’ business model. Their brand promises “guaranteed for life” aspirations when one acquires their product. The legacy business that has stood the test of time. Worth noting is that, KI2 just like KI1 agree that this brand is a model when it comes to sustainable fashion.

Key Informant	S.PSS priorities	Macro-categories & Sustainable Themes	Frequency (f)		
KI2	Eco-efficiency	Evidence that eco-efficiency priorities exist in Kenyan fashion business: Very High Priority	Yes		
		Product life span extension & intensification: reuse waste to create new products in-house (circular design)	2		
		Material life extension (recycle, energy recovery & composting): recycle/reuse of <i>mitumba</i> waste & old clothing/found materials (<i>mkeka</i> , <i>khanga</i> , silk, up-cycled shoes)	9		
		Material consumption minimization: reduce textile waste and scraps within factory, limited edition collection	3		
		Energy consumption minimization: apply “efficiencies” and “cost reduction” processes within operations	2		
		Resources’ (materials and energy) renewability/ biocompatibility: reuse polythene to make new products	1		
		Resources’ toxicity/ harmful minimization: waste management in factory	1		
		<hr/>			
		KI2	Social Ethical	Evidence that social ethical priorities exist in Kenyan fashion business: Very High Priority mainly driven by emerging MSME brands with innovative solutions targeting a younger audience.	Yes
				Social sustainability (focus on good work environment): pay above min. wage, “professional space not a sweat shop”, paid overtime, (designer & teams given) autonomous working conditions, influence, work in multi-diverse teams (co-elaborating & co-creation), training, cultural sustainability, transmigration, transparency	8
Improving equity + justice in relation to stakeholders: CSR, design challenges & apprenticeships, exposure	4				
Enabling responsible consumption; locally handcrafted, upcycled/reused fibres	2				
Favouring the low income, weaker and marginalized: single women, herders, proceeds support orphanage, “clothing incorporating braille” for the blind, youth	5				
Improving cohesion: co-operatives assembly, co-creation & consolidating products by super co-operatives	2				
Empowering the use of local resources: traditional textile production, promoting “Kenyan design & designers”	2				
<hr/>					
<p>Summary: “What the Global ©North have been practicing as sustainability, in Africa, we have been practicing it for year. Phrases like “cost reduction”, and “efficiency” are now being recognized as sustainable outcomes in businesses. The Global North has been very good at telling their stories and best practice, whereas the Global South has been slower at telling their stories [...] and have normally been associated to aid and donations”.</p> <p>Recommendation: Fashion SME’s in Kenya rarely last long. Sandstorm (Kenya), is a good, local, legacy business (to study) that has stood the test of time. Sustainability is complex and one needs to look at certain aspects such as cutting costs (sustainable) and not cutting corners (not sustainable). In general, sustainability means, solving a real societal issue, reducing running costs, working efficiently, innovates, excellence in craftsmanship (technical expertise), having industry knowledge (“knowledge is power”), conquering local and regional markets, creating a comfortable environment for employees, being innovative and (at times) recognizing that technology may not be a solution. Kenyan SMEs also need to consistently tell stories of “how they work” - everyday/ week.</p>					

Table 8: Key Informant 2 (KI2) data: System innovation for sustainability priorities, sustainable fashion themes and their frequencies.

*Frequency refers to the number of statements/mentions attributed to a specific S.PSS macro-category that had a related sustainable theme.

Finally, she gave her own recommendations of what an ideal sustainable business would look like. It would be one that “solves a real societal issue, reduces running costs, works efficiently, innovates, has excellence in craftsmanship (technical expertise), has industry knowledge (“knowledge is power”), conquers local and regional markets, creates a comfortable environment for employees, is innovative and (at times) recognizing that technology may not be a solution”. Kenyan SMEs also need to consistently tell their authentic stories of “how they work” – everyday/ weekly on their social media channels.

In summary, KI2 revealed that there exists a ‘symbiotic’ interplay between eco-efficient and social-ethical priorities as being the key to unlocking sustenance in fashion ecosystems in this market. SME’s that focus on material life-extension strategies and advocate for social sustainability (see Table 8; f9 and f6) in their business processes have an advantage. What also becomes apparent is the material and human resources are the most critical resources in this market. It is likely that investing in the best inputs that cut costs, focus on excellence in craftsmanship and care/supporting key stakeholders within their value chain, ‘give back’ to the fashion ecosystem would emerge as winners in achieving sustainable transitions. Again, just like KI1, participant KI2 supports the notion that fashion sustainability is “complex” that considers multi-layered, multi-level processes and actions such as establishing relevant partners/networks needs to be a consideration for SME achieve a sustainable business model. Strong themes that emerged between the key informant indicate an SME with a ‘hybrid’ approach; one that offers a favourable work environment, durable, locally sourced products and services, and offer customers expertly crafted products using circular materials & meaningful innovations, are the most likely to be promoters of sustenance in the fashion industry.

4.2.2 SME1 Systems Innovation Overview

4.2.2.1 *Business Model Canvas*

Table 9 is a summary of SME1’s Business Model Canvas. All the information was transcribed from an audio recording. The session with the founder took one hour and thirty minutes.

4.2.2.2 *SME1 SDOS Summary;*

Table 10 below shares data analyzed and transcribed by the researcher. It demonstrates the SMEs Project Record as captured in the SDOS toolkit x clothing. This SME has a Product-oriented S.PSS that balances both medium to high eco-efficient and social-ethical priorities in their business. Figure 10 are some photographs of members of staff and a complete product

captured at the SME’s premises during the walkabout tour after the FGD session. The FGD and tour took one hour thirty minutes to complete.

Business Model Canvas		Designed for:	Designed by:	Date:	Version:
		SME1	Lubano, T.	29.05.2023	2
<p>Key Partners</p> <ol style="list-style-type: none"> Premises in Kisumu, Kenya with an ideal location to produce batik textiles Local expert tailors <p>Suppliers:</p> <ol style="list-style-type: none"> Fabric traders in Tanzania, Mali, Nigeria. Fabric types include: cotton, silk, polys, fashion accessories Dedicated and ad hoc BodaBoda riders, and help ship products to customers Second hand clothing market EPZ drills/ fents <p>Transport & Distribution</p> <ol style="list-style-type: none"> Onsite collection Bodaboda delivery Shipping abroad 	<p>Key Activities</p> <p>Involved in the design & production of textile, apparel and fashion accessories such as clothes, bags, jewelry</p> <p>Main activities include:</p> <ol style="list-style-type: none"> Fabric design & production Garment design & tailored production: Production methods are a blend of, in advance production, in small batches, customized and one-off pieces Accessories prototyping, design & production uses 50 -100% recycled and reused scraps/ textile materials and are varied in type Special designed and engineered hardware for the structure of accessories <p>Key Resources</p> <p>Material: Clothing - Fabric (cotton, poly, silk), Second hand leather, zippers, sewing, thread, Accessories - Straps, Piping, Brass, Bone Human: Local tailors CSR: "Charity" "Fair pay, support livelihoods" "Honest" Technology: PesaPal, M-Pesa, Wi-Fi Financial: "Co-own the businesses with tailors" "Financial books are open to internal stakeholders"</p> <p>Our Distribution Channels? Instore purchase Customize by visiting instore Pop ups Social media Website</p>	<p>Value Propositions</p> <p>At SME1, we enable eco-conscious customers who appreciate unique, customized fashionable clothing and accessories to own durable, hand-crafted, excellently designed and engineered fashion that appeals to their love for well-fitting, expertly tailored, contemporary African fashion sense.</p> <p>CHARACTERISTICS: Functional: "Industrial design fuses with fashion" Purpose/Values: Sustainable design through the "traditional crafting of textile production" "Ethical fabrics from Tanzania", "Small batch production", "Spill-off fabric/ vents recycled and upcycled to make bags", "One-off bags" Designing Kenya's first iconic handmade batik fabric through experimentation (WIP) Cultural goals: African, "Made in Kenya" Emotional: "Socially ethical brand" (referenced from website) "African fabric" Experiential: Designed with expertise</p>	<p>Customer Relationships</p> <p>Co-creations: tailor-made, fitted garments through consultation (with or without your fabric).</p> <p>Walk-in customers</p> <p>Ready-made one-off accessories for gifters/ special occasions</p> <p>Online customers (social media and website)</p> <p>Channels</p> <p>Owned channels:</p> <ul style="list-style-type: none"> social media website the shop Referrals/ WOM <p>USA popup:</p> <ul style="list-style-type: none"> Summer festival (April-June) 	<p>Customer Segments</p> <p>Segmented (a hybrid of niche and diversified markets):</p> <ol style="list-style-type: none"> Female fashionistas Expat community living in Kenya (98%) Diaspora, International customers from USA, Sweden Love quality and unique fashion (eg batik from Kenya) Wear designer and customize fashion and apparel Special events – weddings Seasonal products for gifting (June, December) 	
<p>Cost Structure</p> <p>Costs: Labour (most expensive), materials, hardware materials, machine repair, rent Value driven: premium value proposition of well designed, hand-crafted and one-of-a-kind products</p>		<p>Revenue Streams</p> <p>Sustainable, breaks-even</p>			

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Table 9: SME1 Business Model Canvas. Adapted from Neos Chronos (2023), Recorded by Lubano (2023).

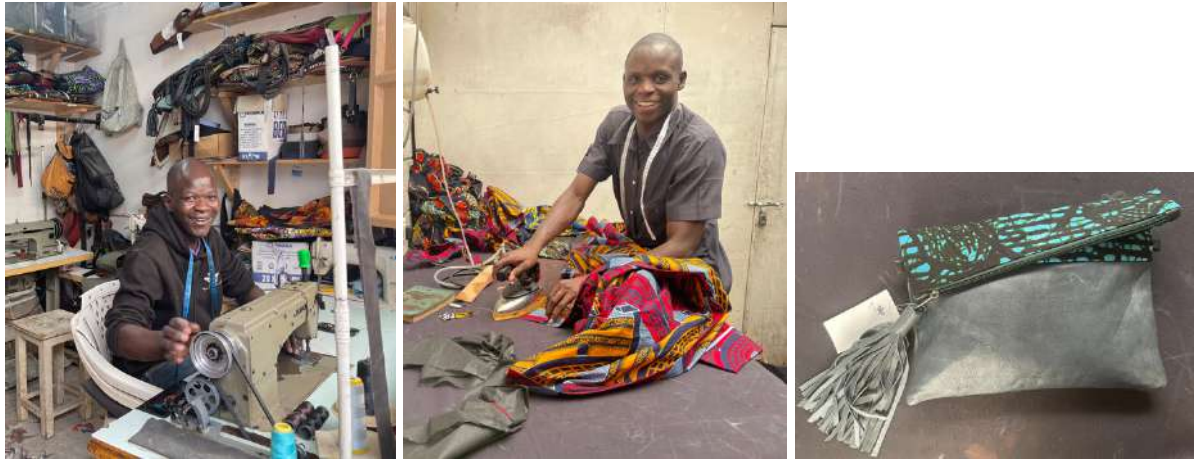


Figure 10: SME1 (left) Tailor sewing (middle), tailor ironing (right) recycled leather & kitenge clutch. Lubano (2023).

Sustainable Design Orienting toolkit x Clothing Summary	
Brand Name	SME1
Established	2011
Business Category	Clothing (major), bags and jewelry (minor)
Nature of Business	Product(s) & Services Local and regionally sourced ethical fabric (cotton), hand-crafted from textile waste. Products include: garments, bags and brass accessories and jewelry. Social-ethical Pan-African handmade fashion (Konrad Adenauer Stiftung Kenya, 2020)
Provider/s	Private limited company
Customers	Local and international audience; B2C
Location	Nairobi, Kenya
Business Type	Small, medium enterprise (SME); has 13 full time employees
Founder	Kenya
S.PSS Orientation	
Business Model Type	Product-oriented
*Description of existing model type	Involved in the design, technical prototyping & production of textile, apparel and fashion accessories Provides a hybrid model for the design and manufacture of clothing, accessories and life cycle services –eg sell of ready-to

	<p>wear, custom design from own or clients textiles, maintenance, repair, remodelling, upgrading of garments to guarantee the life cycle performance of the products sold to the customer/user.</p> <p>SME1, enable eco-conscious customers who appreciate unique, customized fashionable clothing and accessories to own durable, hand-crafted, excellently designed and engineered fashion that appeals to their love for well-fitting, expertly tailored, contemporary African fashion sense.</p> <p>*Referenced from SME2 Business Model Canvas and data synthesized from the SME2 SDOS toolkit)</p>
Eco-efficient orientation	<ol style="list-style-type: none"> 1. offers environmentally and economically advantageous alternatives such as i) “excellent craftsmanship and design of clothes that are of good quality, durable and lasts over 7 years or more” R.A. ii) Don’t throw away scrap clothing but instead design coin bags iii) 50-90% of the raw materials used are from textile waste iv) 100% “hand made”, “hand span”, “hand-crafted” products 2. design (offer) for lifespan extension of product; i) They recycle old zips which are of better quality ii) highest quality workmanship saving the customer damage due to wear and tear and garments that last long before a repurchase, also iii) remodeling services of clothing offered iv) recycle polyester material into custom packaging for clients vi) Offers services for the reuse and redesign of leather bags by cleaning and upcycling second hand leather into bags, totes, wallets, purses, consequently no one is ever the same 3. reduced transport and distribution; i) tailors all live within the vicinity of the business premises ii) courier clothing to clients directly or one picks from the shop 4. design for intensive use of product; i) cut pattern maximizes the extent to which it fits the garment style (expertise in patterning to minimize waste). ii) the SME

	works around textile defects so that pattern fits the design
Social ethical orientation	<ol style="list-style-type: none"> 1. SME1 is a sustainable enterprise that's rooted in local communities and operates within collaborative network structures; i) In-house tailors embrace an 'entrepreneurial mindset'. They co-own the business and work like individual "directors"/ shareholders" of the business ii) In-house considers staff to purchase commodities from the SME at a more affordable price than the actual retail price iii) comfortable workspace with 4 rooms: a room dedicated to meeting the client and fitting, others rooms are for tailoring, ironing and washing bay and an accessories-making room iv) work with local <i>bodaboda</i> networks in the vicinity to make deliveries to client across town 2. enabling responsible / sustainable consumption; i) customers know the brand for their durable products, affordable pricing and recycling practices ii) maximization of materials used where remnants become new products iii) deach summer, brand participates in an annual popup/ fair in the US each 3. intergrating marginalized persons i) work with illiterate persons eg '<i>Parking boys</i>' by giving them menial jobs like cutting pattern from templates ii) apprenticeship and training embedded in the SME iii) "pricing is standardized no matter the client" 4. All tailors are locals and live in the surrounding area (R.A) therefore strengthening locally based economies 5. empowering local resources and cultural sustainability; i) fully local company, locally sourced and produced batik textiles ii) 'Batik made in Kenya' iii) R&D to develop original textiles that will be identified as 'culturally Kenyan" (work in progress)

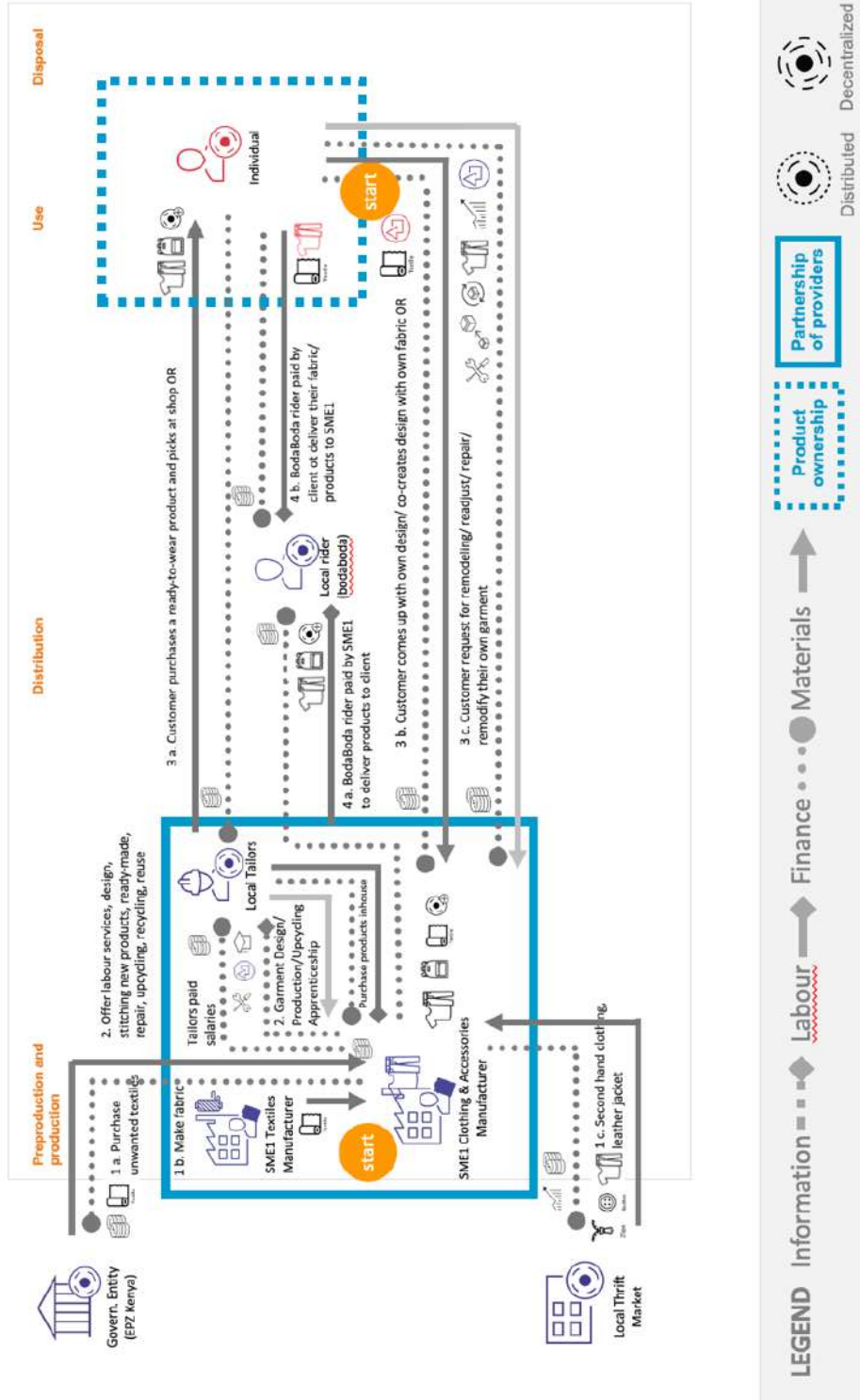
Table 10: SME1 SDOS summary. Source: Lubano, T (2023), informed by informed by Vezzoli et al. (2007 & 2018).

4.2.2.3. *System Map*

Below is the entire system map for SME1. Visualized are all the stakeholder interactions, configurations, material, labour, information and financial resource flows of SME1's S.PSS. Ownership of the products and services remain with the customer. The SME has also highly trained tailors with a Kenyan founder who has an Industrial Design degree from Kenya and studied leather bag design from an Italian institution. The business is economically viable and manages to break even. As yet, it is not profitable.

SME1's system map took four hours to design and visualize.

System map



SME1 System Map: Designed by Teresa N. Lubano (2023)

Figure 11: SME1 System Map. (2023).

4.2.3 SME2 Systems Innovation Overview

4.2.3.1 Business Model Canvas

Table 11 is a summary of SME2’s Business Model Canvas. All the information was analyzed and transcribed from an audio recording. The session was conducted with the Head of Marketing and Communication of SME2 for thirty minutes.

Business Model Canvas		Designed for:	Designed by:	Date:	Version:
		SME2	Lubano, T.	26.04.2023	1
<p>Key Partners</p> <ol style="list-style-type: none"> Rural women’s group Children’s home A textile production company that recycles acrylics A shoe company that recycles shoe soles into new soles A handknit women organization in Njoro, Kenya Security companies An orphan elephant rescue and wildlife rehabilitation center in Kenya A not-for profit organization in Kenya with footprint in Italy A social enterprise based in Rotterdam, Netherlands that battles against children illiteracy Local company specializing in recycling PET bottle and products Donors and various ventures that support social enterprises Designate collection points <ul style="list-style-type: none"> Institutions Churches Shopping centre <p>Suppliers:</p> <ol style="list-style-type: none"> Individuals giving old or unwanted clothes Second hand clothing market in Gikomba <p>Transport & Distribution</p> <ol style="list-style-type: none"> Onsite collection Collection of textile waste from designate points across the country Shippers Showcase at a local artistic handicrafts shop Shipping abroad <p>Cost Structure</p> <p>Costs: Staff & Labour wages, rent, transportation from collection points. (most expensive, fixed costs), variable costs based on economies of scale</p> <p>Pricing Strategy is Hybrid:</p> <ol style="list-style-type: none"> Value driven: Value driven to provide recycled, upcycled or downcycled products that fetches a reasonable price to compensate artisans fairly Cost Driven (products sold to wholesalers is cheaper, bales are made affordable for the local thrift resellers; Dynamic pricing based on quantities) 	<p>Key Activities</p> <p>Involved in the collection, resell, design & production of upcycled, recycled and downcycled textile, apparel and fashion accessories i.e., Rugs, toys, bag packs, baskets, patchwork home décor and accessories</p> <p>Main activities include:</p> <ol style="list-style-type: none"> Collection of textile waste Weighing of textile waste Sorting of textile waste Reselling of wearable textiles Upcycle, recycle or downcycle textiles to new product categories/items <ul style="list-style-type: none"> Design Weaving or Stitching or Shredding <p>Key Resources</p> <p>Material: Second Clothing – (denim, jeans shirts, kitenges, old cloths, curtains, linen, corduroys) Accessories - Straps, Piping, Brass, filling fiber</p> <p>Human: Local tailors & weavers, sorting, logistics, operations communications and production leads and teams,</p> <p>CSR: "Donations to children’s home" "10/- for every kilo recycled"</p> <p>Technology & IP: Sensor technology, R&D Trademarks</p> <p>Financial: "Donation" "Revenues from the sale of products made"</p> <p>Our Distribution Channels? Instore purchase Handicrafts events Social media Website Abroad</p> 	<p>Value Propositions</p> <p>At SME2, we enable anyone to share their old clothes; and offer eco-conscious customers who appreciate sustainably sourced and made, recycled or upcycled fashionable items to own artisanal hand-made fashion that appeals to their love for circular fashion and design.</p> <p>CHARACTERISTICS: Functional: "The future of fashion must be circular" "Social impact enterprise" Purpose/Values: "Find solutions to end textile waste" "Set up a proper, local, circular culture to tackle the textile waste problem in Kenya" Cultural goals: "To nurture, care and love Africa and her environment" Emotional: "Nurturers, loving and caring of the environment" (referenced from website) "transparency" "Ugly can be beautiful" Experiential: Design products with creative ingenuity and innovation "Reuse, recreating; rather than making, we extend the life span of the textiles"</p>	<p>Customer Relationships</p> <p>Own product categories</p> <p>Co-creations: tailor-made product, specific to client specification</p> <p>Walk-in customers at the shop or at events</p> <p>Online customers (social media and website)</p> <p>Channels</p> <p>Owned channels:</p> <ul style="list-style-type: none"> Social media Events LinkedIn Neighborhood collection points website the shop Referrals/ WOM Permanent base at local handicrafts shops (third party) in the country <p>Abroad:</p> <ul style="list-style-type: none"> Ship to EU market in Italy, Netherlands, Switzerland 	<p>Customer Segments</p> <p>Segmented (a hybrid of niche and diversified B-to-C and B-to-B customers/ organizations):</p> <ol style="list-style-type: none"> Eco-conscious individuals that share their love for recycled and upcycled products Local or international organizations that are looking to recycled and upcycled their old garments into new products; fulfil a CSR mission Charitable organizations and social enterprises "Local thrift" women entrepreneurs Diaspora, International customers from the EU 	<p>Revenue Streams</p> <p>Sustainable, Profitable, Scalable</p>

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Table 11: SME2 Business Model Canvas. Adapted from Neos Chronos (2023), Recorded by Lubano (2023)

4.2.3.2 SME2 SDOS Summary

Table 12 below shares data analyzed and transcribed by the researcher. It demonstrates the SME2's Project Record as captured in the SDOS toolkit x clothing. This SME, just like SME1, has a Product-oriented S.PSS that has a high score on both eco-efficient and social-ethical priorities. Its attractive S.PSS presents an ingenious LCD modeling that is embedded in its business practice. What is surprising about this S.PSS is that the production starts at the end of the clothing life cycle making it a unique 'bottom-up' business model. It also is the only SME that is profitable. SME2 has two founders, bringing strong fashion and sustainability expertise from two different markets, Kenya and the Netherlands.

Figure 12, 13, 14 and 15 are some product photographs captured at the SME during the tour after the FGD session. The FGD and tour took one hour and thirty minutes to complete.



Figure 12: SME2 (left) front side of the backpack made from security uniforms (right), inner side of the backpack made from security uniform and kitenge fabric interior (middle).

Figure 13: Patchwork recycled table mat (right) made of 100% cotton designed for an Italian brand. Images: Lubano (2023).



Figure 14: SME2 (left) Weaving comb tools made of iron against a rug made of 100% recycled second-hand jeans.

Figure 15: The researcher (right), holding a soft toy called 'Tummies' made from 100% recycled textiles and filled with downcycled fibres. Images: Lubano (2023).

Sustainable Design Orienting toolkit x Clothing Summary	
Brand Name	SME2
Established	2015
Business Category	Clothing (major), bags and jewelry (minor)
Nature of Business	Product(s) & Services: End-of-life reuse and recycled products such as table mats, soft toys, jean rugs, jean flower planters, bag-packs, shopper bags etc. 90-100% of the material resources are recycled “They give new life to old clothes through recycling textile waste.”
Provider/s	Association / organization
Customers	Local and international audiences; B2C, B2B
Location	Nairobi, Kenya
Business Type	Small, medium enterprise (SME); has 20 full time employees
Founder(s)	Co-founders: A Kenyan and a Dutch man
S.PSS Orientation	
Business Model Type	Product-oriented
*Description of existing model type	SME2 is a social enterprise for the design and production of recycled, upcycled fashion-related products and accessories and life cycle services –they collect textile waste (tech-enabled), weigh, sort, resell, donate childrens’ clothing, design & produce items such as rugs, toys, bag-packs, baskets, patchwork home décor items and other accessories. At SME2, they not only recycle textile waste but they also enable anyone to share their old, torn, unwanted clothes in order to offer eco-conscious customers who appreciate sustainably sourced and made, recycled or upcycled fashionable items to own artisanal hand-made fashion that appeals to their love for circular fashion and design. "We turn ugly into beauty" (W.O). *Referenced from SME2 Business Model Canvas and data synthesized from the SME2 SDOS toolkit

Eco-efficient orientation	<ol style="list-style-type: none"> 1. provides environmental and economically winning solutions; i) has a tech-enabled disposal system. Cloths collected in bins have solar powered sensors (renewable energy) ii) recycle, upcycle, downcycle, unwanted, oversized, textile waste from individuals, enterprise and local thrift markets iii) 100% “handmade”, “hand span”, “hand-crafted”, “locally sourced”, “locally designed” products iv) regular tracking kilograms of collected of textile waste 2. design (offer) for lifespan extension of product; i) They recycle old unwanted jeans to make beautiful rugs and flower baskets ii) intensive recycle, upcycle, downcycle production techniques iii) upcycle old security uniforms into bags extending their material lifespan & reducing incineration costs iv) good quality clothing sorted, packaged and resold to local, rural <i>mitumba</i> thrift value chain at an affordable price v) shredding of cheap, bad quality fibres to make filling for the upholstery industry vi) donate sorted quality clothing to a children’s orphanage 3. Reduced transport and distribution; i) all workers live within the vicinity of the business premises ii) courier clothing to clients directly or one picks from their two shops iii) collection bins fitted with solar panel sensors that send alerts to the logistics team when bins are full 4. design for intensive use of product; i) “We do not use a lot of money as its textile waste, unwanted clothing therefore we do not buy material from a shop” (D.O). “We recycle back about 90% including the reselling of the clothes”. Only 10% material is what we buy e.g. thread, brass buckles, <i>kitenge</i> for the bags...” (Z.O). 5. Resource conservation in packaging; i) SME2 uses only carton board for packaging
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Social ethical orientation	<ol style="list-style-type: none"> 1. Sustainable enterprises that are rooted in local communities and operate within collaborative network structures; i) In-house team love their work environment, SME2 “cares” and provides a “comfortable” environment (Z.W) ii) staff are “paid better, go on leave and holiday” (D.O) iii) staff are “part of a welfare group/ <i>chamaa</i> that has a ‘merry-go-round model” (B.T., Z.W., D.W1) iv) on a mission to “set up a proper, local circular economy and infrastructure of textiles waste [...] that has a social impact (W.S)” 2. empowering locally based economies and improving quality of life; i) purchase 100% second hand clothing from the local thrift market retailers ii) work with the locals, offering menial jobs where required 3. Enabling responsible / sustainable consumption; i) customers frequently visit their premises as it offers a sustainable consumption and production model (SDG 8 and SDG 12) – “visitors perceive their model as “very smart”, & appreciate their “story and processes (L.W)” ii) “others want to partner (D.W2)” 4. Integrating marginalized persons i.e. i) “work with a Burundian (L.W)” ii) “locals come for menial jobs and are paid for it (L.W)” iii) “anyone who is illiterate can come work here, so long as they learn and their work is good (M.A)” iv) training and apprenticeship encouraged v) “do not work with non-renewables, we work with waste” to create “one of a kind, unique items (B.T)”
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Table 12: SME2 SDOS summary. Source: Lubano.T. (2023), informed by informed by Vezzoli et al. (2007 & 2018).

4.2.3.3. *System Map*

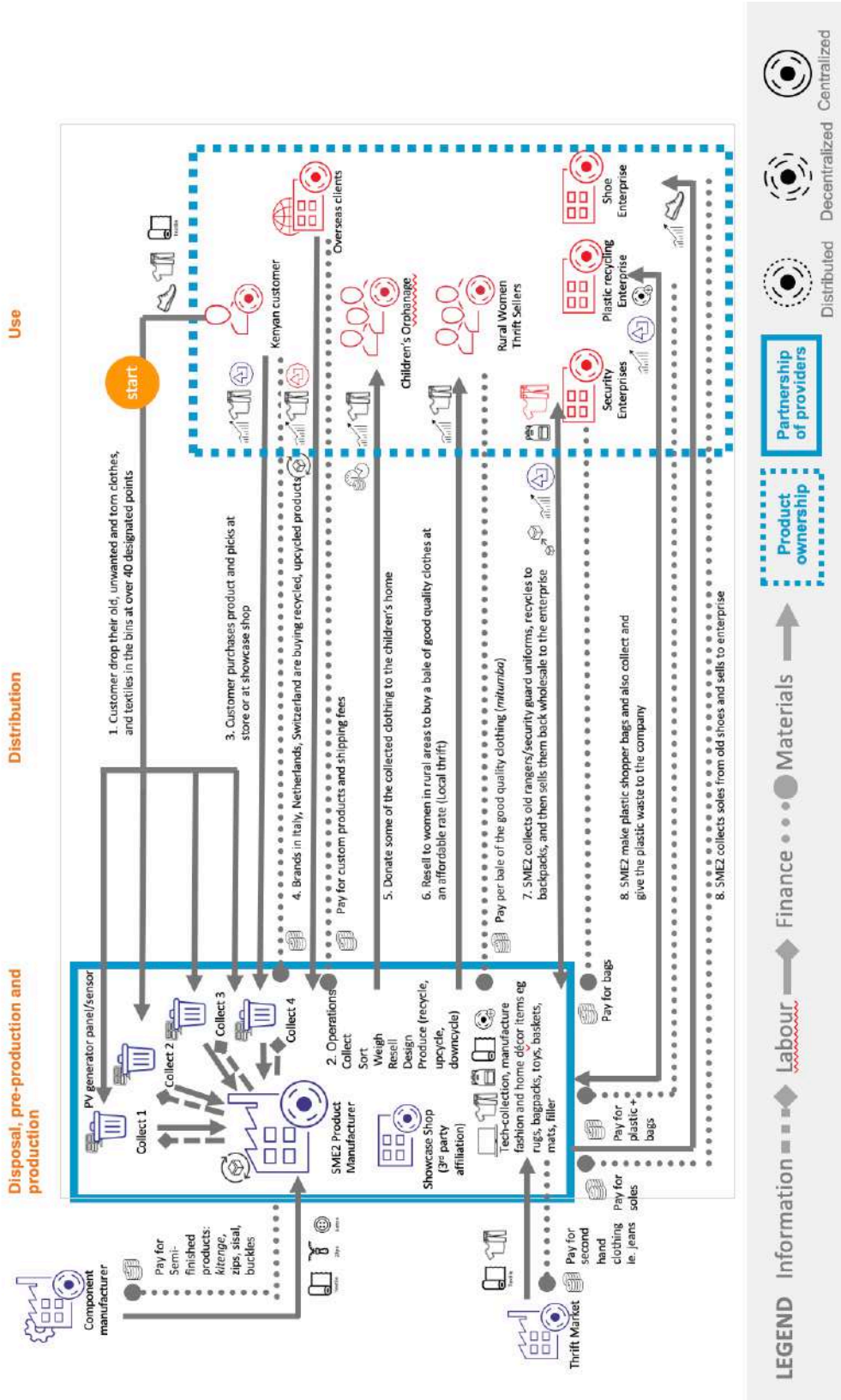
Below is the entire system map for SME2. Visualized are all the stakeholder interactions, configurations, material, labour, information and financial resource flows of its S.PSS. Ownership of the products and services remains with the customer/clients. However, in some instances, we see ownership is exchanged.

The SME has also highly trained staff members, amongst the participants I the logistics manager who is a marine biologist and one of the production team members was a chemical engineer. The founders are exposed and are also highly experienced and in the fields of design and sustainability. The two co-founders comprise of a Kenyan and Dutch. This SME was the only one that appeared to enjoy economic prosperity and is “profitable” (W.S).

This SME’s business starts at the end of life of the clothing life cycle making it a most promising and attractive S.PSS model (Vezzoli, et al, 2021). Its design promotes an even system innovation not only on the production of the products but also on the whole supply and demand fulfilling customer satisfaction that underscores environmental sustainability and circular ethos of recycling, upcycling and downcycling.

The SME2’s SDOS system map (Figure 16) took approximately four hours to design and visualize.

System map



SME2 System Map: Designed by Teresa N. Lubano (2023)

Figure 16: SME2 System Map (2023).

4.2.4 SME3 Systems Innovation Overview

4.2.4.1 Business Model Canvas

Table 13 is a summary of SME3’s Business Model Canvas. All the information was analyzed and transcribed from an audio recording. The session with the founder SME3 was for one hour.

Business Model Canvas		Designed for:	Designed by:	Date:	Version:
		SME 3	Teresa N. Lubano	04.05.2023	1
<p>Key Partners</p> <p>Shippers: Global partner for shipping garments</p> <p>Large screen printers and sustainable production of printed textiles: Voi & Nairobi, Kenya</p> <p>African ethical fabric producers: In Burkina Faso and Ivory Coast (cotton textiles, traditional hand-woven textiles)</p> <p>Local leather suppliers: Nairobi, Kenya – they have a wastewater treatment method</p> <p>In-house team: Founder, Admin and Comms, a sample maker (x2), a design assistant, internship (on occasion), founder manages design (cuts pattern and designs of all products)</p> <p>Formalizing Advisory Board: WIP</p> <p>Local artisans: local weavers, welders, and brass makers in community groups (from farmers, weavers, dyers and other semi-finished inputs) 70% women (informal sector)</p> <p>Local fibre & textile production enterprises: train the community to produce custom garments e.g. EPZ (sew), Rivatex (cotton textile manufacture)</p> <p>Motivations for Partnership: Sustainability-related: both from a social ethical and eco-efficient priorities "Carbon neutral zone" "Production expertise" "Train and work with local community" "Sustainable business practice" "Building a team, that is able to service the needs of the local economy and expertise in the export market"</p>	<p>Key Activities</p> <ol style="list-style-type: none"> 1. Design to sample 2. Small batch production of beautiful ethical garments: jackets, kimonos, premium clothing 3. Free repairs/Maintenance for direct-to-customers or local wholesaler markets 4. Outsource designer pattern prints on textiles and woven textiles 5. Semi-finished products with artisans (accessories for the garments) 6. Runways to get access to markets eg B-to-B and customers, networks 7. Fashion and lifestyle goods (WIP for a Kenyan brand) <p>Key Resources</p> <p>EFI: support from Ethical Fashion Initiative, an initiative by ITC</p> <p>Fibers: Cotton, Silk Linen, Tencel (tree pulp) and cupro (cellulose cotton) blend Nairobi, Ivory Coast, Burkina Faso</p> <p>Leather: local leather, lamb hide Heavy leather for accessories</p> <p>Components: custom, hand done, crafted in bone, brass and cow horn, gold plating</p> <p>Young design team: make samples (make), R & D (training beyond production, WIP for operations, logistics and comms) 50:50 split of time</p> <p>Intellectual: Brand is trademarked</p>	<p>Value Propositions</p> <p>"Making beautiful essentials that have a greater meaning and purpose in people's lives." We create seasonless pieces that are timeless.</p> <p>"Shop less, buy better" "conscious and compassionate leisure lifestyle brand"</p> <p>Source locally and where possible source organic fibres such as cotton, linen/tencel/cupro blends</p> <p>Characteristics:</p> <p>Seasonless and runway collections (most attention on the runway and then cycle to the seasonless collection)</p> <p>"Long culture of weaving" - craftsmanship Fabrics feels beautiful: Velvet feel, a bit of shine, light feel of an organic fabric" "Made in Kenya" "Small batch orders" "work to empower local communities" "handcrafted/handi-casting by artisans" "stand for the ideal to buy less clothing – shop less buy better" "traditional hand-woven techniques" "organic dyes – indigo dyes" "avoid trends, focus on timelessness" "agile and adaptable team"</p>	<p>Customer Relationships</p> <p>Conscious customers who pay for quality. -It is costly because of the cost of high quality natural fibres and the social sustainability aspects involved in the production processes.</p> <p>- "(largely) sourced locally, made in Kenya"</p> <p>Channels</p> <p>Direct to consumer:</p> <ol style="list-style-type: none"> 1. E-commerce on website 2. On consignment (Nairobi only) 3. By appointment 4. Popups 5. Drop shipping (third party) <p>B-to-B:</p> <ol style="list-style-type: none"> 1. Export market- Boutiques (US/UK/Asia) 2. Local - Hotels and lodges in Kenya 	<p>Customer Segments</p> <p>Niche consumer: "confident, reflective, self-aware global citizen"</p> <ol style="list-style-type: none"> 1. Exposed, worldly, value sustainable modes of production, conscious about their impacts about their surrounding (mainly export market) 2. Fashion lovers who love the brands products (Predominantly female) 	
<p>Cost Structure</p> <p>Value Driven model - focused on value creation, premium value proposition that caters to a eco-conscious consumer</p> <p>Fixed Costs (salaries, Material inputs (most expensive) rents, utilities) Fixed pricing: list pricing, shipping cost applies for the exports</p>		<p>Revenue Streams</p> <p>Revenues: N/A Sustainable. Breaking even. Working to be more profitable by reviewing and building a more robust organizational structure/teams</p>			
<p>Designed by: The Business Model Foundry (www.businessmodelgeneration.com/canvas). Word implementation by: Neos Chronos Limited (https://neoschronos.com). License: CC BY-SA 3.0</p>					

Table 13: SME3 Business Model Canvas. Lubano (2023)

4.2.4.2 SME3 SDOS Summary

Table 14 below shares data analyzed and transcribed by the researcher. It demonstrates the SME3s Project Record as captured in the SDOS toolkit x clothing. This SME is a bespoke brand that leverages various local and regional partnerships across the fashion value chain. SME3 is also a Product-oriented S.PSS that has medium to high eco-efficient and social-ethical priorities in its business.

Figures 17, 18 and 19 depict some product images taken at the SME's facilities during the researcher's Business Model Canvas session with the founder. This session with SME3s founder lasted one hour. For the FGD, the SDOS measuring tool was used online. The two-hour FGD session featured only one participant.



Figure 17: SME3's (left) unisex indigo kimono made of cotton and textile hand woven in Burkina Faso.

Figure 18. Organic cotton textiles (middle), made with colourful embroidered thread that are dyed with natural dyes and hand-woven from Cote d'Ivoire.

Figure 19 (right) 100% Kenyan lamb hide jacket showing the beautiful stitching and craftsmanship on the inner side of the jacket. Images: Lubano (2023).

Sustainable Design Orienting toolkit x Clothing Summary	
Brand Name	SME3
Established	2017
Business Category	Apparel
Nature of Business	Product(s) & Services: The ethical brand produces “sustainable, eco-conscious, original designs” (Ethical Fashion Initiative, 2022)

Provider/s	Private limited company
Customers	Local and international audiences; B2C, B2B
Location	Nairobi, Kenya
Business Type	Micro, small, medium enterprise (MSME); has 4 full time employees
Founder:	Kenyan
S.PSS Orientation	
Business Model Type	Product-oriented
*Description of existing model type	<p>SME3 has a decentralized S.PSS model. It is a conscious boutique enterprise whose value proposition is “making beautiful essentials that have a greater meaning and purpose in people's lives (K.M)”.</p> <p>They design and produce garments that are seasonless, timeless pieces that are mainly handwoven, handspan and use organic dyes and ethical fibres from West Africa and Kenya. They target a “self-aware global citizen who values excellence/quality, durability, versatility” (K.M) and sustainability in originally crafted clothing designs.</p> <p>SME3 has a symbiotic and complex stakeholder configuration that has networks spanning within the country and across the region.</p> <p>*Refrenced from SME3 Business Model Canvas and data synthesized from the SME3 SDOS toolkit</p>
Eco-efficient orientation	<ol style="list-style-type: none"> provides environmental and economically winning solutions; i) Only durable superior fabrics are produced in small batches and are organic in nature ii) 100% “handmade”, “handspan”, “hand-crafted”, “locally/regionally sourced”, “locally designed” semi-finished product by local artisans. “textile artisans use hand looms using traditional techiques”(KI1, K.M) iii) scraps/fents donated to third party partners for recycling iv) tracking the kg of textile waste collected iv) digital printed clothing, reduces water consumption

	<p>v) use the best organic fibres sourced locally and globally eg. Cotton, linen, Tencel® and cupro, Kenyan lamb hide leather vi) one of their partners is “carbon neutral certified” (K.M)</p> <p>2. design (offer) for lifespan extension of product; i) The SME “does not practice fast fashion, item will be worn again and again” (W.G) ii) don’t support trends/ styles instead the focus is on versatility, diversity in fabric choice and styling of the same type of garment design</p> <p>3. minimize distribution/ transportation; i) “Digital fashion showcase of new collection at the Lagos Fashion Week (Nigeria)” (W.G)</p> <p>4. design for intensive use of product; i) small batch production ii) materials can withstand intensive use and clothes last a long time” (W.G, KI1) ii) “garments are seasonless, timeless” (W.G., KI1, K.M)</p> <p>5. Resource conservation in packaging; i) SME3 “use recycled paper and packed in khaki carrier bags or carton boxes. Dont use plastic” (W.G)</p> <p>6. Resource conservation in production; i) produce new collections only every 6 months ii) runway collections repurposed to similar designs but in new fabric/textiles variations giving a fresh look iii) cloth accessories e.g. horn, bone and upcycled brass zipper pullers made by local artisans</p>
Social ethical orientation	<p>1. sustainable enterprises that are rooted in local communities and operate within collaborative network structures; i) reliant on multiple third-party stakeholders, from outsourcing to local samplers, to ethical fashion investors, local and regional textile and fabric producers, to “super cooperative enterprises” (KI1), to data access to market actors such as marketplaces, popups and international boutiques</p>

	<p>2. i) third party affiliations that work with a huge community of women ii) all bone, horn and brass “accessories made by local artisans” in Nairobi, Kenya (K.M) guaranteeing that the local economy thrives and fostering the improvement of the quality of life of women and artisans in these communities;</p> <p>3. improvement of the working conditions; i) workforce enjoy their environment, compensated well, “make clothes with love” (W.G.) ii) freedom to talk freely, all staff are on group Whatsapp group iii) owner understands that a “Mental health day is important” (W.G) and cares for the mental well-being and safety of workers</p> <p>4. Improving equity and justice in relation of stakeholders; i) noted that the SME has multicultural, diverse stakeholder partnerships that are players in CE ii) a fully decentralized production model for supply of raw materials, semi-finished goods partners that cuts across geographies</p> <p>5. enabling responsible / sustainable consumption; i) clients buying their products understand that “the cost of sustainability is dear” (W.G), pay for quality and not quantity ii) teach children how to garments are made iii) “Outsourced production networks promote cultural sustainability” (W.G) iv) have unique contracts/ relationships that offer commission/a percentage to support some of the sub-contractors /artisans eg textile designers v) “pay <i>pole pole</i>” (slowly) model with certain customers (W.G) vi) committed to “work with local and regional communities from farmers, dyers, spinners, weavers, embroiders, producers, tailors, artisans, printers” (W.G. K.M)</p>
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	<p>6. integrating marginalized persons i.e. i) unisex, genderless garments designed and produced ii) garments can be worn by all ages iii) work with ‘super cooperatives’ who employ marginalized persons (women and youth)</p> <p>7. improving social cohesion; i) through reimagining designs that are inspired by African traditional cultures ii) promoting cultural sustainability and heritage, traditional craftsmanship, culture & identity iii) “the garments styling cuts through race” (W.G) and has an appeal across all demographics</p>
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Table 14: SME3 SDOS summary. Lubano, T. (2023), informed by informed by Vezzoli et al. (2007 & 2018).

4.2.4.3 System Map

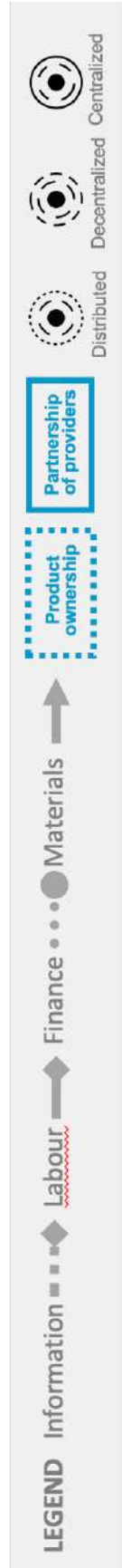
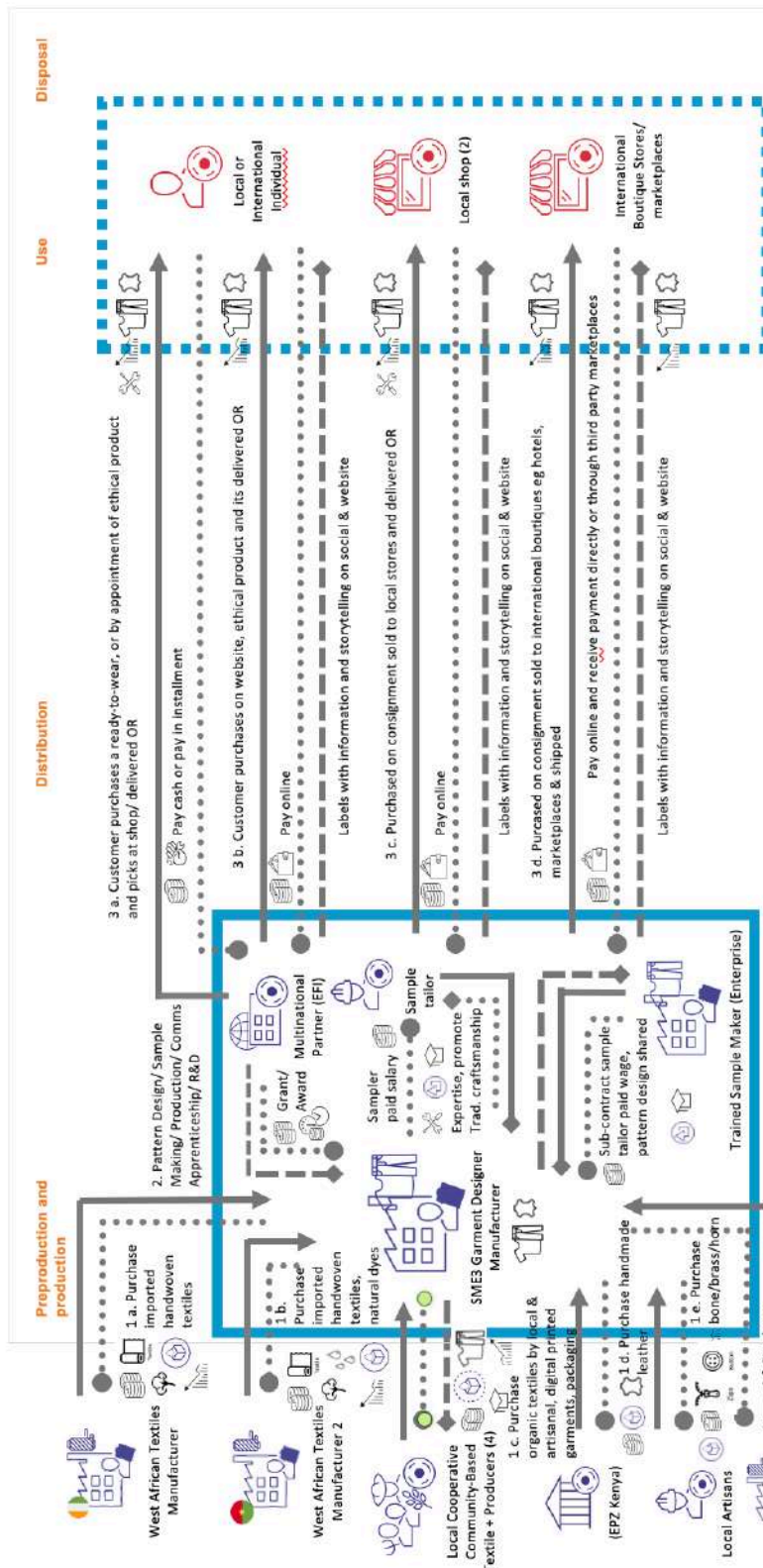
Figure 20 demonstrates the entire system map for SME3. It’s business type falls under the category of an MSME. Visualized are all the stakeholder interactions, configurations, material, labour, information and financial resource flows of it’s S.PSS. Ownership of the products and services remains with the customer/clients.

The MSME has also highly trained professional staff members with a founder who is an expert in fashion design and sustainability. Being the youngest business of the lot, the growing is not yet profitable. However, plans are underway to expand its organizational structure and a move to a bigger premises setup.

This SME’s business has a most robust, flexible setup that is reliant on a decentralized S.PSS model. The SME focuses on building relationships and networks with local CE organizations (some of who are “super cooperatives”) who manage the SMEs production and are keen on socia;-ethical practices. In house, the SME only works with sample makers and also subcontracts sample makers to make their bespoke garments. These “seasonless garments” may cost a premium but customers and experts alike argue that they are worth their value and more as they are enduring garments.

SME3’s SDOS system map took approximately three hours to design and visualize.

System map



SME3 System Map: Designed by Teresa N. Lubano (2023)

Figure 20: SME3 System Map (2023)

4.3 Limitations of the study

- 4.3.1 The area of focus is at the intersection of systems design for sustainability, and Design Thinking. This is a multidisciplinary approach and therefore wide area of research.
- 4.3.2 The term Design Thinking is ambiguous and informal (Kupetz, 2019) and its methodology is non-linear and iterative (Hasso Plattner). Meaning that there is more than one way to problem-solve and it can be difficult to ascertain the level of success in its application. The author mitigates this by ensuring rigor such as adherence to a specific set of system thinking tools (from *Methods of System Design for Sustainability* by LeNS International; Vezzoli et al, 2022) that simplifies the data collection instruments and data analysis is supported through clearly structured and detailed process model.
- 4.3.3 There are a limited availability of system designers, engineers, managers, and experts who design and run S.PSS business models to interview in Kenya's fashion industry. As a result, the descriptive findings cannot be generalized because personal values and perspectives influenced the data collected. Interpretation of the researchers can influence the results (Gavard-Perret, 2008) and therefore, this may limit the research's applicability.
- 4.3.4 Research study, and designing S.PSS's, and in particular, within the fashion ecosystem may be complex and challenging areas, 'specifically when looking at green processes and system design, as well as the lack of regulatory support (Majumdar & Sinha, 2018)'. They also demand changes in the status quo of business and economy (Ostermann et al, 2021).
- 4.3.5 Limitations experienced at Focus Group Discussions
- 4.3.5.1 The FGD research workshop sessions were lengthy in terms of duration to plan, prepare and execute.
- 4.3.5.2 Presented difficulties when trying to describe or define complex terms to the participants such as "sustainability, eco-efficiency, social-ethical priorities".
- 4.3.5.3 Some irrelevant lines of questioning in the SDOS measuring tool. They tended to highlight issues more common in the Global North and not our market.
- 4.3.5.4 Most participants express themselves best in Swahili language and therefore the FGD session had to be modified to accommodate this.

4.3.5.5 There was a modest level of group speak.

4.3.5.6 Researcher had to translate information as some participants were semi-illiterate

4.3.5.7 SME3 had one participant at the FGD, other team members were unavailable

4.3.5.8 Network issues, noise and power interruptions during online interviews for both the online FGD and key informant interviews.

5.0 Discussion

5.1 Designing an attractive S.PSS for fashion industry framework overview

Having determined the nature of *true* Sustainable Product-Service System business models, strategies, and tactics in three Kenyan SMEs, an S.PSS framework is developed. This section strives to triangulate the outcomes of the study by sharing high-level insights, learnings, strategies, and indicators that truly make these SMEs sustainable, remarkable and unique. By studying the SME's BMC and SDOS outcomes, revealing insights emerged that demonstrate how Kenyan SMEs stakeholders' configurations, interactions and activities are prioritizing sustainability in the industry.

The framework overview is discussed in four parts,

5.1.1 Emergent S.PSS themes for fashion sustainability

5.1.2 The eco-efficient priorities foci and

5.1.3 The social ethical priorities foci

5.1.4 A S.PSS framework design proposal for sustainable fashion

Underscoring objective 3 of the study, this section offers emerging themes that will guide fashion-based SMEs on how to design, adopt, or improve and implement, or orient their enterprises toward sustainable outcomes. Though specific to Kenya, these themes may also apply to low to middle-income economies.

5.2 Emergent S.PSS themes for fashion sustainability

5.2.1 *Most fashion businesses are predominantly sustainable*

Key informants and SMEs alike echoed the same thing, there is a strong, harmonious social and economic construct that delivers low environmental impact embedded in the fashion ecosystem. Keenly studying the nature of the SMEs business models cases, one will encounter nuances insights and comments. For example, when it comes to the quality of material resources, "organic materials and dyes have been the

norm (KI1)”, textile fibres for the most part, have been “handspan”, and “handwoven” and “traditionally hand-dyed” (SME3 founder). This low level of mechanization guarantees that most production practices are in small batches, at any given time.

From a social-ethical point of view, there are intimate and personal interactions between internal stakeholders and their founders, i.e. “here (in Africa) tailor’ names are known, which is not the norm in the Global North”. Also, “working conditions are good, unlike the sweatshops witnessed in the Global North contexts” (KI2). Furthermore, KI1 is of the opinion that when it comes to sustainability “the definition of sustainability isn’t singular” and recommends that there is room for a re-definition of what sustainability means from a local (low and middle-income economies) lens.

5.2.2 *Designing a sustainable business in the local fashion ecosystem is complex and lengthy.*

SME2 and SM3, though small and micro businesses in size, respectively, these SME’s work have an extensive list of stakeholders and stakeholders interactions; from the installation of tech-enabled disposal systems, to working with handprinted/handwoven textile and fabric producers, to high detailing and craftsmanship in garment and accessories production, strategic digital marketing and communication strategies, investing in Research & Development (R&D) to stay ahead, and even investing in capacity building for their workforces; these SMEs present working relationships with more than five partners (see System maps Figure 15 and 19 to track number of third party suppliers/partnerships) and work with over 8 different operations line streams (see System maps Figure 15 and 19 to track material, labour, information, financial resource flows) at any given time. These interactions occur on a regular basis, and therefore are important to the success of the businesses.

This indicates that founders and senior managers must go to great lengths to prioritize (no matter the cost) the promise of their ambitious value propositions and continuously reframe sustainability communication and offering to their clientele. SME3 founder mentioned that they work with Enterprise X because they have transparent “carbon neutral practices” and also they “work and train local community members who predominantly are 70% women”. This means that the production cycles for a single one product line may transcend geographies, tribes and demographic strata. This positions the SME at an advantage of promoting inclusive and social cohesion within complex networks.

In terms of the lengthy processes, SME2 admitted to the fact that it took them one year to deliver on an order of 5,000 pieces of handstitched recycled pencil pouches

to a foreign customer. Whilst, SME3 works on their ‘runway collection’ over a 6-month cycle period. SME1 shared that it will take her business three years or more to create what she envisions as her uniquely “made in Kenya” textile fabric designs. All these are proven insights that innovating in the sustainable fashion ecosystem is time-consuming and difficult, but not impossible.

5.2.3 *Sustainable fashion businesses focus on the core sustainability dimensions simultaneously which include, economic prosperity, social equity and inclusion and environmental protection.*

What varies is the degree of each as it largely depends on the nature of the business setup. To demonstrate this triple bottom line, SME2 demonstrated a keen focus on environmental protection by stating that, “they don’t see themselves as working in the ‘fashion industry’ but rather they see themselves as an organization that is providing a solution to an existing problem. We are working with what is there (textile waste) and extending their lifespan” (W.S). Known as the non-interference: techno-cycles, here, resources are hardly drawn from nature but are rather reused or recycled (Ellen MacArthur Foundation as cited in Vezzoli, 2021, p.34). KI1 mentioned that there is a particular “Kenyan fashion brand that only produces one collection a year” and another that has a “seasonless, timeless” appeal (K.M., KI1).

One participant, L.W. of SME2 spoke of promoting social cohesion and equity by emphasizing that, “we work with someone from Burundi” [...] we also hire locals, who come to help with menial jobs and get paid for the work they do”. Participant M.A. from SME2 confirmed that “anyone, even those with no formal training can work at the SME so long as they successfully undergo the necessary training to do the job well”. In alluding to the dimension of economic prosperity, participant D.W. at the same SME mentioned that they seem to have happy clients “who feel that we are doing well. They come to visit, ask about our processes, and even want to become partners with us”. Similarly, a senior staff member, W.S., mentioned that they work with brands that are keen on circularity which aligns with their mission which is, to “set up a proper, local circular economy and infrastructure of textiles waste ...that has a social impact”. She described the Kenyan textile waste issue as “devastating” where they have witnessed how “second-hand clothing, such as oversized pants and unwanted clothes, ends up in landfills and rivers, with marabou storks eating shoes and clothes.”

Moreover, SME3’s founder was interested in knowing that her business partners practice “wastewater treatment” on their premises and have “carbon neutral” measures

in place. Here we see a symbiotic relationship between environmental protection and social and ethical concerns that work in unison. This in turn qualifies statements by experts that, ‘*sustainable S.PSS offers unique client wants and aspirations as well as innovative stakeholder interactions that result in eco-efficiency, social equity, and cohesion (Vezzoli et al, pp.8-9, 2007)*’. Unconsciously, across the SME business cases, we see the entrepreneur underscoring multiple Sustainability Development Goals (SDGs) i.e. SDG 1 (Poverty), SDG 6 (clean water and sanitation), SDG8 (decent work and economic growth), SDG 12 (responsible consumption and production).

5.2.4 *Fashion SMEs benchmark their sustainable business practices with ‘glocal’ exemplars*

Throughout the study, exemplars were repeatedly mentioned in interviews or FGD discussions. Some brands that are leading true systemic change in the fashion ecosystem include, Sandstorm (KE) and affiliate, the Opportunity Factory (KE), Sheldrick Wildlife Trust (KE), Bata (KE), Bébéravi (KE), FunKidz (KE), Rummage (KE), Anyango Mpinga (KE), Katush (KE), Hamaji (KE), 1v1 - pronounced “Level One” is a brand by Restyle (KE), Hisi Studio (KE), Everlane (US), and Patagonia (US).

5.2.5 *Sustainable fashion SMEs are reliant on their internal team’s expertise, agility and loyalty to meet their vision and mission statements*

Team composition is an extremely critical faucet in sustainable fashion businesses. In expressing the importance of smart and agile teams, SME3’s founder revealed that her “team is young and therefore adaptable in delivering on the enterprises business goals”. She also mentioned that though youthfulness and agility is a prerequisite, her sample maker wasn’t young and had been working with her for a long time. This most likely indicates that some of the skills required in making the brand’s garments need a high level of technical craftsmanship that can only be acquired over time.

In explaining team loyalty, SME1’s founder had implemented a unique tactic that ensure that her army of 11 tailors co-design, collaborate and share in the business shares. At this enterprise, tailors are co-owners of the business and “have the ATM bank cards” (R.A) of the business. This most likely means that the founder sees it beneficial for the tailors to not only have autonomy in managing the finances of the businesses but as a long-term view of ensuring loyalty and skills retention. In turn this guarantees a regular livelihood for the workforce and the promotion of decent work and economic growth (SDG 8).

Founders/owners are the vision bearers of their enterprises. Therefore it is the responsibility of (Heitmüller, 2013. p.16) managers to envision a set of characteristics they want their organization to be associated with which are transmitted to employees through a complex and congruent system of communication, behaviour and design. This requires that they are experts in their business field. For instance, SME2 has an able leadership team comprising of two co-founders; a Kenyan national and a Dutch who both have a background in “textile and sustainability and the other a background in design and business sustainability respectively” (W.S). These skills are complimentary and necessary knowledge resources that most likely ensure the success of this particular SME. Similarly, the founder of SME1’s first degree was in Industrial Design from the University of Nairobi and a took a specialized course in leather bag design in Florence, Italy. Founder of SME3 studied fashion design the United Kingdom.

5.2.6 *Sustainable fashion enterprises primarily collaborate with companies that are interested in circularity or are in themselves ‘circular’.*

Circular Economy (CE) is a concept that focuses on decoupling, resource efficiency, greater manufacturing efficiency, and a transition away from linear economic models. According to McCarthy et al. (2018), it tries to promote slower material flows and limit resource exploitation without impacting economic activity. In lay terms, this means that SMEs should be striving to ‘green’ their operations. The SME cases presented in the study attract an eco-conscious demographic; those who are interested in purchasing products from businesses that promote low environmental impacts.

For the SME’s serving a B-to-C segment, there seems to be an appeal for products that are affordable, are recycled, upcycled and “downcycled” (P.M), “have a long lasting design” (KI1, W.G)”, “use organic fibres and dyes” (K.M), “can be refurbished/remodeled/ repaired” (R.A), “can be resold” (P.M) and or have either direct social impact or deliver environmental protection.

From a B-to-B clientele point of view, there are two market opportunities. The first relationship, is one that caters to an export market, where textile waste products are recycled/upcycled and shipped to another market for resale by an international retailer. The second relationship, is where the SMEs “help businesses move into a more circular space because they do not have proper means of disposing of their own waste, so in this instance, we collect them to upcycle and resell them (wholesale) back to the same organizations” (P.M).

K11 emphasized this need in his recommendation stating that “SMEs need to be sensitive to the linearity of the clothing life cycle and move towards circularity”. Figure 21 (see red outline) uses the Systems Map for SME2 to demonstrate where this opportunity rests. Here, both Provider/ the SME and the Actors (consumers, enterprises, individuals, institutions, community) collaborate in fashion circularity. This entails Actors taking the responsibility to make donations, sharing/dropping their old, unwanted, oversized or torn clothing directly with the Provider who then internalizes the cost of investing in a responsible disposal system and creating new product offering from these clothing. It is this form of a S.PSS model that is the ‘most plausible and attractive’ (Vezzoli 2021, pp. 49-50) form of system innovation.

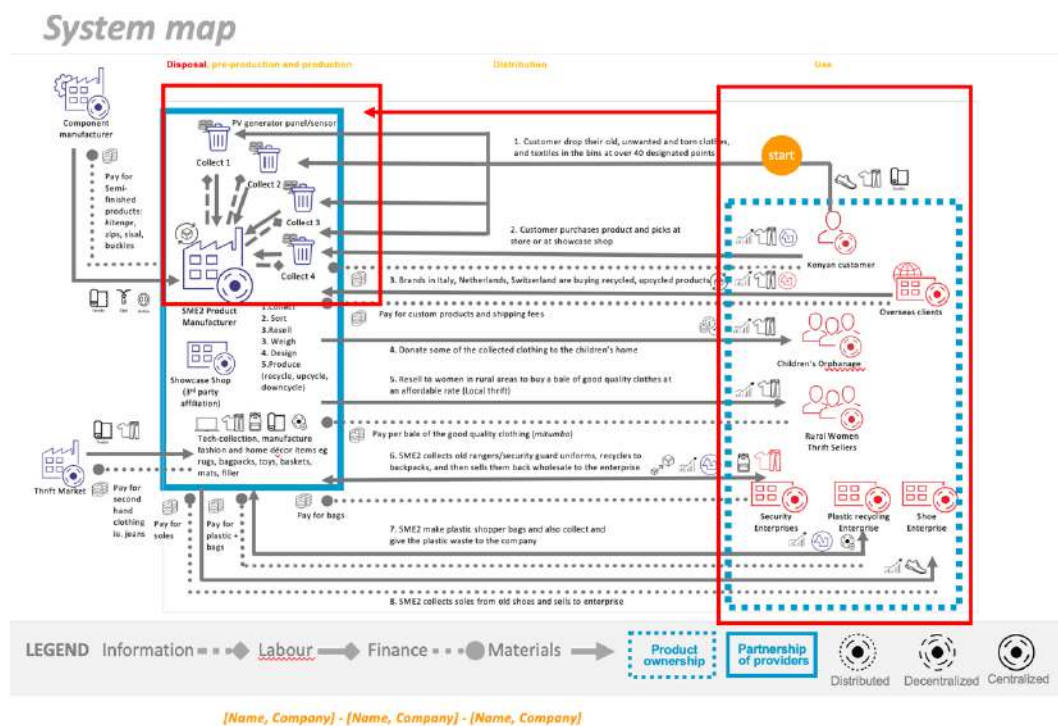


Figure 21: SME2’s System Map demonstrating where the opportunity for circularity exists (2023).

5.2.7 Sustainable fashion-based SME’s have system innovations that are adaptable and dynamic.

Two of the three SME cases mentioned that they were re-strategizing their organization structure or developing a new product in the coming months. This discloses how imperative it is to reinvent oneself as a strategy to be successful in this market. One SME mentioned that they stay committed to delivering on their vision by “adapting and knowing what works and focusing on what we want to do” (K.M) in

ensuring they deliver on their product-oriented ‘unit of satisfaction’ to their clientele. SME3’s founder also mentioned that when they saw a huge number of copy-cats of their black and white jacket kimonos in the market, they changed the black dye to a natural indigo hue. For SME1, they annually produce their own batik fabrics so as to create new innovative African fabric designs for their clientele, whilst SME2 mentioned that what differentiates their brand is that they make “one-of-a-kind items and that’s what makes them stand out” (B.T). No product line is similar to what exists in the market. W.S. of SME2 stated that they don’t even consider themselves as a business in the “fashion industry” but rather they see themselves as “an organization that is providing a solution to an existing problem, we are working with what is there and extending their lifespan”. This most likely assumes that a dynamic mindset is encouraged amongst the workforce — and not pigeonholing the business to a single industry. In this market, adaptability, versatility and flexibility are, therefore, the lifeblood of the success of a sustainable fashion brand (or organization).

5.2.8 *Technological efficiencies are viewed as means to facilitate transactions and visibility rather than as a major component of the business*

This theme demonstrates that fashion SMEs in low- to middle-income markets keep their processes manual or low-tech, and that this is advantageous to them in order to remain sustainable in their business operations. Evident from the study was that technology was only being harnessed at the most basic level and predominantly to facilitate online transactions and payments internally and to external audiences. Key transaction channels were through e-commerce or physical payments and the acceptance of various modes of payment such as mobile money (MPESA), PDQ machines such as PesaPal’s SABI POS, card transactions on online marketplaces, or a blend of these.

Each SME has a robust and active online presence where they used social media or their websites to communicate their business activities or product/service offering to their customers.

From an operations point of view, only one SME was “experimenting with sensor solar technology” (R.M) in their disposal system with all of the SMEs having little if any scenarios of using state-of-the-art technological innovations enshrined in their businesses.

Also patents, trademarks and copyrights of innovations are rare and “seem un-useful (K.M) this is because there are huge issues associated with IP (plagiarism, copy-cat) within the industry.

Revealing to this discussion was KI2’s opinion where she mentioned that she is a “critic of technology” and that the current solutions provided by technological innovation are “never long-lasting, fail or do not solve the issues they purport to resolve”. She only endorses technological innovations when they are solving a very “basic need and is meaningful” such as the example of beauty & fashion brands that have “virtual fitting rooms” or ones that could champion building digital tools that can solve the water scarcity issues that are experienced in the country.

5.2.9 *Codesign and collaboration are enshrined in sustainable fashion businesses in Kenya.*

Across the board, there are multiple primary and secondary stakeholders' co-creating and working collaboratively with these SME’s. Whether it’s through harnessing the power of cooperatives (cited by KI1), integrating regular apprenticeship and training among internal stakeholders (SME1, SME2 and SME3), or pooling local artisans' skills (cited by SME1, SME2, SME3 (through third party), collecting, sharing, donating, repackaging to resell textiles waste products (SME2), all these initiatives show participatory co-designed integrations, interactions and initiatives within their systems.

5.2.10 *Fashion-based SMEs have S.PSS orientations that are predominantly product-oriented.*

Across the board, all three SME cases have product-oriented S.PSS models. Customers retain ownership of the products purchased from the MSMEs (see the dotted line. Result-oriented and user-oriented S.PSS were not encountered. Nevertheless, the system innovations had richer stakeholder interactions and configurations that may not otherwise be seen in similar businesses in the Global North.

5.3 Social ethical priorities foci

5.3.1 *Community social cohesion is reinforced in “cooperative networks” and plays an integral role in fostering fashion sustenance, but this has not been discussed enough.*

According to KI1, cooperatives are harnessed through the assembly of “communities across regions and demographics” and managed by a “super cooperative”. These super cooperatives intergrate social impact in their practices. For example, they could ensure that they “employ local women” youth and marginalized/weaker communities. They could go further to create social amenities such as “nurseries, and health insurance” resources for their workforce and access to markets for their partners. Moreover, these “super cooperatives” have

very strong local community networks, investors and can offer market opportunities with their collaborators.

Therefore, smart, socially-conscious fashion-based SMEs strive to seek out these “super cooperatives” to collaborate and work with them. Fashion-based SMEs understand that in order to succeed they must work with these “super cooperatives” to underscore their CSR goals/initiatives and push forward their sustainability agendas.

Championed by “super cooperatives”, here are some “cooperative networks” tactics that promote social equity and cohesion within the networks:

- i) Setup of informal or informal “*chamas*” within SMEs (SME2)
- ii) The entrepreneur/founder availing a “bursary fund” or a promise to educate well-performing children of members of staff (KI1)
- iii) “Salary advances for medical care or compassionate leave funds” (KI1)
- iv) or even more permanent solutions such as offering affordable health insurance for the workforce
- v) Individuals acting as ‘collectors of textile waste and unwanted clothing’ play a collaborative role in environmental protection (as seen in SME2)
- vi) Donations of quality second-hand clothes to children’s homes (SME2)
- vii) Tailors feel like “owners of the business” (SME2)
- viii) Tailors are known by the founders and they work closely and more often than not in the same physical environment (KI1)
- ix) Staff can access products made by the SME at more affordable rates (SME2)
- x) Full team including the founder/entrepreneur are present at the end of a runway show to bow to the audience. This shows recognition and respect for their hard work (KI1)
- xi) Opportunities offered such as “Designers Challenge” (KI2), and apprenticeship programs that offer capacity building, funding and/or access to markets and opportunities

Most of these social sustainability tactics are not properly documented and are nearly unnoticed activities that should be highlighted much more. This could be linked to the fact that Africans take our ‘*Harambee*’ spirit and that community relationships are taken for granted.

Because of these strong community networks, problems with discrimination, freedom of association and negotiation are rarely experienced.

5.3.2 *Cultural sustainability is predominantly ubiquitous in sustainable fashion businesses*

Cultural sustainability of the ‘African fashion sense’, material culture, traditions, customs and methods of manufacture are admired, used for inspiration, and reimaged in contemporary contexts by both SME1 and SME3. These SMEs also manifest work relationships with local and regional communities that practice traditional skills that meet the entrepreneur's design innovations and intentions. For example, SME1 locally produces batik fabric using the traditional wax technique seen in West African practices; SME3 is drawn to the highly specialized, complex, handwoven hand dyed, hand-spun techniques of textile production in Burkina Faso. This country boasts a strong textile heritage of hand-woven cotton fabric traditionally called *Dan fani* (Fashion Revolution, 2015).

5.4 Eco-efficient priorities foci

5.4.1 Sustainable businesses are not necessarily profitable.

Though the research did not enquire about the cost structure and revenue streams of their businesses, all SMEs were requested to indicate whether they felt they were profitable or not. Only one in three of the SMEs interviewed confirmed that they were a profitable business and were looking to scale into a new space in the coming months (SME2). The other SMEs were only breaking even. One SME projected that in order to facilitate profitability and scale, in the coming months, they were looking to reinvest their revenues into restructuring their organization by building a more robust team “that is able to service the needs of the local economy and have expertise in the export market”. It is also likely that the capital investment is from the entrepreneur's savings or funding/grants.

However, because the enterprises are young and in their natural growth curve, it is not uncommon for them to consider scalability and profitability at this stage.

Finally, the researcher would like to argue that in as much as economic prosperity is still elusive, these businesses are still successful in their own right, because of their “excellent technical expertise and/or fame (KI2) and most importantly, their strive to green their businesses. “Money will always follow” (KI2).

Consequently, the researcher recognizes that there are clear tradeoffs between environmental wins and economic wins.

5.4.2 Few fashion-based SMEs implement disposal systems in their operations or processes

Only one of the three SMEs deliberately implements a disposal system. More needs to be done in terms of providing solutions for the end-of-life phase of the clothing system. However, there is some progress in this area where SMEs are partnering to keep their systems circular.

Recommended tactics to embed disposal practices and tackle end-of-life phase may include, “SMEs demonstrating how to repair clothing in workshops” (KI1), promoting sharing/rental of garments and SMEs provide mechanics and clear labels/instructions of how to return old or torn clothing back to the premises for circularity measures. Most TAF SMEs only think as far as getting product to the user, and not life beyond this service. SME’s need to ensure that they ‘close the loop’ by also thinking about the end of life of the clothing.

5.4.3 *Energy consumption minimization is prioritized, albeit unconsciously*

86% of electricity generated in Kenya comes from renewable energy sources (Mwango, 2023). 90-100% of the fashion-based SMEs use main grid electricity. When queried about their strategies of how they minimize their energy consumption they seemed to have no other renewable alternative in place. This in the short and medium term should not be a concern as the electricity they use is already harnessed from renewables.

What remains to be widely understood is that this is one thing that the Kenyan government has done successfully to support the industry to be on track from a sustainability front.

5.4.4 *Measuring greenhouse emissions or carbon tracking is rare*

We still are a long way in normalizing carbon tracking. Unlike brands in the Global North that are implementing carbon emission tracking strategies in their business operations, by and large, within the continent there hasn’t been much uptake of this.

More has to be done to raise awareness and improve capability in the fashion sector for evaluating carbon footprint. Some initiatives, such as "keeping a count of the kilograms of textile waste collected" (by SME2), show that the intention is there.

5.5 A S.PSS framework design proposal for sustainable fashion

Underscoring objective 4 of the study, this Figure 22 shows a step-by-step framework of how fashion-based SMEs in Kenya can achieve truly sustainable PSS. The image is followed by a table (Table 15), which explains the necessary resources, processes, proposed interventions that shall enable the entrepreneur/designers/engineers and teams to design, adopt, and implement a holistic sustainable business model for the SME. Throughout the framework, both systems thinking and design thinking approaches are used, iteratively – demonstrating an important role that the designer’s plays in catalyzing innovation in practice.

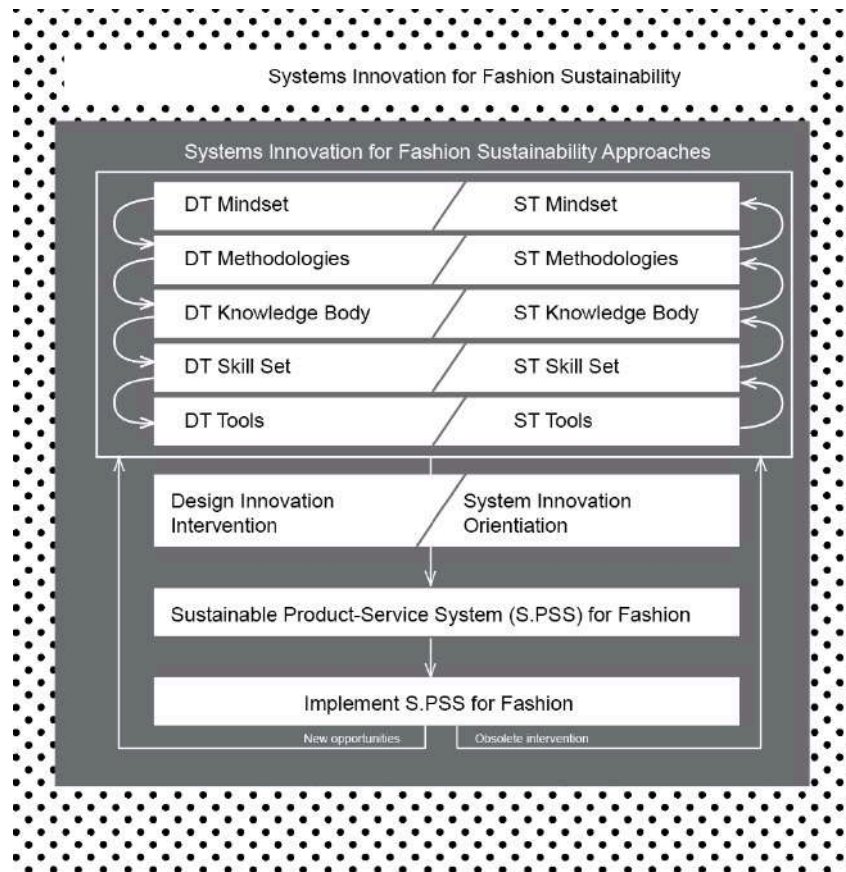


Figure 22: Overview of a S.PSS framework for Sustainable Fashion Source: Lubano T.N. (2023).

Resources		Process	Proposed Interventions
Mindset	Design Thinking	Review your business model and contemplate what strategies and innovations would make your fashion brand more sustainable	Case studies, competitor portfolio, client requests, new areas to explore (R&D), review fashion awards, Ethical Fashion Initiative website, reputable authorities around sustainable fashion
	Systems Thinking	Review your business model with the intention of reorienting your current business model with a system-oriented perspective Intentionally avoid 'greenwashing' strategies	Exemplar S.PSS models, system innovation for fashion, manuals, articles, journals

Methodologies	Design Thinking	Evaluate your design strategies for sustainability. Start by looking at the Clothing Life Cycle and map where the addressable gaps are and define them specifically	Clothing Life Cycle (Azzi et al, 2020)
	Systems Thinking	Then, evaluate which system design methodologies that are applicable and can be implemented. They should suit your needs and are relevant for problem solving Assess the system design for sustainability methodologies for their technical, human resource, material resource complexities Choose the most effective ones (one or two methodologies) that will best suite your needs and can be managed with your design teams/ engineers/ senior managers.	<i>Methods for System Design for Sustainability</i> (Vezzoli, et al, 2021) Life Cycle Assessment (LCA) Design for Disassembly (DfD) Sustainable Materials Selection
Knowledge Body	Design Thinking	Determine the knowledge required to design and execute on the systems change (think around the areas of design paradigms and theories)	Human Centred Design, Universal design, Inclusive Design, Systems design, Service design, Design for Sustainability, Circular Economy, Design Management, Environment Social Governance (ESG)
	Systems Thinking	Determine the specific knowledge creation processes to achieve sustainable fashion in your business based on the selected system design methodology (both internal and external)	Fashion sustainability data, Qualitative and quantitative data, data analytics, interpretive, an addressable market, human interest
Skillset	Design Thinking	Identify ‘designerly thinking’ skill competencies (artistic,	Designers, fashion designers, service

		creative). They should be good at understanding the business of fashion, design strategy, designing and creativity, brainstorming visualization, sense-making, problem solving and co-creation Make them part of the S.PSS team	designers, inventors, graphic designers, marketing and communication senior managers, founders, innovators, creative thinkers, human centred design agencies (e.g. IDEO)
	Systems Thinking	Identify the systems thinking skills competencies (scientific, factual). Pinpoint the personnel who have excellent problem-solving skills, are analytical, sense-making, crunch numbers and can handle complexity. Make them part of the S.PSS team	Logistics managers, researchers, procurement managers, sustainability experts, data engineers and developers, operation managers, founders, investors, finance managers, biologists, environmentalists
Tools	Design Thinking	Define the design thinking tools to be employed. Think about the <i>business value around fashion sustainability</i> that you would like to offer your clientele	Focus Group Discussions, Human Centred Design, brainstorming sessions/ workshops, Business Model Canvas, empathy maps, storyboarding, rapid iterations, digital tools for teams eg Miro
	Systems Thinking	Finally define the appropriate tools and techniques to be deployed	Sustainable Design Orienting (SDO) toolkit / Concept Description Forms/ Interaction story boards/ system maps (Vezzoli et al, 2021) Causal/feedback loops (Sterman, 2000), Computer Aided Design tools and apps; AI/AR digital tools, visual simulations for

			systems innovations in business/ fashion
Innovation	Design Innovation Interventions	Consider design to address a real need that addresses clear areas in the fashion sustainability areas of innovation such as technological, functional, cultural, collaborative, circularity/environmental, customization, material/ecological impacts, nature inspired, human centred.	Apps, new materials, long lasting garments, recycled, upcycled, refurbished or downcycled collections, bio-degradable fibres, organic dyes, sensorial/heuristic fashion, Web4.0 creations, AI/AR modelling
	Define Systems Innovation Orientation	Design for the adoption of a systemic change and transformation towards prioritizing sustainability Seek inspiration by addressing three or more Sustainable Developmental Goals (SDGs) (UN, 2015) and design for Circular Economy Establish the orientation of the S.PSS	Systems Product-Service Systems (for Distributed Economies) Product-oriented, user-oriented, results oriented
Sustainable Product-Service System for Fashion		Using the data collected e.g. from the Methods for Systems Design for Sustainability (MSDS) tools, analyze the existing system and set priorities Designer/ engineer / inhouse team to synthesize the data with visualization tools such as descriptive statistics (see Tools) Focus on underscoring the pillars of sustainability (Social inclusion, environmental protection and economic prosperity)	Eco-efficiency priorities Social ethical priorities Community social cohesion (is rapidly becoming a systems innovation in practice in low to middle income economies)
Implementation of S.PSS for Fashion		Collaborate with all stakeholders to design, reorient and	Monitoring and evaluation tools for systems innovation,

	<p>implement the new S.PSS model into your business affairs</p> <p>Founder/ senior manages to administrative decisions on sustainability prioritization.</p> <p>Design a roadmap/blueprint of how to achieve the set environmental/social ethical benefits/ outcomes. This includes calling out the tactics of S.PSS</p> <p>Periodically monitor and evaluate your system innovation to improve your business operations</p> <p>Engage key stakeholders and resources, contract signing, financing, investment for R&D</p> <p>Prototype and test (and iterate)</p>	<p>analytics, study reviews, feedback/survey/online sentiments, check and measure revenues, carbon tracking</p> <p>Tactics such as marketing, product and service design e.g. prototypes, contracts, networks</p>
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Table 15: Comprehensive guide of designing S.PSS framework for Fashion-based SME's. Source: Lubano.T.N. (2023).

6.0 Conclusion

The complex predicament of global environmental pollution within the fashion industry is not a fashion problem, it's a societal problem. In Kenya, textile waste is dumped in landfills, producing harmful toxic gasses as they decompose and choke our rivers. In this paper, an attempt has been made to demonstrate how designers/the entrepreneur/ engineers and allied stakeholders can use both systems thinking and design thinking mindset to intervene and appropriately address the (complex) problem situation facing Kenya's fashion sector.

Textile waste is the number one issue facing the industry and therefore a systemic change is most urgently required to reduce the environmental challenges brought about by the refuse. The researcher evidences that there are indeed small, emerging Kenyan SMEs that are already looking into the problem. Little if any literature existed to shed light on how they had

oriented their business practice for sustainability. In this research the researcher therefore focused on systems design in the area of the fashion industry and more specifically, the integration of related product-services and key stakeholder interactions within complex systems.

In the findings, the researcher elaborates on the nature of the SMEs business by using the Business Model Canvas as well as combining it with Methods for Systems Design for Sustainability tools proposed by Vezzoli et al (2021) and packaged by LeNSLab Polimi team. Using one of the critical measuring tools called the Sustainable Design Orienting Scenario tool, the researcher gives clarity to how the SMEs are prioritizing sustainability in their affairs. Data from this tool were then synthesized and what emerged were three distinctively different System Maps that elaborated on their design for environmental and social-ethical sustainability. Such tools are not only important for those who are considering designing for sustainability but also for businesses to have a ‘finger on the pulse’ on their sustainability transition endeavors, tap into new business opportunities, or (re)orient to sustainable priorities.

In the discussions, the researcher synthesizes the data to demonstrate emerging S.PSS themes emanating from these fashion-based SMEs. The researcher elaborates that their system innovations *are* indeed sustainable. Their S.PSS were characterized by complex stakeholder interactions and configurations that took a considerable time to achieve, are inspired by ‘glocal’ exemplars, co-elaborate for circularity, invest in expert, agile team compositions, are adaptable and dynamic, promote co-design, collaboration and cultural sustainability within the fashion value chains. All the fashion-based SMEs were product-oriented S.PSS’s.

To conclude, the researcher comprehensively demonstrates how such system innovations are designed and implemented in business practice to promote sustainable fashion. To support this, a framework for S.PSS applied to SMEs in Kenya’s fashion industry was articulated. This framework offers the entrepreneur/ designers/ engineers and allied stakeholders an informed reference point of how to design, adopt and implement sustainability.

Despite the various limitations encountered in the study, this paper uncovers the process of integrating systems thinking and design thinking in business. Moreover, endorses the important role that design plays in fostering innovation in practice and provides relevance to the discipline in advancing good design practice for a better world.

7.0 Recommendations

As evidenced in the literature review, while Kenya's fashion industry plays an important part in the country's socioeconomic development, there is a looming environmental catastrophe

due to the massive amounts of imported second-hand clothing. The role of the founder/entrepreneur, designers, engineers, environmental experts, policymakers and allied stakeholders in championing systemic change within the fashion sector is even more important and needs consideration.

The researcher recommends that this transition can only take place with the assistance of well-equipped designers who can aid in (re) orienting fashion-based businesses to a more circular model.

Second, there has been little research into the role of design thinking and systems thinking in fostering innovation in practice, particularly in the African context. Further research is required to investigate innovative approaches and develop sustainable systems that can be effectively implemented within Kenya and by extension, low-to-middle-income economies — as we have seen, “sustainability may mean something totally different in the Global South”. Potential themes to explore may include:

- i) Evaluating the environmental, economic, and social consequences of sustainable system design in the Kenyan fashion sector. More succinctly, researchers can investigate the areas of resource consumption, waste generation and management, economic generation, economic profitability, employment development, and social well-being.
- ii) Investigating the use of S.PSS for Distributed Economies in the fashion industry; this model has been proposed as a “promising approach to consider for low- to middle-income economies” (Vezzoli et al., 2021). Examine how these fashion-based SMEs that are supported by the artisanal sector contribute to circularity, the associated support system innovation, and how they build social cohesiveness within the community.
- iii) Consider the function of design in raising awareness and encouraging carbon tracking. One critical area would be to study how design methodologies could effectively raise consumer and industry stakeholder knowledge of the carbon footprint of Kenya’s fashion products. Investigate how design interventions like visual communication, digital tools and interactive experiences might aid in carbon tracking and encourage sustainable consumer behavior.
- iv) Look at the role of design in promoting and implementing sustainable fashion policies. There is a need to investigate how design approaches like design thinking and co-creation can help with policy development, stakeholder

involvement, and the successful implementation of sustainability measures in the local fashion industry.

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Appendices

A. WorkPlan

Research Section	Timeline (November 2022 – June 2023)
Introduction	2 weeks
Need for this Study	2 weeks
Background	4 weeks
Objectives and Research Questions	2 weeks
Design Thinking & Systems Thinking Theoretical Framework	2 weeks
Research Methodology	4 weeks
Data analysis interpretations and discussions	8 weeks
Summary conclusion and recommendations	2 weeks
Reviewing work for final submission	2 weeks

B. Instruments

i) Business Model Canvas template

See 1-1. The researcher uses the visual, one-pager Strategyzer's Business Model Canvas created by Neo Chronos to establish the nature of the cases' business planning and model. This Business Model Canvas is a strategic management and entrepreneurial template, that allows to develop new or document existing business models (Neo Chronos, 2023). Critical information about the company, their product's value proposition, infrastructure, customers, and finances are captured on the chart. It will also help establish where (in which area) the intent of being 'sustainable' lies. Note that this tool evolves as a business grows. The Business Model Canvas is provided under the Creative Commons Attributions 4.0 International Licence from <https://neoschronos.com/templates/>

It is available as a Microsoft Word document.

Business Model Canvas				
Designed for:		Designed by:		Date:
Version:				
Key Partners Who are our Key Partners? Who are our key suppliers? Which Key Resources are we acquiring from partners? Which Key Activities do partners perform? MOTIVATIONS FOR PARTNERSHIPS: Optimization and economy, Reduction of risk and uncertainty, Acquisition of particular resources and activities	Key Activities What Key Activities do our Value Propositions require? Our Distribution Channels? Customer Relationships? Revenue streams? CATEGORIES: Production, Problem Solving, Platform/Network Key Resources What Key Resources do our Value Propositions require? Our Distribution Channels? Customer Relationships? Revenue Streams? TYPES OF RESOURCES: Physical, Intellectual (brand patents, copyrights, data), Human, Financial	Value Propositions What value do we deliver to the customer? Which one of our customer's problems are we helping to solve? What bundles of products and services are we offering to each Customer Segment? Which customer needs are we satisfying? CHARACTERISTICS: Newness, Performance, Customization, "Getting the Job Done", Design, Brand/Status, Price, Cost Reduction, Risk Reduction, Accessibility, Convenience/Usability	Customer Relationships What type of relationship does each of our Customer Segments expect us to establish and maintain with them? Which ones have we established? How are they integrated with the rest of our business model? How costly are they? Channels Through which Channels do our Customer Segments want to be reached? How are we reaching them now? How are our Channels integrated? Which ones work best? Which ones are most cost-efficient? How are we integrating them with customer routines?	Customer Segments For whom are we creating value? Who are our most important customers? Is our customer base a Mass Market, Niche Market, Segmented, Diversified, Multi-sided Platform
Cost Structure What are the most important costs inherent in our business model? Which Key Resources are most expensive? Which Key Activities are most expensive? IS YOUR BUSINESS MORE: Cost Driven (leanest cost structure, low price value proposition, maximum automation, extensive outsourcing), Value Driven (focused on value creation, premium value proposition). SAMPLE CHARACTERISTICS: Fixed Costs (salaries, rents, utilities), Variable costs, Economies of scale, Economies of scope		Revenue Streams For what value are our customers really willing to pay? For what do they currently pay? How are they currently paying? How would they prefer to pay? How much does each Revenue Stream contribute to overall revenues? TYPES: Asset sale, Usage fee, Subscription Fees, Lending/Renting/Leasing, Licensing, Brokerage fees, Advertising FIXED PRICING: List Price, Product feature dependent, Customer segment dependent, Volume dependent DYNAMIC PRICING: Negotiation (bargaining), Yield Management, Real-time-Market		
<small>Designed by: The Business Model Foundry (www.businessmodelgeneration.com/canvas), Word implementation by: Neos Chronos Limited (https://neochronos.com), License: CC BY-SA 3.0</small>				

1-1 Business Model Canvas template. Source: Neo Chronos

1-2

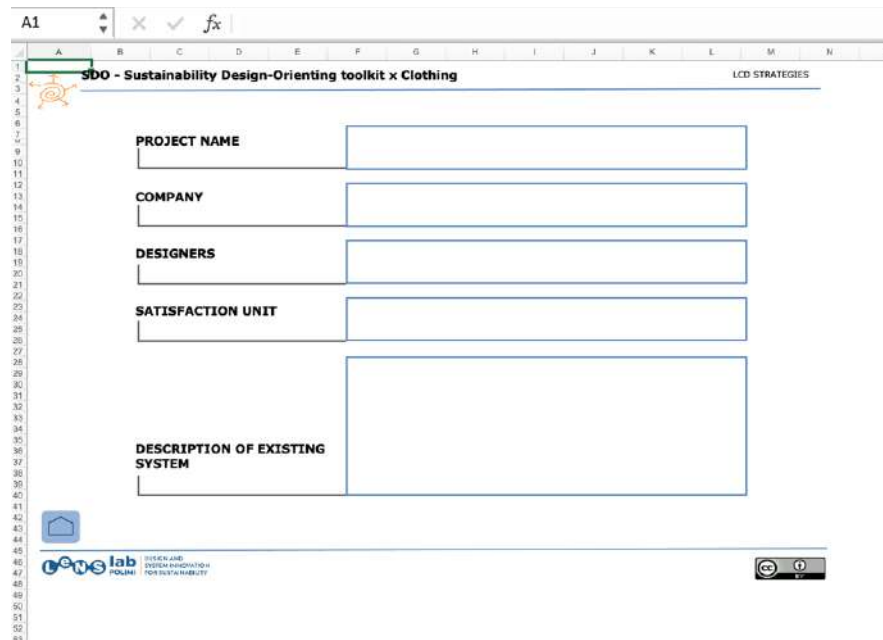
ii) Sustainability Design-Orienting Scenario (SDOS) Toolkit x Clothing template

The SDOS is a source of inspiration for possible stakeholders' interaction to design radically new social, economic, and technical solutions, and as co-design strategic conversations (Azzi et al., 2020). The SDOS excel form has 17 sheets that tackle (see 1-2a) a summary of the existing project records (see 1-2b) analyze the priorities of eco-efficiency and helps the designer set up social ethical orientations in a step-by-step process c) checks and visualizes environmental and ethical sustainability. This document is tailored for businesses within the clothing industry. This will inform the larger piece of the data collection and researcher will use 'creative system innovation boards' to administer the SDOS direction of enquiry at the focus group discussions (See Appendix C.) Line of enquiry will be read out and explained and responses will be written on post-it notes which will be placed on the appropriate priority. The entire focus group will be audio recorded.

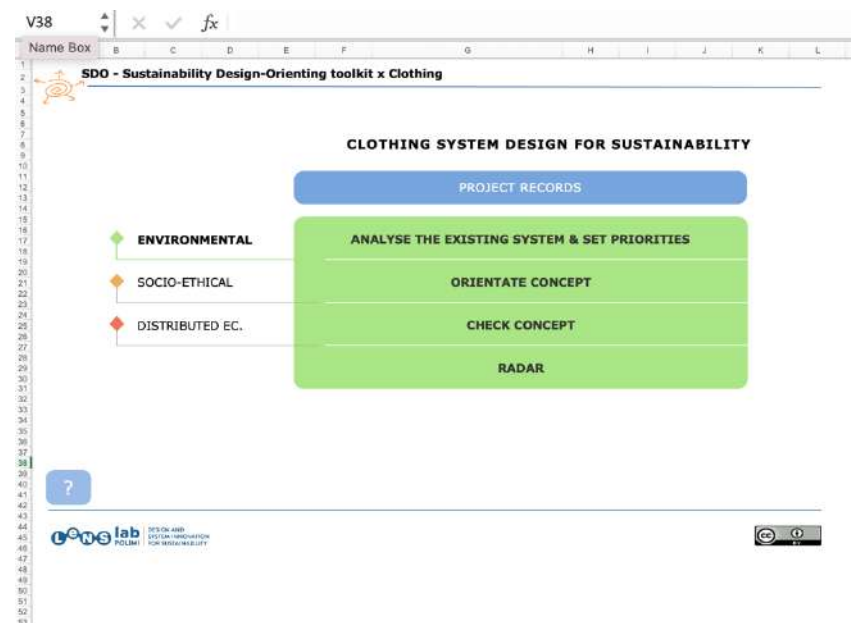
The design tool is available free for use from <http://lens-europe.eu/tools/view/59> .

Author: LeNSlab Polimi team.

The SDOS toolkit x clothing template is available as a Microsoft Excel document and has various sections.



1-2a SDOS Project Records Sheet



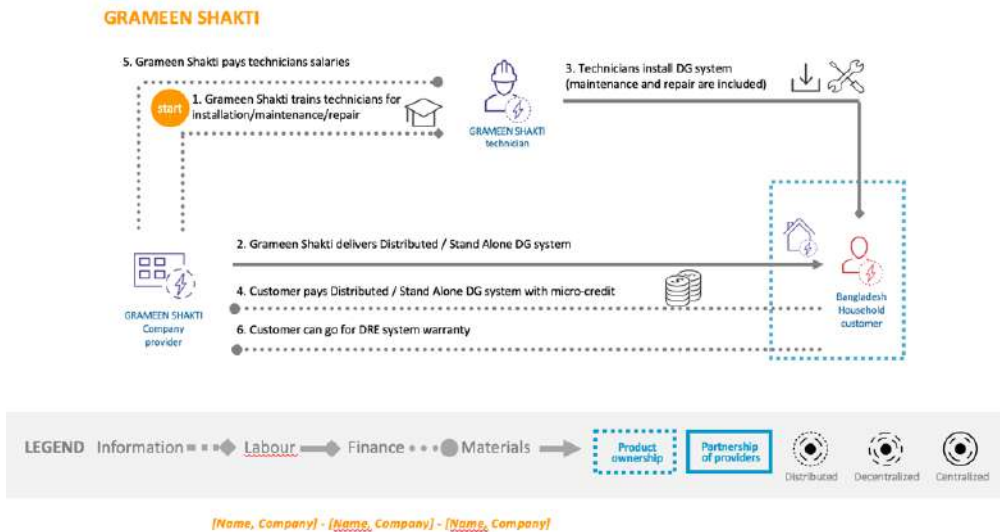
1-2b SDOS Start 1 Sheet

iii) System Map template

Designed to visualize the configuration of the system, describe both the actors involved and their interactions, with attention to highlighting the characteristics of S.PSS models (See Sample 1-3). Available from <http://lens-europe.eu/tools/view/4>. Author: LeNS Polimi-DS

The S.PSS system map template is available in a PowerPoint document with various icons to use for the visualization of the enterprises entire system innovation.

System map example



1-3 System Map S.PSS (sample from page 7)

C. Focus Group Semi-Structured Format



UNIVERSITY OF NAIROBI

Faculty of Built Environment and Design Department of Art and Design

Prepared by Teresa Lubano

Supervising Lecturer: Dr. Francisca Odundo

Institution: University of Nairobi

Course: Master's degree in Design

Contact: teresa.lubano@students.uonbi.ac.ke | teresa.lubano@gmail.com

Date: 15.03.2023

Dear [Name of Founder],

[NAME OF SME]: FOCUS GROUP DISCUSSION SEMI-STRUCTURED FORMAT

1.0 Overview

Teresa Lubano is working on a Master's thesis through the University of Nairobi's Department of Art and Design. As a most promising sustainable fashion SME, you and your team are invited to participate in a focus group discussion. The research topic is *Designing Sustainable Product-Service System framework for SMEs in Kenya's fashion industry*.

2.0 Terminologies

2.1 Sustainable Product-Service System (S.P.S.S)

S.PSS is an economically viable, environmentally and socio-ethically sustainable business model. A Sustainable Product-Service System (S.PSS) can be defined as;

‘...an offer model providing an integrated mix of products and services that are together able to fulfil a particular customer demand (to deliver a “unit of satisfaction”), based on innovative interactions between the stakeholders of the value production system (satisfaction system), where the ownership of the product/s and/or its life cycle responsibilities remain by the provider/s, so that the economic interest of the providers continuously seek new environmentally and/or socio-ethically beneficial solutions’ (Vezzoli et al., 2018).

2.2 Sustainable Fashion

Sustainable fashion can be defined as:

a business that encompasses **social issues**, such as improvements in working conditions and remuneration for workers, as well as **environmental ones**, including the reduction of the industry's waste stream, and decreases in water pollution and contributions to greenhouse gas emissions (UN Alliance for Sustainable Fashion, 2022 (SDG 6, 8, 12)).

3.0 Objectives of the Study

The researcher wishes to understand and establish your organization's views, attitudes and practices in regard to how your company is orienting its businesses towards sustainable goals through the use of an innovative system innovation, also called Sustainable Product-Service Systems (S.PSS). The resultant will be to develop an S.PSS framework that will help other TAF SMEs orientate their business toward a more sustainable path.

4.0 Ethical Considerations

This semi-structured focus group discussion format is accompanied by a permission letter from the Department of Design through the chair's office.

The researcher confirms that the study is being conducted in an ethical manner ensuring that she obtains informed consent from all the participants. To assure participants' confidentiality and anonymity, the researcher will remove all identifying information from the transcripts, and refer to participants according to identification codes.

Below outlines the format for the focus group discussion. Each section will take approximately 40 min. Participants will be given Post-it notes to write down their answers.

SECTION 1

Measuring Eco-efficiency orientation of the Provider's business model

Table 1 analyses the eco-efficiency orientation embedded in the SMEs system innovation. Mark with a 'X' on the 'Yes', 'No' or 'Don't Know' section. Accompany with an 'Explanation' for the same. If the participant marks 'Don't Know', then let them indicate 'Not Applicable'.

No.	S.PSS Orientation	Question	Yes	No	Don't know	Explanation
1	Eco-efficiency;	Is the SME business model internalizing costs?				

2		Is the SME business model orienting the main ongoing transitions towards sustainability (globalization, information e.g. exploiting dematerialization)				
3		Is the SME promoting niche economic models?				
4		Is the SME making an impact in reducing environmental challenges?				
5		Is the SME creating opportunities (monetary or otherwise) and value for its allied stakeholders within its system?				
6		Is the SME using technology in its business affairs				
7	Life Cycle;	Is the SME disposable products (packaging) used?				
8		Do parts of the SME system/products tend to wear out quickly?				
9	Transportation /Distribution reduction;	Does the SME offer information or guidelines for purchase or care?				
10		Does the SME develop relationships with locally based suppliers? (e.g. local material and energy suppliers)				

11		Is there excessive transportation of goods?				
12		Does the SME developed partnerships with producers to avoid/reduce packaging?				
13		Does the Provider offer remote support and status monitoring?				
14	Resource reduction;	Does the SME minimize resource consumption?				
15		Are the products, packaging or support products provided highly material intensive?				
16	Resource conservation;	Is all energy produced by the Provider from exhausting resources like fossil fuels?				
17		Is the SME using less resources/ raw materials/ reducing its carbon foot print within its business operations?				
18	Toxicity reduction;	Are the processed resources toxic or toxic for the consumer/ worker/ during distribution?				

Table 1: Analysing eco-efficiency priorities based on Vezzoli et al (2022) Sustainability Design-Oriented Scenario (SDOS).

SECTION 2

Measuring Social ethical orientation of the Provider's business model

Table 2 measures the social ethical orientation embedded in the system innovation. Mark with a 'X' on the 'Yes', 'No' or 'Don't Know' section. Accompany with an 'Explanation' for the same. If participant marks 'Don't Know', then let them indicate 'Not Applicable'

No.	S.PSS Orientation	Question	Yes	No	Don't know	Explanation
1	Socially sustainable;	Is the SME improving employment and working conditions;				
2		Are there problems with forced or child labour?				
3		Are there problems with health and safety?				
4		Are there problems with work overload/ inadequate wages?				
5		Are there problems with discrimination?				
6		Are there problems with freedom of association and collective negotiation?				
7	Improving equity and Justice in relation to stakeholders;	Are there stakeholders/ clients criticizing the supply system?				
8		Are there any unjust relationships between suppliers, sub-contractors, and sub-suppliers?				
9	Enabling responsible / sustainable consumption;	Is the user/ client able to acknowledge clearly and easily the social (un) sustainable along the whole value chain?				
10		Is the user/ client able to understand the social (un)				

		sustainable behavior promoted by the SME of the supply chain? (is it transparent)				
11	Favouring the low income, weaker and marginalized;	Integrating children, illiterate, elderly, disabled, unemployed, and other marginalized social persons				
12		Does the SME (or its system) create obstacles or limit access to people with a weaker social status?				
13		Is the SME (or its system) accessible to people with lower income?				
14		Does the SME/system contribute in any way to the marginalization of certain people?				
15	Improving social cohesion;	Is the offering SME/system creating or promoting any form of intra-gender, intra-cultural, intra-generational marginalization?				
15		Is the SME/system providing any form of discrimination (sexual, religious, cultural, gendered?)				
17	Empowering/enhancing the use of local resources;	Does the current reference SME/system impoverish local cultural values and identities?				
18		Does the current SME/ system only offer one solution / few variations for all regions?				

19		Does the current reference SME (and/or its system) impoverish local economies?				
20		Is the SME absorbing local non-renewable resources?				

Table 2: Analysing Social ethical priorities based on Vezzoli et al (2022) Sustainability Design-Oriented Scenario (SDOS).

D. Semi-Structured Key Informant Interview Format



UNIVERSITY OF NAIROBI

Faculty of Built Environment and Design
Department of Art and Design

Prepared by Teresa Lubano

Registration number: B51/40950/2021

Supervisor: Dr. Francisca Odundo

Institution: Nairobi University

Course: Master's degree in Art and Design

Contact: teresa.lubano@students.uonbi.ac.ke | teresa.lubano@gmail.com

Dear [Name of Key Informant],

KEY INFORMANT: SEMI-STRUCTURED INTERVIEW FORMAT

1.0 Overview

Through the department of Art and Design, University of Nairobi, Teresa Lubano is conducting a Master's thesis research related to the textile, apparel, and fashion industry. As an expert on sustainable innovations, you are invited to participate in a 40-minute online interview. The research topic is: *Designing Sustainable Product-Service System framework for SMEs in Kenya's fashion industry*. Your participation is voluntary.

2.0 Terminologies

2.1 Sustainable Product-Service System (S.P.S.S)

S.PSS is an economically viable, environmentally and socio-ethically sustainable business model. A Sustainable Product-Service System (S.PSS) can be defined as;

‘...an offer model providing an integrated mix of products and services that are together able to fulfil a particular customer demand (to deliver a “unit of satisfaction”), based on innovative interactions between the stakeholders of the value production system (satisfaction system), where the ownership of the product/s and/or its life cycle responsibilities remain by the provider/s, so that the economic interest of the providers

continuously seek new environmentally and/or socio-ethically beneficial solutions’ (Vezzoli et al., 2018).

2.2 Sustainable Fashion

Sustainable fashion can be defined as:

a business that encompasses **social issues**, such as improvements in working conditions and remuneration for workers, as well as **environmental ones**, including the reduction of the industry’s waste stream, and decreases in water pollution and contributions to greenhouse gas emissions (UN Alliance for Sustainable Fashion, 2022 (SDG 6, 8, 12).

3.0 Objectives of the Study

The researcher wishes to understand and establish your views, attitudes and practices in regards to how textile, apparel and fashion SMEs orient their businesses towards sustainable goals through the use of an innovative system innovation, also called Sustainable Product-Service Systems (S.PSS). The resultant will be to develop an S.PSS framework that will help other SMEs orientate their own business in fashion towards a more sustainable path.

4.0 Ethical Considerations

This semi-structured interview is accompanied by a permission letter from the Department of Design through the chair’s office.

The researcher confirms that the study is being conducted in an ethical manner ensuring that she obtains informed consent from all the participants. To assure participants’ confidentiality and anonymity, when writing the thesis, the researcher will remove all identifying information from the transcripts, and refer to participants according to identification codes.

Below is a summary of the schedule and questions that shall guide our interview.

Name	Proposed Date	Proposed Time	Google Link
[Name of the Key Informant]	XX.XX. 2023	[Timing here] am/pm	https://meet.google.com/xzo-eiym-fii

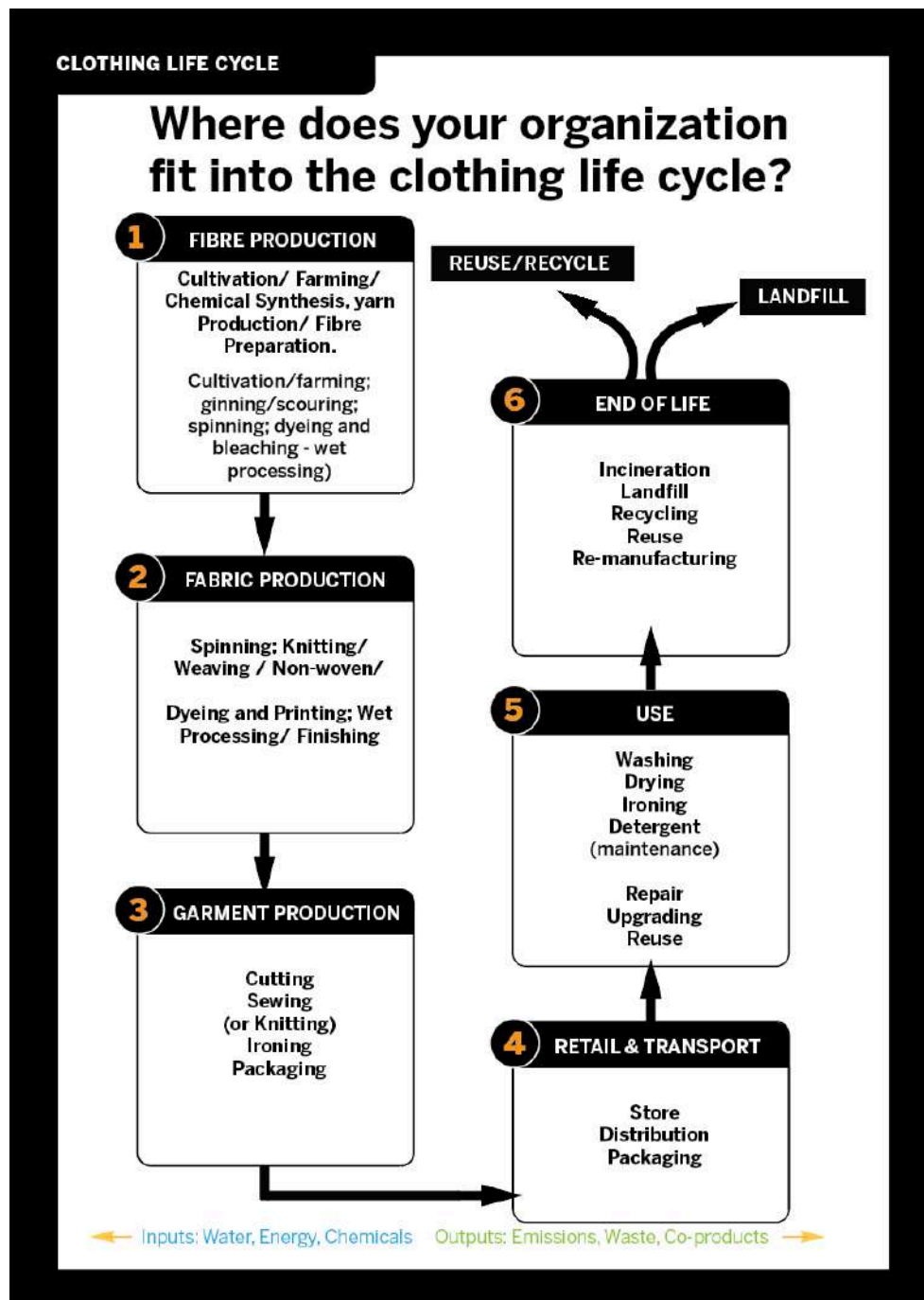
Semi-Structured Interview (40 min)

1. Introductions (5 min)
2. In your view, are there any Kenyan SMEs (emerging or established) in the textile, apparel and industry that are prioritizing *truly* sustainable priorities in their business models? (10 min)

3. If so, what does it mean for such SMEs/ fashion designers to be committed to sustainability from the product and services point of view, and the environmental, social and economic impact? (15 min)
4. Are there any recommendations that you can suggest that would enhance the adoption and implementation of sustainable fashion based on the understanding of what a Sustainable Product-Service System is? (10 min)

Thank you very much for your participation.

E. Clothing Life Cycle Poster



5-1. Clothing Life Cycle. Source: Azzi, et al, 2020; adapted by Lubano, T. 2023

F. SDOS Posters – A3 size

<p>SUPPORTING SOCIAL CONSCIOUSNESS</p> <p>Is the offering SME/system creating or promoting any form of intra-gender, intra-cultural, intra-generational marginalization?</p> <hr/> <p>Is the SME/system providing any form of discrimination (sexual, religious, cultural, gendered)?</p>	<p>ECO-EFFICIENCY</p> <p>Is your SME internalizing costs?</p> <hr/> <p>Is the SME business model orienting the main ongoing transitions towards sustainability (globalization, information e.g. exploiting dematerialization)?</p>	<p>ECO-EFFICIENCY</p> <p>Is the SME promoting niche economic models?</p> <hr/> <p>Is the SME making an impact in reducing environmental challenges?</p>	<p>ECO-EFFICIENCY</p> <p>Is the SME creating opportunities (monetary or otherwise) and value for its allied stakeholders within its system?</p> <hr/> <p>Is the SME using technology in its business affairs?</p>
<p>LIFE CYCLE</p> <p>Is the SME disposable products (packaging) used?</p> <hr/> <p>Do parts of the SME system/ products tend to wear out quickly?</p>	<p>TRANSPARENCY IN SUPPLY CHAIN MANAGEMENT</p> <p>Does the SME offer information or guidelines for purchase or care?</p> <hr/> <p>Does the SME develop relationships with locally based suppliers? (e.g. local material and energy suppliers)</p>	<p>TRANSPARENCY IN SUPPLY CHAIN MANAGEMENT</p> <p>Is there excessive transportation of goods?</p> <hr/> <p>Does the SME develop partnerships with producers to avoid/reduce packaging?</p> <hr/> <p>Does the SME offer remote support and status monitoring?</p>	<p>RESOURCE REDUCTION</p> <p>Does the SME minimize resource consumption?</p> <hr/> <p>Are the products, packaging or support products provided highly material intensive?</p>
<p>RESOURCE CONSERVATION</p> <p>Is all energy produced by the SME from exhausting resources like fossil fuels?</p> <hr/> <p>Is the SME using less resources/ raw materials/ reducing its carbon foot print within its business operations?</p>	<p>SAFETY REDUCTION</p> <p>Are the processed resources toxic or toxic for the consumer/ worker/ during distribution?</p> <hr/>	<p>SOCIAL ETHICAL</p> <p>Are there problems with health and safety?</p> <hr/> <p>Are there problems with work overload/ inadequate wages?</p>	<p>SOCIAL ETHICAL</p> <p>Are there problems with discrimination?</p> <hr/> <p>Are there problems with freedom of association and collective negotiation?</p>
<p>IMPROVING EQUITY & JUSTICE</p> <p>Are there stakeholders/ clients criticizing the supply system?</p> <hr/> <p>Are there any unjust relationships between suppliers, sub-contractors, and sub-suppliers?</p>	<p>TRANSFORMING TO SUSTAINABLE TRANSPARENT SUPPLY CHAIN</p> <p>Is the user/ client able to acknowledge clearly and easily the social (un) sustainable along the whole value chain?</p> <hr/> <p>Is the user/ client able to understand the social (un) sustainable behavior promoted by the SME of the supply chain? (is it transparent)</p>	<p>INTEGRATING THE LOW INCOME PEOPLE & MARGINALIZED</p> <p>Integrating children, illiterate, elderly, disabled, unemployed, and other marginalized social persons</p> <hr/> <p>Does the SME/system contribute in any way to the marginalization of certain people?</p>	<p>INTEGRATING THE LOW INCOME PEOPLE & MARGINALIZED</p> <p>Does the SME (or its system) create obstacles or limit access to people with a weaker social status?</p> <hr/> <p>Is the SME (or its system) accessible to people with lower income?</p>

Does the current reference SME/ system impoverish local cultural values and identities?

Does the current SME/ system only offer one solution / few variations for all regions?

Does the current reference SME (and/or its system) impoverish local economies?

Is the SME absorbing local non-renewable resources?
