CORVINUS UNIVERSITY OF BUDAPEST

From Concept to Action:

Towards a Generalizable Model for Implementing Sustainable Supply Chain Management in Practice

DOCTORAL DISSERTATION

Supervisors: Prof. Dr. Gyula Vastag, DSc., Dr. Diófási-Kovács Orsolya, PhD

Thompson H. McDaniel Jr.

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Preface

My time spent at the Corvinus University doctoral programs over the past four years was a unique culmination of research, exploration, and the pursuit of both personal and professional challenges, which started many years previously. I want to express my gratitude to Corvinus University and the Faculty of Economics, Business, and Informatics for their support in pursuing my interests and advancing in this critical phase of my professional and academic development. I am particularly indebted to Zsuzsanna Arany and Andrea Ko for laying a solid groundwork and guiding me through the process.

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I would also like to extend my gratitude to the many professional colleagues and my extended network of friends, students, and former colleagues who have provided significant support through numerous acts of contribution, both small and large.

Finally, I would like to thank my family who supported me with both their patience, love, and enthusiasm always, and cheered for me every step of the way.

Abstract

The abstract used in this dissertation was adapted from my previously published article (McDaniel et al., 2025). Sustainability in Supply Chain Management (SCM) is becoming vital due to rising environmental, social, and competitive pressures related to innovation, risk, and financial performance. This paper aims to identify, develop, and explain the practical steps for implementing a generalizable, sustainable, or green supply chain in practical terms. By employing a mixed-methods research design approach, this thesis seeks to utilize empirically validated concepts that are both scientifically grounded and practically applicable across various supply chain environments, spanning multiple industries and geographic regions. This mixed-methods research is based on an explanatory sequential approach beginning with a quantitative strand followed by a qualitative strand. In the quantitative strand, the research seeks to ground the overall study with a statistically representative and objective understanding of Green and Sustainable Supply Chain Management (GSCM and SSCM) concepts. This is followed by a series of action research (AR) case studies that seek to provide explanatory support by exploring a deeper, richer, and contextual insight into the initial quantitative findings.

In the initial quantitative phase group concept mapping (GCM), multidimensional scaling (MDS) and hierarchical cluster analysis (HCA) are used to create a set of concepts based on a larger number of statements derived from a set of interviews with corporate supply chain managers and experts across a range of industries, with substantial experience in emerging and developed markets and operating within different segments of the end-to-end industrial supply chain. Four key industry sectors were examined: metals and mining, packaged consumer food and beverage, automotive and vehicle manufacturing, and consumer electronics. The study focused on specific supply chain segments, including raw material extraction, procurement, primary processing, value-added manufacturing, as well as sales and distribution. The result is a hierarchy of practices proposed across the end-to-end supply chain, and hypotheses developed about achievability and impact on sustainability over time. The findings show a prioritized decision-making matrix of expected investment and potential impact of a wide range of practices into higher-level concepts, further supported by a range of analytical mapping tools, including Value Stream Mapping

(VSM), Value Chain Analysis (VC), and Causal Loop Diagramming (CLD) methods. Pattern matching revealed differences between emerging and developed markets and supply chain segments that decision-makers should be cognizant of.

This is followed by the qualitative strand, which includes two AR case studies based on a proven and reliable action research methodology specifically adopted for supply chain management. The two action research case studies covered multiple geographies, including central Europe, Slovakia, Hungary, and Kenya. The enterprises investigated presented a diverse range of business, social, and environmental issues, along with strategies, providing practical context for the initial concepts developed in the quantitative strand.

By analyzing supply chains from a multi-part perspective encompassing structure, geography, level of maturity, and industry segment, this research goes beyond generic empirical studies and one-dimensional studies based on a single industry, geography, or case example. Furthermore, the mixed-methods approach offers a multi-perspective lens that combines empirical and conceptual approaches, grounded in theory and quantitative rigor, with a deep, specific, practical, and contextual understanding that can only be gained from real-life business experiences in real time.

Table of Contents

List of Tables

List of Figures

List of Abbreviations

ACDMM Advanced Certificate in Design, Manufacturing, and Management
AI Artificial Intelligence
AR Action Research
CAPEX Capital Expenditure
CLD Causal Loop Diagramming
CMA Certified Management Accountant
CFO Chief Financial Officer
COO Chief Operating Officer
CPA Certified Public Accountant
CSR Corporate Social Responsibility
EoI Ease of Implementation
EMBA Executive Master of Business Administration
F2F Face-to-Face
GDP Gross Domestic Product
GCM Group Concept Mapping
GROW GROW Fairly (Case Study Organization)
GSCM Green Supply Chain Management
GX The Garment Exchange (Case Study Organization)
HR Human Resources
I Impact
IoT Internet of Things
KE Kenya
KPIs Key Performance Indicators
LSS Lean Six Sigma
MBA Master of Business Administration
MDS Multidimensional Scaling
ML Machine Learning
MT Metric Ton
NGO Non-Governmental Organization
Ops Operations
PM Project Management
PMBOK Project Management Body of Knowledge
R&D Research and Development
SCM Supply Chain Management
SD Sustainable Development
SKR Shell-to-Kernel Ratio
SME Small and Medium-Sized Enterprise
SSCM Sustainable Supply Chain Management
TBL Triple Bottom Line
TPS Toyota Production System
USA United States of America
VC Value Chain
VCA Value Chain Analysis

VOC Voice of the Customer
VOE Voice of the Environment
VOS Voice of Society
VSM Value Stream Mapping

1 General Introduction

The general introduction used in this dissertation was adapted from my previously published article (McDaniel et al., 2025).

1.1 Sustainability and Supply Chain Management (SCM)

This research study is fundamentally anchored in the principles of Sustainable Supply Chain Management (SSCM) and Green Supply Chain Management (GSCM). Over the past six decades, SSCM and GSCM have become prominent fields both in theory and practice, aiming to address the environmental and social externalities generated by contemporary global infrastructure. These externalities arise from increasing consumer demand and are further influenced by the policies, legislation, and systems that underpin the global economy. The evolution of SSCM and GSCM demonstrates a shift from an initial focus on environmental concerns to a more comprehensive approach that integrates all three pillars of sustainability: environmental, social, and economic (Ahi & Searcy, 2013).

This research seeks to bridge the gap between broad quantitative investigations into SSCM and GSCM and narrowly focused case studies centered on individual sites, industries, or regions. While case studies are prevalent in the literature (Prasad et al., 2018; Zhou et al., 2018) and regarded as foundational, they are often criticized for lacking rigor (Seuring, 2008) and for being primarily exploratory, serving more to identify future research directions than to test established hypotheses (Ansari & Kant, 2017). Frequently, these studies do not capture sufficient data across the various tiers of the supply chain, focusing instead on a single organization rather than offering a multi-level perspective (Liu et al., 2023; Fraser et al., 2020). SSCM, particularly when compared to GSCM, has only gained momentum in recent years (Min & Kim, 2012), and stands to benefit greatly from multidisciplinary approaches and methodologies that can advance the field (Bag & Anand, 2016; D'Eusanio et al., 2019; Kaufman et al., 2018).

Consequently, this research adopts a mixed-methods approach. While such methodologies have been employed infrequently in the fields of SSCM and GSCM—appearing in less than 5% of published studies (Ansari & Kant, 2017; Salazar et al., 2023)—the literature highlights a growing need for increased attention to mixed-methods designs (Dubey et al., 2017). Integrating these approaches is regarded as essential for advancing multi-disciplinary tools within SSCM and GSCM research (Kaufman et al., 2018; Salazar et al., 2023).

GSCM began in the United States in the 1960s and later developed into the broader field of SSCM. In recent years, both have gained global attention, especially in emerging markets facing pollution and economic modernization challenges (Lu et al., 2015; Mitra & Dutta, 2014). While GSCM is well-established, SSCM extends it by addressing more pillars, including social dimensions and the triple bottom line (TBL). Despite

this broader scope, SSCM still builds on the foundations set by GSCM (Ahi & Searcy, 2013; Souhli et al., 2020).

Examining the history and terminology of SSCM and GSCM concepts, as well as their antecedents—sustainable development (SD) and the triple bottom line—over the past 75 years can help clarify their relationships. This approach aims to reduce ambiguity and confusion regarding these terms. The similarity between the frameworks and the variety of definitions present practical challenges, as the concepts are often used interchangeably in both informal business settings and academic contexts. For example, Mutingi (2013) suggests "[t]he term "green" is now widely used interchangeably on the more established "sustainability" concept, which points to a more holistic view of environmental, social and economic impact (Dobers & Wolff, 2000; Rahimifard & Clegg, 2007; Saha & Darnton, 2005)" (p. 526).

More recently, however, it is suggested that SSCM is the broader, more comprehensive framework of which GSCM is a subset. For example, Ahi & Searcy (2013) suggest the following:

> Overall, the results show that the definitions for GSCM were generally more narrowly focused than those for SSCM and had an overwhelming emphasis on environmental issues. Although some definitions of SSCM show considerable overlap with those of SSCM and GSCM, it is clear that SSCM is essentially an extension of both. (p. 334)

Additionally, during this dissertation, the different phases and strands of research evolved to focus on other areas within the broad umbrella of SSCM. This may be seen as a limitation of this research; however, it should be emphasized that this was difficult to avoid within the context of the overall research design. Because of the sequential nature of the mixed-methods approach, the specific context emerging in the different phases of the field research, individual stakeholder points of view, and varying goals and objectives of the enterprises under investigation, it was impossible to know in advance which pillar within the broad SSCM framework would be most critical or dominant.

To alleviate ambiguity and ensure cohesion, we will refer to SSCM, or SSCM and GSCM together, as the overarching construct or framework that covers all overlapping concepts and definitions. This is illustrated below in Figure 1. This approach is consistent across both streams and the three individual phases, as all stakeholders, in both the GCM exercise and the AR case studies, were onboarded into the research in each of the separate phases with an introduction of the different definitions. This is elaborated in more detail in the following chapters.

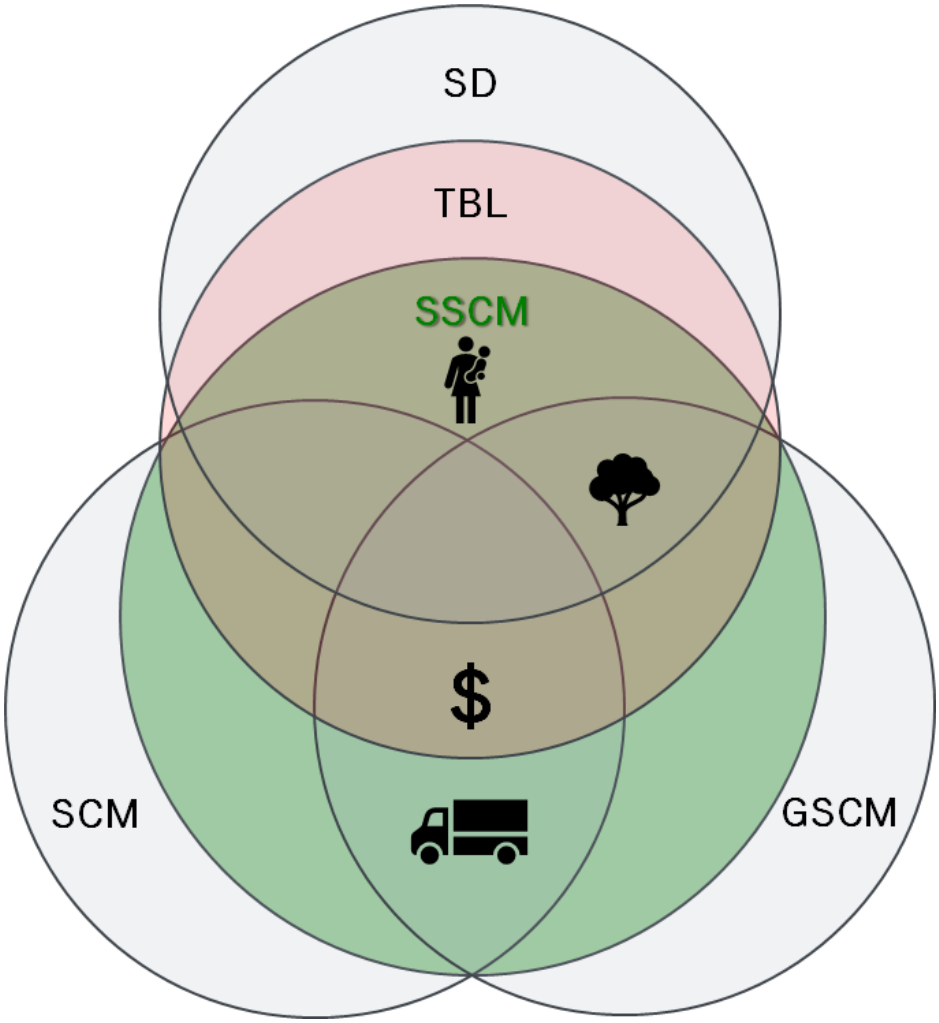

Figure 1: Interrelationship of Key SSCM Concepts and Definitions

Table 1: How Does SSCM Overlap Other Key Frameworks?

Concept	Focal Points	Concepts Not In Scope	When Emerged
Sustainable Supply Chain Management (SSCM)	People, Planet, Profits, and Logistics	NA	2008
Green Supply Chain Management (SSCM and GSCM)	People, Profits, and Logistics	People, e.g., explicitly focus on society and social issues	1990s
Triple Bottom Line (TBL)	People, Planet, Profits	Logistics and supply chain	1994
Sustainable development (SD)	Planet and People	Logistics & Profits, e.g., explicit focus on financial themes	1987
Supply Chain Management (SCM)	Profits and Logistics	People & Planet	1982

The concepts of SSCM and GSCM are built on foundational pillars such as SCM, SD, and TBL. Sustainable development (SD), defined in the Brundtland Report (1987), introduced the three pillars—environmental, social, and economic sustainability (Butlin, 1989). The Triple Bottom Line (TBL), coined in 1994, provided a practical framework for integrating these pillars into business (Elkington, 1998).

Supply Chain Management (SCM) initially focused on logistics and financial objectives, with early ideas traced to Forrester (1958), who described the integrated global supply chain. The term SCM was popularized by Keith Oliver in 1982 (Kransdorff, 1982), emphasizing the need to break down siloed functions in organizations (Laseter & Oliver, 2003). SCM is now a mature and quantitatively rigorous field, with extensive research growth in recent decades (Solari et al., 2024). For instance, Siomara & Teta (2024) analyzed over 76,000 articles (2012–2022), highlighting SCM's importance for business and the rising role of sustainability: "'Sustainability,' 'Green Supply Chain Management,' and 'Sustainable Supply Chain Management' underscore the shift towards integrating environmental concerns within Supply Chain Management, reflecting its growing significance in bolstering both operational efficiency and sustainability" (p. 16). The scientific rigor of SCM continues to evolve (Hopp, 2011).

Environmental concerns began merging with SCM in the 1990s (New, 1997), giving rise to SSCM and GSCM (Sarkis, 2003). Seuring & Müller (2008) expanded these definitions to emphasize social issues, referencing both the Brundtland Report and TBL. The expansion was driven by challenges in global supply chains, such as outsourcing and labor issues: "For example, apparel distributors such as Nike, Disney, Levi Strauss, Benetton, Adidas, or C&A have been blamed in recent years for problems occurring during the production of their clothing" (Seuring & Müller, 2008, p. 1699). This is relevant to this dissertation, which includes a case study on 'Fast Fashion' and its mitigation.

The literature on SSCM and GSCM has grown rapidly in the past 15–20 years, but definitions remain inconsistent (Saini et al., 2023; Souhli et al., 2020; Ahi & Searcy, 2013). Implementation challenges persist due to a lack of clear theoretical models and management strategies (Touboulic & Walker, 2015; Kang et al., 2011), and over 50 combined definitions demonstrate a lack of cohesion (Sánchez-Flores et al., 2020). Comprehensive frameworks are needed to fully understand the impact of SSCM and GSCM on financial, social, and environmental outcomes.

Rather than defining SSCM and GSCM, this research focuses on exploring what they entail in real-world settings, why particular models succeed or fail, and how their successful features can be replicated.

For this reason, the design of this research uses a mixed-methods approach combining empirical, quantitative approaches such as group concept mapping (GCM), multidimensional scaling (MDS), and hierarchical cluster analysis (HCA), with qualitative approaches including Action Research (AR) case study

methodology and value stream mapping (VSM). This approach was chosen as an effective way to create a holistic picture, providing both breadth and depth to the “what”, “why”, and “how” questions about SSCM and GSCM posed above. An in-depth discussion of the methods, why they were chosen, and how they were applied is detailed in Chapter 3, Research Methods.

One of the challenges of the TBL approach within the overall SSCM concept is the relative effort that has gone into operationalizing the environmental and social pillars, but with much less accountability to the economic pillar (Carter & Easton, 2011). A challenge that the SSCM and GSCM research is still grappling with is how to fully equate the execution of environmental and social goals explicitly with a perception that such a strategy could or would produce financial benefits (Walley & Whitehead, 1994). Carter & Easton (2011) suggest that the inability to integrate financial metrics into SSCM and GSCM entirely may be due to frameworks that are still vague, overlapping, and inconsistent. Further exacerbating this notion is the underdevelopment of digital technologies until very recently, and confusion around terminology, such as words like “responsibility,” where concepts like corporate social responsibility (CSR) fit into the overall framework.

For example, a more recent literature review by Souhli et al. (2020) identifies 30 definitions for Green GSCM and 19 definitions for SSCM with a standard, overlapping but inconsistent set of characteristics around social, economic, ecological, and corporate social responsibility (CSR) performance. In this analysis, some common themes emerge, indicating that definitions from GSCM are more focused on environmental aspects, although in some cases, including social elements alongside ecological and economic elements. In contrast, definitions from the SSCM are more likely to have a balanced view of the TBL pillars, including a more robust inclusion of CSR elements.

Another challenge is how to come up with a comprehensive model despite attempts having been made (Saini et al., 2023). Such attempts are often based on highly statistical modelling approaches, theoretical models with a focus on theory building. As such, the real-world applicability can be questioned. Nevertheless, themes do emerge that are valid for testing. These include many selected themes that emerge over time relevant to this research, including “innovation”, “design”, “impact”, “performance”, “coordination”, “management”, and “waste” (Yang et al., 2020). Many of these themes are of increasing importance and more recent relevance based on a trend analysis of the literature since 2012, when a significant increase in SSCM and GSCM articles emerged.

1.2 Research Goals and Motivations

Based on Maxwell's (2012) theory of research goals and motivations, there are three lenses through which to view and define the research goals of the dissertation. These are the personal, the practical, and the intellectual lenses.

The personal goal of the research is to find ways to better align the author's daily actions and behavior with the professed sustainable value system towards business, society, and the environment, which the author has developed over many years. In defining these personal research goals, a good place to start is the Walt Whitman (2005) poem *Song of Myself*, from his collection *Leaves of Grass*: "Do I contradict myself? Very well then, I contradict myself, (I am large, I contain multitudes.)" (Section 51).

The author, like many people in society, is a multifaceted actor inhabiting multiple roles daily. Most people are simultaneously consumers, family members, employees, organizational leaders, community members, and citizens of a sovereign entity. This brings forth conflicts and contradictions in daily life, some of which are within our control, and many which is not. Nevertheless, citizens still retain a high degree of choice in the activities they perform in the various roles they inhabit. Moreover, while most people are aware that we live amid an extreme ecological and social crisis driven by human behavior, such knowledge and concern do surprisingly little to change either individual or societal behavior.

The author's motivation for the research is ultimately driven by the inherent conflict and contradiction between the values developed through lived experience and the behavior, activities, and choices that society, including the author, makes in everyday life. Individuals, global corporations, and society at multiple levels all express a desire to change behavior to appropriately address the current environmental crises facing the planet. However, society finds itself mired in cognitive dissonance, unable to adjust norms and behaviors at the rate which science increasingly warns is necessary to avoid planetary disaster.

There are structural reasons why this is such a huge challenge, most notably the success and dominance of capitalist and consumer-based economic structures, which reward and propagate economic growth and a bias towards its continued upward trajectory. Moreover, while economic growth brings many significant benefits, including innovation, advances in science and healthcare, poverty alleviation, to name a few, the downsides are daunting, including irreversible climate change, biodiversity loss, pervasive pollution, and health risks, as well as exacerbating global inequality.

Therefore, the personal goal of the research is to find ways for individuals, organizations, communities, and greater society to properly align our collective daily actions with our professed values and desire to change our behavior 'before it's too late'.

The author's multiple professional roles inform the practical goals of the research. These include a twenty-five-plus-year career as a business consultant and business executive operating in the operations and supply chain function, as well as a business school lecturer teaching executive MBAs and undergraduate business school students on accredited supply chain and sustainability courses.

In this context, the goal is to improve and develop understanding and insight into practical solutions for improving sustainability, which can be deployed in multiple business settings and environments. Some examples and context for how this could happen in practice include the following roles, which the author currently holds or held previously:

- An executive with direct control and responsibility for implementing supply chain solutions and creating supply chain strategies.
- A consultant, advising clients in control of and responsible for making impactful business decisions which directly influence environmental and ecological sustainability; and
- As a member of individual networks and of the broader business community, with access to a wide range of business decision-makers, and where there is opportunity to communicate personal knowledge, insight, and experience related to the field of sustainable supply chain management and overall sustainability.

The intellectual goals are to contribute to a more profound and longer-term understanding of sustainability and environmental issues, based on reasonable scientific methods, as they specifically relate to the field of supply chain management.

Although the author's academic and business activities focus on implementation and practical application, there is a recognized need for theoretical research and discussion outside the realm of day-to-day business decision making. The role of academia is to provide time and space not available in front-line business to take a longer-term view required to address the complexity of both the problems and potential solutions.

The author envisages two elements to achieving the intellectual goals, both of which take place amid academic contexts.

- Firstly, the academic research goal involves actively participating in the science of understanding and solving the problems in the field of SSCM and GSCM.
- Secondly, the teaching and outreach goal involves actively working with students of all levels to collaborate and spread knowledge and ideas related to understanding and solving sustainability issues and GSM issues.

1.3 Structure of the Dissertation

Chapter 1 is the introduction and sets out the context for SSCM and GSCM as a potential solution to the rapidly increasing sustainability challenge we are faced with in today's world. This is followed by chapter 2, a review of the literature of SSCM and GSCM as it has emerged and developed over 75 years, including the innovative contributions of the literature as well as the gaps that still need to be solved. In chapter 3, we review our principal methodologies, which include setting out the mixed-methods sequential explanatory

research design approach, deploying group concept mapping (GCM), various analytical mapping tools (VSM, VCA, and CLD), and action research (AR) and cooperative learning methodologies.

In chapter 4, the research sets forth the initial quantitative research strand, developing and constructing a set of SSCM and GSCM concepts based on group concept mapping (GCM). The GCM exercise includes two outputs. Firstly, a concept map of SSCM and GSCM management practices for making supply chains more environmentally sustainable is developed. Secondly, a priority matrix provides guidance on decision-making and allows us to test the validity of these outputs in subsequent research streams, which include two case studies.

In chapter 5, an approach is laid out for selecting a set of case studies that meet rigorous criteria for an AR methodology specifically adopted for supply chain management. The criteria are discussed in detail, along with how the selected case studies successfully meet these criteria. In chapter 6, we cover the first of two case studies, a sustainable nut processing facility in Kenya whose main challenge is to successfully develop and deploy a triple bottom line (TBL) strategy during a financial and operational restructuring after 10 years of iterating its business model.

In chapter 7, we covered the second of two case studies, a clothing exchange focused on ‘normalizing secondhand clothing’ in the local community in Budapest. This case study explores how to scale the current volunteer and community model, enabling the organization and business to have a meaningful impact on the significant problem posed by the fast fashion model, which is taking over the world. In Chapters 8 and 9, a cross-case analysis is undertaken, accompanied by final discussion and conclusions. Appendices are presented in section 10.

1.4 Contributions to Theory and Practice

One of the most significant challenges in SSCM and GSCM is the difficulty in identifying the best practices for supply chain management that are applicable or generalizable across multiple industries, geographies, and supply chain segments. According to Balkumar, Kartik, et al. (2024, p. 2010), “Research works addressing multiple parts of a supply chain are hardly found”. Most SSCM and GSCM studies covering entire supply chains focus on a single industry and are generic, lacking attention to specific firms. As a result, they do not identify root causes at the grassroots level and cannot shed light on the detailed factors needed for implementation (Balkumar, Kartik, et al., 2024).

A significant challenge in SSCM and GSCM research is developing rigorous empirical methods that are both practical and applicable within real organizational contexts. This research seeks to make several novel contributions. First, it aims to integrate empirical quantitative and qualitative approaches, which have proven effective in disciplines such as medicine and community development but have been rarely applied within

the fields of SSCM and GSCM. Second, this study intends to address issues at the supply chain level rather than focusing solely on single case studies, a common approach in SSCM and GSCM research. Finally, the research aspires to develop a model that is generalizable across various dimensions of supply chains, including industry, geography, and market type.

While acknowledging that such goals and expectations for such a contribution are considerable relative to the scope of this PhD, the research does present novel findings, though there are notable limitations. Additionally, this study identifies several potential directions for future research. These are further elaborated in sections 2.5, 4.4, 6.10, 9.2, and 9.4.

2 Literature Review

The literature review used in this dissertation was adapted from my previously published article (McDaniel et al., 2025).

The evolution of GSCM into the SSCM research field stems from industrial ecology, which developed in the United States during the 1960s and 1970s. This field adopts an "operational approach to sustainability," emphasizing integration of industrial infrastructure and the biosphere, recognizing both economic and physical (biophysical) material flows in industrial systems, and highlighting technology's crucial role in achieving sustainable industry (Erkman, 1997; McDaniel & Vastag, 2022, p. 180).

SSCM and GSCM emerged during a period when environmental awareness and theoretical frameworks merged and developed into specific practical approaches. During this period, scientific researchers and practitioners began to reimagine industrial manufacturing and agricultural economic systems from resource-intensive, wasteful systems into systems that minimized environmental and social damage and, in some cases, even improved or restored social and environmental systems.

To conceptualize this development, a timeline was created, breaking down the evolution of SSCM from the 1960s environmental movement to the present, where SSCM has become a well-developed research field maturing and evolving in specific and focused ways. This is depicted in the timeline below, which focuses on specific periods of development in the SSCM and GSCM fields.

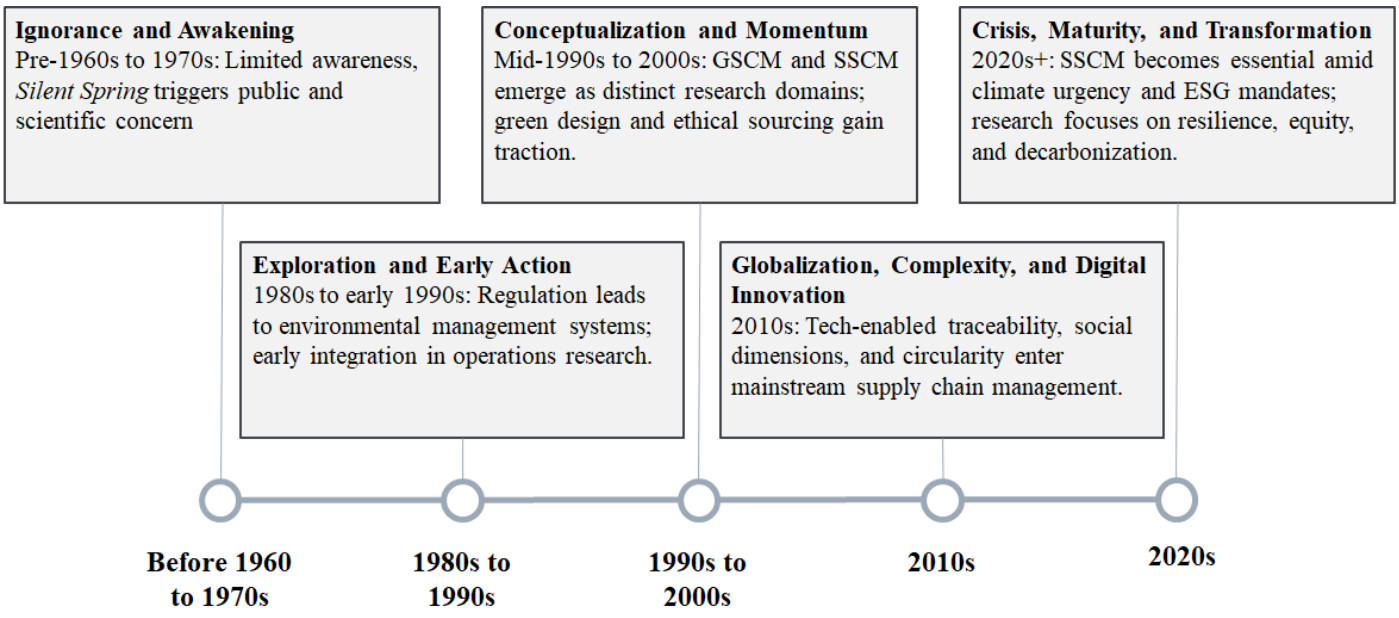

Figure 2: The Development of Sustainable Supply Chain Management

2.1 Ignorance and Awakening

Rachel Carson's *Silent Spring* was instrumental in starting the environmental movement, which is the initiating event influencing the development of the SSCM and GSCM research fields (Carson, 2015). Prior to this event, the environmental movement was typified by resource conservation in terms of land use as well as reduction of pollution on local levels (Hays, 1999). The publication of Carson's Seminole book is broadly recognized for sparking global action both within industry and within governments and public policy (Arp et al., 2023). It triggered bans on dangerous chemicals, moved governments and regulators to implement new policies, and increased awareness of the public on the dangers of almost invisible toxins being released into the environment and the large-scale damage they wrought (Nature Ecology & Evolution, 2022). More than just a recitation of facts and science, Carsen could tell a compelling story that sparked action and outrage and ultimately a movement, despite powerful interests who strongly opposed Carsen's message (Lear, 1993).

The burgeoning environmental movement that followed Carson's publication was further strengthened when the Club of Rome, together with MIT, published *Limits to Growth*, a groundbreaking study using state-of-the-art computer modeling at the time (Meadows et al., 2013). This introduced what was then a radical idea, "steady-state economics", a paradigm that was generally anathema to the orthodox points of view of most economists, politicians, and environmentalists. This idea, along with other alternative development models, laid the foundation for other academics and researchers, including Herman Daly's ecological economics (Daly & Farley, 2011). Her report also played a role in growing the participation of environmentalism and helped broaden the movement beyond academia and into the public sphere (Herrington, 2021).

2.2 Exploration and Early Action

Following the rise in global consciousness of environmental degradation and its consequences, more voices became prominent in identifying specific solutions. For example, refining strategic approaches to land use for human infrastructure that is aligned with nature rather than in conflict with it (Odum 1969). Or creating community-based solutions and design principles for managing common resources rather than relying on private or government institutions which often have problematic incentive structures (Ostrom, 1990). During this phase of the trajectory of SSCM and GSCM as a research field, frameworks and approaches such as ecological economics started to gain significant traction. Such intellectual and theoretical frameworks emphasized specific actions and remedies that could actually be implemented. For example, Daly (1973, 2015) laid out a practical approach to governing the global economy based on a steady state whereby economic theory integrated ecological science, recognized that many aspects of resource usage was destructive and irreversible, and distinguished between the notions of quantitative versus qualitative growth, advocating for the latter. Researchers examining agricultural practices such as Altieri (1989) advocated for

new and revolutionary approaches moving away from resource intensive practices that drove the development of agriculture during the so-called “green revolution” and instead articulated the need to move towards a lower intensity approach, such as the agroecology framework, to avoid the consequences of ecosystem failure.

From an industrial manufacturing and infrastructure point of view researchers in the 1980s such as Stahel & Reday-Mulvey (1981) put forth the notion of an economic system based on a closed-loop whereby resource usage became more efficient when innovative methods such as remanufacturing allow for longer lifecycle of industrially manufactured goods. Building on the concept of energy and resource flows, researchers in the 1980s, such as Odum (1979), laid the theoretical groundwork, including ideas such as ‘emergy’ accounting and systems ecology, which are key aspects of what later developed into GSCM and SSCM. These concepts and their importance as an environmental accounting tool with potential influence on sustainable supply chains and a circular economy are still gaining traction in current SSCM research efforts (Alkhuzaim et al., 2021)

2.3 Conceptualization and Momentum

The specific terminology of green supply chain management (GSCM), the predecessor to sustainable supply chain management (SSCM), emerged in the 1990s. If one is to take a systems perspective towards both the environment and the supply chain, as emerged in the 1950s and the 1960s in both fields (Forrester, 1958; Daly, 1973), this is a logical development.

The groundwork for the ideas of GSCM and SSCM were laid following the development of a defined framework for sustainability based on the Brundtland report in 1987 and the development of TBL, a practical framework for measuring its successful implementation. The convergence of environmental and economic frameworks into supply chain and operations approaches starts to make sense when one considers that achieving sustainability is a complex problem driven by modern economic structures and exploding consumer demand worldwide. From this perspective, one can imagine that supply chain-based solutions are a key component of any overall solution (Erkman, 1997). It was during this period of the fields’ development that detailed clarity around scope and scale became more intensely documented.

> When defining the scope of SSCM and its antecedents, TBL, SD, and SCM, we consider a variety of perspectives (de Oliveira et al., 2018) covering key organizational activities including product design, procurement, manufacturing, packaging, logistics, and product end-of-life management (Srivastava, 2007; Min & Kim, 2012). These definitions are practical manifestations of the theories and paradigms of systemic social and economic frameworks like ecological economics (Melgar-Melgar et al., 2020). Concepts focusing beyond functional activities of a single organization and emphasizing the decentralized nature of multiple complex actors are necessary to define the modern supply chain (Vachon

& Klassen, 2006; Sarkis, 2012). From this perspective, we can think of Green and Sustainable Supply Chain Management (SSCM and GSCM) as an integrated system (Linton et al., 2007). (McDaniel & Vastag, 2022, p.180).

We can therefore view Sustainable Supply Chain Management (SSCM) similarly, but as a broader concept that extends the narrower GSCM view, focused on environmental issues, to the broader view, embracing also social issues and fully incorporating the concepts of triple bottom line (TBL) and sustainability as it was derived from the original articulation of SD (Ahi & Searcy, 2013).

When assessing SSCM and GSCM definitions, it is crucial to consider diverse operating contexts, such as emerging markets (Adel, 2021). These perspectives help identify causes and solutions for reducing environmental impacts through SSCM practices. This study examines both the validity and implementation of SSCM approaches, following Sarkis, et al. (2011).

Environmental considerations began to appear more frequently in supply chain literature during the 1990s. Lamming and Hampson (1996) connected environmental issues to core supply chain concepts like purchasing, quality management, Lean strategies, and collaborative business relationships. Their findings suggest that integrating environmental factors enhances supply chain management as stakeholders increasingly demand eco-friendly products and greater accountability.

Lean Manufacturing's environmental benefits also emerged in the literature from the 1980s (Hart, 1995). Empirical research shows a positive link between Lean practices and improved environmental performance, using ISO 9000 and ISO 14000 as proxies (King et al., 2001; Rondinelli & Vastag, 1998). However, these studies often lack detailed analysis of how Lean directly impacts environmental goals. Regional studies, such as Rao (2004) in Southeast Asia and Zhu & Sarkis (2004) in China, reinforce the connection between Lean practices and environmental outcomes, though generalizability remains limited.

Klassen (2006) expanded GSCM and SSCM to include supplier and customer collaboration, recognizing Lean as a useful strategy for addressing internal stakeholder concerns. However, Lean is not consistently seen as central to improving environmental performance, whether in strategic policy or day-to-day logistics management.

2.4 Globalization, Complexity, and Digital Innovation

In recent years, SSCM has evolved well beyond traditional models. Major advances include digitization (Balkumar et al., 2024), circular manufacturing (Pollard et al., 2023), life cycle thinking (Tellnes et al., 2024), innovative business models (Christopher et al., 2024), sustainable lifestyles (Cheng et al., 2021; Lubowiecki-Vikuk et al., 2021), sustainable design (Hallstedt et al., 2023; Wu et al., 2024), and new product and service approaches (Sarancic et al., 2023). For example, digitization, especially via the Internet of

Things (IoT) (Zhang et al., 2024), enables sensor-driven circular processes in agriculture and other sectors, mitigating supply chain impacts. There is also growing focus on technologies like artificial intelligence, blockchain, cloud computing, and big data analytics (Feng et al., 2022).

While SSCM approaches benefit supply chain management, they also introduce trade-offs. Stakeholders—consumers, policymakers, businesses, and industries—do not always see benefits or costs distributed evenly, which complicates implementation (Saxena et al., 2024).

Another major challenge and opportunity is improving transparency of material flows throughout the supply chain. Enhanced tracking and traceability, such as product labeling (Amicarelli et al., 2024), can reduce waste. Design-driven solutions are increasing across entire supply chains (Zarei-Kordshouli et al., 2023), at both the product (Sarancic et al., 2024) and technology levels (Junaid et al., 2024).

Culture (Piyathanavong et al., 2024) and sustainable lifestyles (Wojtaszczyk et al., 2024) are now recognized as essential elements in holistic sustainability strategies. Strategically, enterprises and supply chains must shift toward dynamic, proactive actions instead of merely reactive or cooperative ones (Zimon et al., 2019).

Understanding practical implementation is also crucial. Shekarian et al. (2022) catalog over 789 SSCM/GSCM practices, structured into 11 main and 38 minor categories. Kähkönen et al. (2018) offer a conceptual model distinguishing practices by internal/external, proactive/reactive, and environmental/social dimensions. This study builds on these by offering a more refined framework for decision-making and prioritization.

2.5 Crisis, Maturity, and Transformation

In recent years, bibliometric reviews highlight growing attention to green procurement, reverse logistics, eco-design, and performance measurement. They also call for more research bridging context-specific SSCM and GSCM strategies (e.g., in emerging economies) with generalized frameworks and policy guidance.

Future research gaps include tailoring SSCM strategies to developing-country supply chains, integrating regulatory and institutional contexts, and exploring paradoxes in applying universal SSCM and GSCM models versus local realities.

Recent literature reviews (Kumar et al., 2023) highlight increasing attention on the need for more extensive and focused digital technology adoption, particularly artificial intelligence (AI) and machine learning (ML). Other areas of focus include adopting and developing performance measurement systems that successfully link sustainability metrics to operations and desired or achieved outcomes. From a functional point of view, sustainable procurement, manufacturing, and reverse logistics are areas of interest among researchers in the

field. From a strategic point of view, the need to shift business models to better align with the adoption of circular economy frameworks will be critical.

Regarding the impact of technology on GSCM and SSCM, many of the developments have and will continue to follow the same key innovations for all aspects of organizations and business. Areas that are likely to provide a significant boost specifically for sustainability issues include real-time traceability and risk management via technologies such as smart sensors and the broader concept of IoT (Wattanakul et al., 2018).

This includes, for example, smart devices installed along various nodes in and across supply chains, which enable real-time monitoring that detects waste, improves ecoefficiency, and facilitates circular processes such as reverse logistics. Overall, technology can reduce the need for transport, enable sustainable logistics solutions, improve compliance and performance measurement, and reduce waste in perishable logistics chains (Sharma et al., 2023). This is consistent with both the input from the SSCM quantitative strand in this study and its conclusions, for example, the concept 'Information Technology' which appears prominently in our concept map.

Regarding the need for performance management and performance measurement, this has always been a key focus in the GSCM and SSCM literature. For example, Beamon, B. M. (1999) highlights early on in the development of the field a need to better design systems and specific metrics adopted for green supply chains, pointing to gaps and potential solutions that focus on improving the lack of appropriate environmental performance metrics and proposes a framework that includes environmental performance, cost, and customer service. Carter & Rogers (2008) demonstrate how a TBL framework, which includes the environmental, social, and economic performance, links to and impacts overall supply chain management performance.

Across the development of the SSCM and GSCM fields, however, there has been a shift whereby in the past the focus was on areas like compliance and operational efficiency and highlighting the need for cost reduction, regulatory compliance, and pollution control with KPIs that reflect energy usage, cost and emissions (Zhu & Sarkis, 2004; Hervani et al., 2005). Key gaps that have been identified more recently, such as a lack of integration between regular operations and sustainability and a need for greater standardization, have spotlighted the need for more universal frameworks for measuring sustainability performance, and increased integration and reporting with standardized financial and operational performance (Ahi & Searcy, 2013; Beske & Seuring, 2014). Going forward, researchers have pointed towards a need for better alignment and integrations with TBL metrics, mainly social and financial KPIs, standardized frameworks for consistent reporting around the ESG (environmental, social, and

governance)standard (Brandenburg et al., 2014), including communication and collaboration with stakeholders (Li et al., 2025).

As both the GSCM and SSCM fields develop and mature and the extent of the issue becomes increasingly urgent areas of focus are expected to highlight promising solution frameworks such as decarbonization of manufacturing, logistics and the entire end-to-end supply chain (Mubarik et al., 2025), and the implementation of circular economy business models and the impact of sustainable supply chains (Theeraworawit et al., 2022).

3 Research Methods

The methodological approach used in this dissertation was adapted from my previously published article (McDaniel et al., 2025).

3.1 Research Questions

To address the gaps in the research identified above, this study seeks to answer the following primary and secondary questions. The primary question of the research is:

How to develop an end-to-end sustainable supply chain model that can be practically implemented in a broad range of contexts, including different industries, different geographies, and across all components of the supply chain?

To more wholly and thoroughly answer the primary research question, the following secondary questions are examined:

- What SSCM and GSCM practices, tools, and techniques are deployed across supply chains, as potential solutions, that impact enterprises' efforts to be socially and environmentally sustainable and improve sustainability performance?
- What are the potential solutions, or solution concepts, that can be implemented to facilitate enterprises' desire to redirect their supply chains to be more socially and environmentally sustainable?
- How can companies create action plans to deploy recognized practices, tools, and techniques to restructure and fundamentally change supply chains that are not sustainable?
- What analytical tools can be utilized to help identify and better understand specific problems across enterprises' end-to-end supply chains?
- How do the conceptual models and action planning frameworks for a sustainable supply chain model - developed in the initial strand of research – compare to genuine real-world supply chains being implemented in practice?

This research utilizes a mixed-methods approach that incorporates both quantitative and qualitative methods. The initial phase uses a structured conceptualization methodology, specifically concept mapping or Group Concept Mapping (GCM). GCM is a systematic process for organizing ideas from a group on a chosen topic and representing those ideas visually through a series of related maps (Kane & Trochim, 2007). This method enables groups of varying sizes, with participants from diverse backgrounds, knowledge, experience, and cultural contexts, to contribute collaboratively.

In the second strand of the research, composed of two phases, the analysis of qualitative case studies is deployed using action research (AR) methods to test the initially developed concepts in real-world

environments, to gain deeper levels of insight. Across both the qualitative and quantitative strands, mapping tools including value stream mapping (VSM), value chain analysis (VCA), and causal loop diagramming (CLD) are used as practical and theoretical tools to gain insights into the specific practical elements of the case studies and facilitate the interpretation of our research outputs. The use of these tools has emerged as a powerful approach in the real-world implementation of best practice supply chains. It has thus evolved and frequently been adopted in academic research in the areas of sustainability in general and SSCM and GSCM specifically.

3.2 Using a Mixed-Methods Research Approach

Mixed-methods research is beneficial for research questions in fields with high degrees and increasing levels of complexity (Lall, 2021), as found in highly evolved, rapidly changing, social systems such as modern health care or global supply chains. While complexity is a catch-all term applied to almost anything, in the context of this research, it can be defined "as a dynamic and constantly emerging set of processes and objects that not only interact with each other but come to be defined by those interactions" (Cohn et al., 2013). In such situations, research approaches, which need to answer questions addressing rapidly evolving environments, must also evolve, hence the need to deploy new methods. Mixed-methods research is an emergent methodology that systematically and explicitly integrates qualitative and quantitative methods to address hypotheses (Tashakkori & Newman, 2010).

What Is a Mixed-Methods Research Approach, and Why Use It?

Mixed-methods research design deploys a combination of qualitative and quantitative research strands to answer research questions. To fit the definition and requirements of a mixed-methods research approach, a study typically requires at least one quantitative and one qualitative research strand or stream. A mixed-methods research study can follow several different models, including convergent or sequential, with sequential studies being either exploratory or explanatory (Creswell et al, 2017).

An exploratory sequential mixed-methods research approach typically involves a qualitative research strand followed by a quantitative research strand. This approach is often deployed when aspects of the study, including concepts, data points, and cause-and-effect relationships, are unclear. In this approach, the qualitative strand of research can establish various hypotheses, and the quantitative strand can be used to substantiate and provide further evidence for proving or disproving these hypotheses (Kroll & Neri, 2009).

An explanatory sequential mixed-methods research approach begins with a quantitative strand followed by the qualitative strand to provide deeper-level insight into the initial quantitative findings. This approach is very popular in the Health Sciences research space (Creswell et al, 2011). The benefit of a mixed-methods approach is that it allows researchers to answer questions and conduct experiments in a way that is more complete than by relying on singular methods. In this way, conclusions can be achieved that are more

comprehensive and provide both broad generalizable contexts as well as deeper level insights into specific questions.

This study relies on the second approach, the explanatory sequential mixed-methods research design. In the Health Sciences field, this is often a preferred approach as qualitative methods provide a more contextual, more profound insight into specific mechanisms which are identified or uncovered in the initial quantitative strand (Creswell et al, 2011).

For similar reasons, this study employs an explanatory sequential approach. In phase 1, the quantitative strand, a concept mapping study uses statistical methods to validate concepts in SSCM and GSCM empirically. In phases 2 and 3, the qualitative strand, the validity of the empirically defined concepts is tested using case studies developed based on AR methodology, a qualitative approach. This is summarized in Figure 3 below.

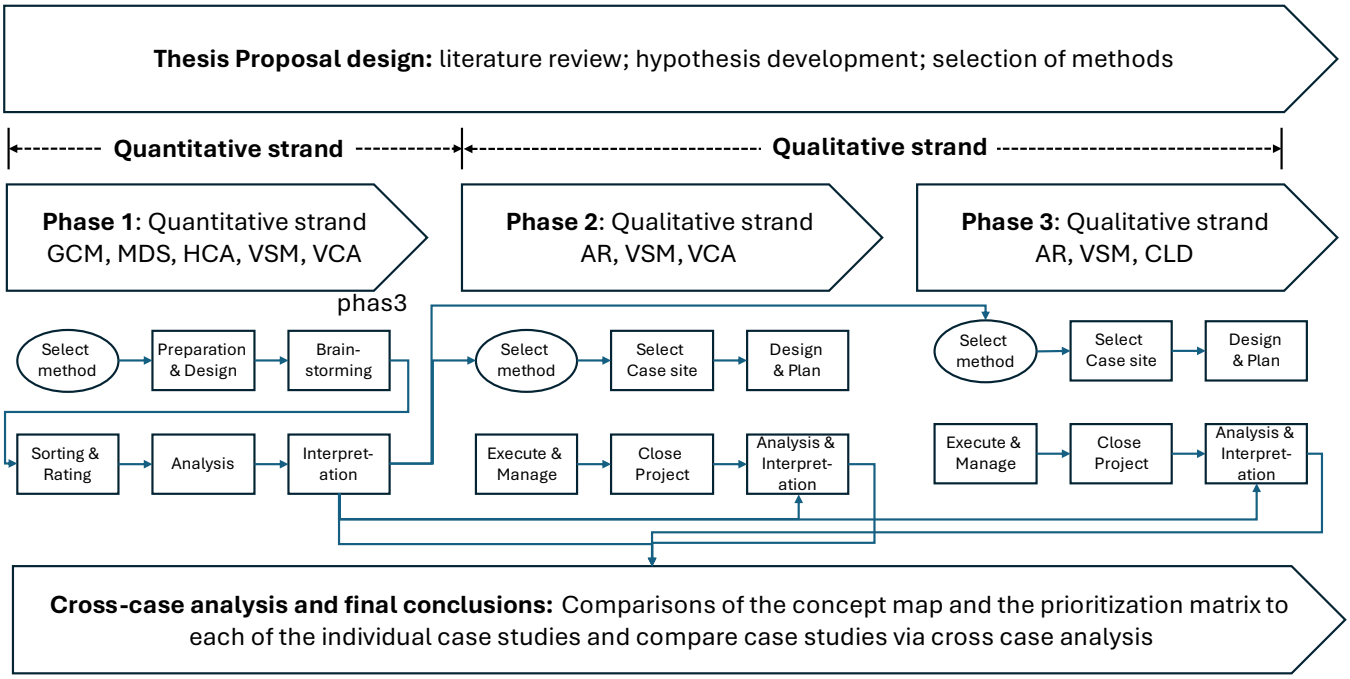

Figure 3: General Overview of the Research Process

The research process shown above directly addresses the study's central question: developing practical SSCM models. The quantitative strand focuses on model development using a concept map and a prioritization matrix, while the qualitative strand and AR case studies explore how validated concepts are applied in practice. Secondary questions are considered in both strands: management practices are

brainstormed qualitatively and investigated quantitatively; analytical tools in the qualitative strand help assess supply chain sustainability issues; and SSCM solutions are empirically validated through collaboration of both strands. Action plan creation and decision-making frameworks are compared to real-world implementation to gauge effectiveness. Finally, the AR case studies explain and support findings from the quantitative research, as discussed in chapters 6–8.

The selection of a mixed-methods approach seeks to address one of the key identified weaknesses in SSCM and GSCM literature, which is how to define supply chain models that are both broad and generalizable as well as specific, practical, and provide relevant insight at the ground level of actual execution.

Referencing Maxwell (2016), the history and research of mixed-methods typically pinpoints its emergence sometime in the second half of the 20th century. For example, research identifying the importance of triangulation (Campbell & Fiske, 1959) emerged during this time. Research by Creswell et al. (2011) states ‘‘The formative period of mixed-methods began in the 1950s and continued until the 1980s. This period saw the initial interest in using more than one method in a study” (p. 25).

Maxwell (2016) suggests the use of mixed-methods, including quantitative and qualitative research methods and their explicit integration, was ongoing much earlier; however, it was not necessarily recognized and labeled as such. Maxwell concludes that this is both important and has a significant impact, as this refutes many of the conflicts regarding which is more effective, qualitative or quantitative. At the same time, it supports the conclusion that the combination and integration of such methods provides a more holistic, complete, and deeper understanding of conclusions from specific research studies. It also seeks to substantiate that such methods do not necessarily need to follow specific formulas, labels, or patterns to be valid mixed-methods research designs.

The use of mixed-methods research design is highly relevant to the development of the SSCM and GSCM field of research. While SSCM and GSCM have been an established field of research since the 1980s and 1990s, the field has seen a substantial rise in the volume of articles published in the last 20 years (Balkumar et al., 2024). During this time, the field approached the subject from numerous perspectives and employed a wide range of quantitative and qualitative methods; nevertheless, gaps and weaknesses in the literature were identified.

While there is a large number of SSCM and GSCM studies using either qualitative and quantitative approaches, there are relatively few that combine qualitative and quantitative methods. Dubey et al. (2015) conducted such a study, deploying interpretive structural modeling (ISM), MICMAC analysis, and confirmatory factor analysis (CFA) to enhance theory building in the field of SSCM and GSCM. Some of the limitations of this study include a narrow focus on Indian manufacturers, suggesting that their research

study “can further be enhanced using multiple cases in both developing and developed countries” (p. 84), a point explicitly addressed in this PhD dissertation. Moreover, while theory building is important, this dissertation focuses more extensively on practical implementation. Jabbour et al. (2014) use a similar mixed-methods design, with a sequential quantitative strand, followed by a qualitative strand. However, like Dubey et al. (2015), it focuses on a single market, Brazil, which is also considered an emerging market like India, and therefore does not address the earlier-mentioned limitation of addressing both developed and undeveloped markets. Younis et al. (2020) likewise perform a study that is similar in design, deploying mixed-methods sequential with a qualitative strand followed by a quantitative strand. Similar to other studies in the research, this study focuses on a single market, the United Arab Emirates (UAE), which is considered underdeveloped or emerging, much like Brazil and India.

Balkumar et al. (2024), one of the more recent SSCM and GSCM literature reviews, discussed the importance of both qualitative and quantitative approaches; however, it does not explicitly look at the use of mixed-methods and its importance, although two of the above-mentioned studies were included in the review. That literature review also notes initially:

> Qualitative analysis [being] dominant over quantitative ones, indicating that the area has not matured to analytical research and implementation level on a larger scale. It must also be noted that some studies may fall under both qualitative and quantitative categories. [However], given that the domain is gaining importance concerning implementation, the number of quantitative articles in the recent past has leveled the numbers between the two categories. (Balkumar et al., 2024, p. 2010)

This is deemed important because quantitative approaches, including models and formulae, may be necessary to address several issues at various levels of analysis. However, it is important to recognize that there are advantages and disadvantages for both approaches, and that by combining them, it is possible to maintain the strengths of both and while simultaneously overcoming the various weaknesses. For example, the strength of quantitative empirical approaches includes the objectivity and the rigor of the analysis, while qualitative studies have a weakness towards less objectivity and more bias. “Quantitative data can be measured and objective, whereas qualitative data is descriptive and difficult to measure” (Balkumar et al., 2024, p.2010).

How Was the Mixed-Methods Research Design Executed?

It is important to point out that the design of the overall research is sequential. This necessarily means that not all aspects of the research are known in advance. Therefore, a high level of control over access to information and how data is collected was not always possible. While this may be seen as a limitation, we believe that when reflecting on the various methodologies, it fits within the boundaries of validity, reliability, and rigor required to execute high-quality empirical research. For example, it was not known in advance of

executing the quantitative phase of the research which concepts would emerge, and that the interpretation would yield the prioritization matrix. It was also not known which case studies would be selected or which methodological approach would be used for conducting them. Initially, there was only a general idea to use one or more case studies in a qualitative, sequential, and explanatory way to support the output of the quantitative phase. This lack of control over data and specific case sites implies that the suitability of the data collected at each phase or strand may not appear suitable in the context of a cohesive mixed-methods study. However, it can be argued that despite potential limitations, the overall phases are suitable to enable a cohesive mixed-methods analysis.

Only after the completion of the GCM quantitative phase did this research undertake to select specific case studies. Broad-based criteria were used to ensure suitability for the mixed-method approach of the research design. For example, potential case sites had to have in scope an end-to-end supply chain with multiple nodes of analysis, including a customer, a supplier, and an intermediary manufacturing or transformation process, which would be the focal point of the SSCM implementation. Also, the case site had to be in the process of implementing a significant and strategic component of sustainability within its supply chain; otherwise, the case sites would not be able to test the outcomes of the quantitative phase in any explanatory fashion. Finally, the structure of participation had to be both academic and business-focused, with a greater emphasis on practical implementation. It was essential to have an explicit and transparent understanding with stakeholders that the researcher's involvement would serve two purposes: an academic lens, where the study's results would be used for academic purposes, and a specific business goal and outcome distinct from any academic purposes. Without the specific business-related aspect of the case study, the value of the research activity and the validity of implementing a valid supply chain could be significantly weakened.

Another important part of selecting the proper case studies and designing the scope of the work was to ensure strong cohesion across both quantitative and qualitative strands and the three sub-phases. To facilitate this, several clear and explicit criteria were essential in both the design and execution of the research. Firstly, all three phases had to address significant aspects of sustainable supply chain management. Secondly, all three phases needed to identify specific tools, techniques, and practices for analyzing and implementing an end-to-end supply chain to improve overall sustainability performance. Thirdly, all three phases needed to address the question of how to successfully implement a sustainable supply chain in real-world contexts and environments.

Both case sites selected meet these criteria and are summarized in the table below. While the selected case studies have features that support strong arguments for their suitability to our research design, there are also aspects where cohesion may be less clear, potentially creating limitations to this research. For example, the Quantitative GCM exercise in the first phase had a strong GSCM focus, and the social and financial side

may appear to be less prominent. However, when considering the process of onboarding, where participants received multiple definitions of sustainability, including social and financial aspects, one can see a balanced view of sustainability represented. This is further supported by the many statements (at least 20) from the brainstorming that were intensely focused on social aspects of sustainability, and include the socially focused concept ‘Culture’, arising from the GCM.

In terms of the analytical tools and approaches used, there were some overlaps. For example, in the GCM and the GROW case study, VCA was deployed, while a slightly different tool, VSM, was used in both the GROW and the GX case studies. Regardless of the differences, both tools are focused on finding ways to create value and eliminate waste by focusing on operational activities.

When evaluating the real-world deployment of SSCM, the aspect of practical implementation was powerful. In the GCM exercise, experts brought forth real-world experience and examples from a wide range of enterprises and supply chain scenarios. In the case studies, however, rather than looking backward at experience, implementation was in real time, creating lived experiences. While aspects of perspective, backward vs. forward, may appear to create a lack of cohesion, the design of the research suggests that it is necessary to compare past data points in order to form hypotheses, in the form of a concept map and prioritization matrix, which can be tested in real time via actual implementation.

Table 2: Criteria for Selecting Case Studies

		Phase 1 (Strand 1)	Phase 2 (Strand (2A)	Phase 3 (Strand 2B)
Does it address SSCM?	*Alignment & similarities*	• Strategic organizational context is SSCM according to definitions of SD, SSCM, and GSCM • Supply chain context is the extended, global, end-to-end supply chain	• Context is SSCM with explicit social, environmental, financial, and supply chain goals • Deals with a specific global supply chain with key nodes in the EU, East Africa, and the USA	• Context is SSCM with explicit social, environmental, financial, and supply chain goals • Deals with a specific global supply chain with key nodes in Hungary, Southeast Asia, Africa, and Latin America
	Specific context and potential differences	• Stronger focus on GSCM and environmental aspects, although social and financial aspects are explicitly and implicitly present • Context is broadly large global organizations and supply chains	• Supply chain excellence and efficiency are seen as a vehicle to improve financial performance • Context is SME & NGO environment with an explicit social, environmental mission and TBL focus	• Supply chain modelling, analysis, and design are core components of developing a circular supply chain excellence model • Context is transforming a community-based start-up organization into a viable, scalable commercial enterprise
Does it identify specific tools and practices?	*Similarities*	86 management practices clustered into eight concepts supporting value creation and waste elimination, further supported by VCA	Application of VSM to identify waste and create value. Specific management approaches deployed strongly align with the Phase 1 concept map	Application of VSM and CLD to identify waste and create value. Specific management approaches deployed strongly align with the Phase 1 concept map
	Differences	Focus on Brainstorming and supported by second-hand VCA	Focus is on-site VSM with actual stakeholders; management practices are less standardized; not always supply chain specific	Focus is on-site VSM with actual stakeholders; strong focus on circularity; not always supply chain specific
Does it address the implementation of sustainability in a real-world context?	*Similarities*	Experience of senior supply chain executives across multiple organizations and time scales, driven by SCM goals	Real-time experience of key senior executives and stakeholders with specific SSCM goals	Real-time experience of key senior executives and stakeholders with specific SSCM goals
	Differences	Broad range of examples; focus on large-scale organizations with commercial missions; backward-looking	Single, particular instance; small-scale organization with strong NGO component and sustainability mission-driven; forward-looking	Single, particular instance; small-scale organization with strong community component and sustainability mission-driven; forward-looking

3.3 Group Concept Mapping Methodology

GCM, as a key component of our mixed-methods approach, was selected for several reasons. For example, there is a need for more mixed methods in GSCM and SSCM generally (Dubey et al., 2015). Additionally, concept mapping is highly relevant for mixed-methods because it bridges qualitative and quantitative approaches (Trochim, 1989), enhances integration in mixed-methods (Kane & Trochim, 2007), promotes stakeholder engagement and participatory research (Rosas & Kane, 2012), and facilitates visualization of multidimensional constructs (Jackson & Trochim, 2002). Finally, concept mapping brings specific dimensions that are beneficial to evaluate and understand GSCMs and SSCMs including facilitating understanding of complex systems (Seuring & Müller, 2008), supporting decision-making and strategy development (Sarkis, 2003), collaboration and communication (Pagell & Wu, 2009), and enabling holistic assessment (Ahi & Searcy, 2013).

Upon analyzing the literature surrounding SSCM and GSCM, it is evident that a majority of empirical studies and mathematical modeling approaches have been utilized, while a smaller proportion of papers have focused on literature reviews (de Oliveira et al., 2018). Flores-Sigüenza et al. (2021), for example, examined almost 70 empirical studies in SSCM and found that the majority focused on deterministic mathematical programming approaches. Koberg & Longoni (2019) assessed SSCM articles over 15 years, finding the majority of articles to be either quantitative, qualitative, or conceptual, with only ~3% deploying mixed methods. Al Amin, M., & Baldacci, R. (2025) further emphasize this point, observing that, “Existing studies often lack a comprehensive mixed-method approach that integrates expert-driven prioritization with quantitative optimization, which is essential for dynamic, high-impact industries . . .” (p.2).

Despite the extensive use of various tools and techniques in empirical studies, the specific application of Group Concept Mapping (GCM) approaches that incorporate Multidimensional Scaling (MDS) and Hierarchical Cluster Analysis (HCA) for creating visual “concept maps” based on participants' data sorting has received limited attention. Historically, papers that employ GCM with MDS and HCA have primarily concentrated on fields such as healthcare, education, and community development, rather than in business, and particularly not in supply chain management. For instance, Group Wisdom (n.d.) notes that among their database of 489 studies, only 18 pertain to business and marketing, with none related to SCM, SSCM, and GSCM. Additionally, of the 25 categories where GCM analysis has been conducted, only one—business and marketing—concerns private industrial enterprises, while the remainder are focused on healthcare, educational institutions, or community development organizations

The GCM process can be described as a sequence of specific, operationally defined steps that yield a conceptual representation (Trochim & Linton, 1986). Conceptualization refers to the articulation of thoughts and ideas that are represented in some objective form through a structured conceptualization process,

“concept mapping” (Trochim, 1989a; 1989b; 1989c; Trochim et al., 1994). In concept mapping, ideas are represented in the form of a picture or map. To construct the map, ideas first must be described or generated, and the interrelationships among them articulated. Multidimensional scaling and hierarchical cluster analysis are then applied to this information, and the results are depicted in the form of two-dimensional maps. The participants entirely determine the content of the map; they are the owners of the problem domain. Participants brainstorm initial ideas, provide information on their interrelations, interpret the analysis results, and subsequently decide on the map's utilization.

Benefits of using a concept matching approach include the ability to synthesize a diverse set of ideas and “voices” coming from participants with broad and varied experience and background (Trochim & Linton, 1986). It also allows for “complex, causally ambiguous” systems to be visualized holistically (Ladinig & Vastag, 2021). This is significant because it facilitates autonomous ideas being grouped into comparable clusters while also allowing for rigorous analysis, such that common themes can be elaborated, and valuable insights can then be extracted.

Concept mapping is also well-suited for analysing practical, relevant case examples in real time and has been demonstrated in previous research to be empirically sound. Validity in concept mapping is interpreted as the best available approximation of the truth of propositions (Cook & Campbell, 1979) and the trustworthiness of the methods and results (Guba & Lincoln, 1981). Dumont (1989) examined whether the statistical analysis in concept mapping, in the spirit of construct validity, is doing what it purports to do; their findings supported the validity of map analysis.

By deploying GCM, this study brings a novel approach to better understanding SSCM and GSCM. While the GCM approach has been used successfully to study value chains (Berg et al., 2018), environmental certifications (Rondinelli & Vastag, 2000), evaluation and program planning (Trochim & McLinden, 2017), quality performance within a complex manufacturing environment (Ladinig & Vastag, 2021), and improvement options in government services (Vastag & Jenei, 2019), it has not been extensively used in the SSCM and GSCM field especially when considering a mixed methods approach combining GCM with MDS, HCA, and empirical triangulation. Our study has the further benefit of combining qualitative interview methods with quantitative mathematical modeling, making this a unique contribution.

Compared to other studies, we used Group Concept Mapping (GCM) to tailor our hypothesis development to a more inductive approach. Rather than developing broad hypotheses from singular case studies, we deployed a quantitative approach, generalizing from multiple in-depth observations of experts. This allowed us to develop solutions applicable to broader contexts. Additionally, unlike studies cited in the latest comprehensive literature reviews, which are generic and do not address specific firms, the GCM approach involves interviews with specific supply chain managers and specific companies. Further novel elements of

this study include a broader generalizability through multiple industries, geographical markets, and organizational perspectives.

This study included participants from four different industries representing multiple organizations, multiple markets, and multiple views on the supply chain. This is in contrast with other GCM studies that considered one industry, for example, the novel biomass-based value chain (Berg et al., 2018), the aluminum industry (Rondinelli & Vastag, 2000), or the automotive industry (Ladinig & Vastag, 2021). The four industry segments we surveyed – metals and mining, packaged consumer food and beverage, automotive and vehicle manufacturing, and consumer electronics – were selected based on common themes. They are global, with nodes across the end-to-end chain separated by long distances. They are recognized as negatively impacting the environment in multiple areas, including climate change (metals and mining, packaged consumer food and beverages), biodiversity loss (metals and mining, consumer electronics, food and beverages), and toxic pollutants (consumer electronics, metals and mining). They represent significant sectors of the economy in most countries.

Another issue identified in the latest literature reviews is that "research works addressing multiple parts of a supply chain are hardly found" (Balkumar et al., 2024, p. 2010). Of the SSCM and GSCM studies that address entire supply chains, they primarily focus on a single industry, are generic, and do not pertain to a specific focal firm; thus, they cannot address root causes at the grassroots level. The drawback of such studies is that they remain at a high level and thus cannot provide insight into the low-level factors necessary to initiate implementation (Balkumar et al., 2024). We attempt to overcome this weakness by designing studies that encompass multiple industries, multiple geographies, and multiple segments of the supply chain using actual case examples and combining them using a GCM framework, which is both conceptual and quantitative at the same time.

One of the most significant challenges remains how to overcome barriers to implementation (Mollenkopf et al., 2010). The approach of this research study attempts to overcome these weaknesses using a mixed-methods approach by firstly developing a conceptual model based on quantitative approaches with empirical results, which are further supplemented by supporting qualitative analysis. In a second step, the research compares the outputs of the empirical model to specific in-depth case studies using a rigorous qualitative AR method and approach. The purpose of the 2-step mixed-methods approach is to gain deeper-level insights into the initially validated empirical concepts developed in the first phase of the research. Using GCM as the quantitative foundation for the initial research strand further emphasizes its importance as a cornerstone methodology.

3.4 Analytical Mapping Tools (VSM, VCA and CLD)

In both strands and all three phases of this research, analytical mapping tools are deployed, specifically

value stream mapping (VSM), value chain analysis (VCA), and causal loop diagrams (CLD). These tools have several commonalities that make them ideal for analyzing supply chains. For example, each of these tools focuses on identifying waste and creating or improving value.

In recent years, VSM has gained particular attention as a preeminent tool to eliminate waste and create value due to its broad-based success and application across many supply chains in many different industries, particularly the automotive industry and the Toyota Motor Corporation (Hines & Rich, 1997). More recent systematic literature reviews of VSM suggest that it is the go-to tool for improving supply chains as it, " . . . has been widely adopted in various industries, . . . has been used to create action plans, . . . [and] is highly effective . . ." (Antonio et al., 2023, p. 37).

A VCA, or value chain analysis, is a strategic tool used to break down the activities within an organization (or system) to understand where value is added — and where waste, inefficiency, or non-value-adding activities exist. The concept of value chains and VCA gained significant traction in both academia and business with Michael Porter's seminal treatise on the value chain framework linking both strategic and operational value-adding activities as a core source of performance improvement (Porter, 2008). This approach and method have also been extended to the idea of global value chains as underpinning global supply chains, particularly in developing economies (Gereffi & Fernandez-Stark, 2011).

A CLD, or causal loop diagram, is a visual tool used to represent the feedback loops and causal relationships within a system. It is widely used in systems thinking and system dynamics to understand complex problems, including organizational, environmental, and industrial systems. CLDs have been shown to enhance value creation efforts in firms through waste prevention and waste management (Freeman et al., 2014), as well as a key enabler for operationally transitioning supply chains to integrate into the circular economy (Jonsdottir et al., 2025).

In general, analytical tools utilizing supply chain mapping techniques such as VSM, VCA, and CLD are widely considered useful and highly relevant in both academia and industry. These tools are essential for understanding complex supply chain networks, identifying vulnerabilities, optimizing operations, and enhancing transparency. Complexity has long been a theme in managing, understanding, and improving supply chains and is only growing in significance. Supply chains are longer for several reasons related to the integrated global economy, access to resources, the trajectory of innovation and technology, and significant differentials in labor costs. This has made the need for tools that are both visual and collaborative essential for managing and improving supply chains (Christopher, 2016).

These tools are also essential for understanding supply chain risk. The prevalence of macro and micro events creates supply chain disruptions at an ever-increasing rate, whether from pandemics, military conflicts, trade

policies, or global realignment of trading partners and policies. For these reasons, analytical tools based on visualization and mapping solutions are deemed critical as they are well-suited to have heightened interest in identifying critical nodes and risks across complex, global, and increasingly intertwined supply chains (Dolgui & Ivanov, 2020).

Finally, these tools have gained popularity for their relevance in understanding and improving sustainability and transparency across supply chains. Both government and consumers are demanding more transparency in where things come from, what is inside them, and how they are manufactured and transported. For this reason, mapping tools and techniques have become an essential aspect related to key trends such as ethical sourcing and supply chain traceability. (Wieland & Gold, 2021).

VSM

In this study, we rely on VSM as a primary analytical tool for waste identification and value creation. However, given specific contexts within this study, VCA and CLD were used as they were more relevant to the specific context. For example, the qualitative analysis of different supply chains in the GCM phase of the research used VCA, and in the analysis of circular business models CLD was deployed.

The association and synergies identified between Lean Manufacturing and sustainable development are well documented over many decades and are a critical foundation of the SSCM and GSCM literature. Often referred to as a "Lean is Green" approach to sustainability, Lean Manufacturing and sustainable development have in common the explicit goal of eliminating waste and increasing the ratio of value creating activities to non- value creating activities (Rother & Shook, 2003; Huppes & Ishikawa, 2005), both in the manufacturing sector as well as many other sectors including services ranging from banking and insurance to healthcare (Tapping & Shuker, 2003).

VSM is one of the fundamental concepts of Lean Manufacturing (Vamsi Krishna Jasti and Sharma 2014) or Lean thinking, as invented by the Toyota Motor Corporation and as part of the Toyota Production System or TPS (Dave, 2020). These concepts, tools, and methods have been popularized in both academic literature (Dekier, 2012) and the wider business press (Womack et al., 2007; Womack & Jones, 1997) with a broad focus on implementation and the automotive industry, as well as other industries like metals and mining. There are also identified broad applications across the global international supply chain, with aspects of environmental waste and potential solutions, for example, the recycling of aluminum cans to reduce mining and transport (Hines et al., 2017). In recent years, a plethora of academic work has validated the efficacy of Lean in a variety of contexts, including sustainability (Ferrazzi et al., 2024).

The key approaches of VSM, making it interesting and relevant for researchers and practitioners of sustainability or SSCM and GSCM, are the emphasis on reducing waste and creating value. VSM seeks to

maximize this relationship by identifying and codifying the key elements of waste and converting them into metrics that can then be used to implement changes and improve value (Paramawardhani & Amar, 2020). This concept applies both to economic value for a business and its shareholders, often referred to as VOB or voice of the business (Arafeh, 2015; Zvikaite et al., 2022), as well as for the customer (Aggarwal, 2021; Salcido-Delgado et al., 2019), often referred to as VOC or voice of the customer.

The natural evolution of this approach then raises the question, can it be extended to other contexts or voices, for example, the voice of the environment (VOE) (Olson & Brady, 2009; Chang, 2018), or the voice of society (VOS) (Jing, 2012; Wong et al., 2007). While research in these areas is still nascent, efforts have been undertaken and have provided substantial evidence that this is indeed a practical and workable approach.

TPS and the concept of a value stream are the origins of the specific tool and method of VSM. In its initial inception, VSM seeks to practically eliminate waste in a process or a supply chain from an economic perspective (Womack & Jones, 1997; Rother & Shook, 2003). The language of Lean and the VSM method focuses on value-added and non-value-added activities, seeking to explicitly reduce the latter, which are referred to as waste. This approach to Lean defines seven or eight specific types of waste, which include transport, inventory, motion, waiting, overproduction, overprocessing, and defects. Eventually, an eighth waste was added to the methodology, referred to as skills. The implication is that when workers or associates who are part of a value stream are not allowed to think for themselves, their skills go to waste and are not optimized. Because these forms of waste specifically involve natural resources in terms of materials that are mined and extracted, such as metals, petroleum products, etc., as well as the expenditure of fossil fuels in terms of transport, reducing waste from an economic point of view can also be seen as reducing waste from an environmental and social point of view.

The value stream methodology purports to increase value by reducing waste. The VSM methodology calculates explicitly the ratio of value-added activities to non-value-added activities by converting each of the seven wastes into product values, or metrics, expressed in units of time. VSM methodology is also a visualization tool (Bärring, 2017), which helps practitioners to gain a deeper level of insight required to make the changes to achieve desired improvements, including eliminating waste and increasing value. The efficacy of these methods is broadly and widely accepted both in business and in the academic world.

The intuitive and obvious relevance and relationship between the defined wastes such as defects inventory and transportation have led both academics and practitioners to find ways to extend the Lean philosophy and specific tools like VSM to address sustainability, initially from an environmental point of view (Lee et al., 2021) and secondarily from a social sustainability point of view (Gholami, 2019).

While the relationship between physical waste in an industrial manufacturing environment, economic waste in a corporate environment, and the environmental impact of such waste seems obvious, it has only been in the past 10 or 15 years that the VSM approach has been made explicitly usable from a sustainability point of view. The use of VSM has been extended to the sustainable field in recent years by adding environmental metrics such as energy usage; nevertheless, until recently, it has been considered not well defined in terms of its ability to analyze sustainable manufacturing (Duflou et al., 2012). At the same time, the visual aspects of VSM, a critical component and usage of the tool, were also viewed as not very well addressed (Faulkner et al., 2012). More recent investigations, however, have made strides by updating the VSM methodology to be more relevant and systematic towards identifying sustainability criteria, for example, in the Sus-VSM method and tool (Faulkner & Badurdeen, 2014).

VCA and CLD

This dissertation uses VCA and CLD in a more limited fashion relative to VSM. In the first phase, VCA was used because it fit the context more appropriately than using VSM. To further support the conclusions of the phase 1 GCM study, an additional qualitative assessment was deemed valid to support the outcomes of the research. Because of the way the research was structured, i.e., corresponding to specific value chain segments within an extended supply chain, the context for deploying VCA was more relevant than VSM. The key aspect, purpose, and goal of the analytical tool were nevertheless very similar or relevant, i.e., to understand flows, identify waste, and improve value across the end-to-end supply chain.

Similarly, VCA was also used in the second phase, the GROW AR case study, which was a part of the qualitative strand of research. In this case, the VCA was used to support the initial analysis, which was driven by a VSM approach. In this context, VSM was the essential aspect of investigation for the units of analysis, an end-to-end supply chain encapsulating customers, suppliers, processing, and logistics that is global in scope and scale. However, when analyzing opportunities within the manufacturing unit, a functional approach emerged whereby VCA analysis was contextually more relevant in supporting the overall approach.

In the third phase of the overall research, the GX AR case study, also part of the qualitative strand of research, utilized a CLD to support the primary VSM analytical approach. Because the theme of circularity was so significant in the GX case, and the patterns emerging in terms of specific feedback loops required a specific type of analysis, CLD was selected and deployed in this specific situation.

3.5 Action Research (AR) Methodology

As described in the mixed-methods research design approach, this study deploys an action research (AR) case study methodology as a qualitative research method to support the quantitative and empirical findings of the concept mapping research strand. Because the design of this research is sequential explanatory, the

use of AR case studies is meant to test and substantiate the outcomes of the initial research strand and provide deeper levels of insight.

The challenge with highly quantitative studies is that although they are rigorous, they can often lack insight and context. At the same time, the use of case studies and AR methodology has received criticism for its ability to be exact and rigorous (Koshy, V. 2005). It has also proven to be popular, particularly in areas where application or practical implementation is important. Because the field of supply chain management is an area where applied research is paramount, the use of AR is perceived as being particularly useful.

As with any methodology, AR comes with certain perceived advantages and disadvantages. At the forefront of these are the advantages that AR, based on cooperative inquiry and a collaborative approach, is perceived as being practical and therefore relevant, as it focuses on actual real-world situations rather than nebulous statistics and analysis. On the other hand, a perceived disadvantage of AR is that it is open to a lack of rigor and can have a weak adherence to the scientific method.

While the importance of academic rigor has always been emphasized, the issue of relevance has often been less appreciated. In recent years, critics of academic research have cited the need for academic research to be more relevant, suggesting that quantitative extractions often proved remote and not relevant to practitioners and managers in the field (Alvesson, 1996, p. 455). More recent studies have suggested that academic research needs to do a better job of helping managers better understand themselves and their organizations, and in more practical terms (Markides, 2007, p.765).

Naslund et al. (2010) emphasize the importance of research methods being both relevant and rigorous. One of the key benefits attributed to AR is its relevance and focus on practicality and implementation. However, there is a perception and some evidence that this has come at the cost of the appropriate rigor needed to be scientifically sound. To address this gap, Naslund et al. (2010) have adopted the AR method specifically in the context of supply chain management to meet both criteria, e.g., ensure that the method is both relevant and rigorous.

The term AR was initially credited to Kurt Lewin (1946) (Susman and Evered 1978); however, the definition by Rapoport (1970, p.499) is possibly more widely used in literature and defines AR as follows. “Action research aims to contribute to the practical concerns of people in an immediate problematic situation and to the goals of social science by collaboration within a mutually acceptable ethical framework.” In this way, AR can be seen as a flexible and widely applicable approach (Baskerville and Wood-Harper1996). Until relatively recently, however, the use of AR has not been widely documented (Näslund, 2002).

One potential reason for not adopting the use of AR more widely in SCM is the perception that this method somehow lacks rigor. According to Alvesson (1996, p.456), “… qualitative research [can often be seen] as

superficial as questionnaire studies." Similarly, Voss, Tsikriktsis, and Frohlich (2002, p.196) have suggested that the AR approach and the use of case research have led to a research approach based on "industrial tourism" which lacks a sound methodology and research method consistent with the standard of scientific method required of peer-reviewed academic research. Ironically, the fact that AR emphasizes the importance of practicality has been, in some instances, used as a criticism against the method, suggesting that it is merely consulting "masquerading as research" (Coughlan & Coghlan, 2002, p.237).

A key question for AR, then, is whether the method can be adopted in a way that is both relevant and rigorous. Moreover, while it has primarily been established that AR is relevant to many fields of research, it is also helpful that AR methodologies have been adopted specifically for the field of SCM.

In line with the sequential explanatory mixed-methods approach, we use two case studies and apply a specific approach applicable to the field of supply chain management, which addresses questions of relevance and rigor. The AR research framework deployed in this study includes the following components adopted from Naslund et al. (2010):

Table 3: Criteria for Ensuring Relevance and Rigor in SCM AR Case Studies

Level 1 (Major Aspects)	Level 2 (Second-Level Aspects)	Level 3 (Evaluation Criteria)
Design Aspects	• Research Question	• Clarity, mutual interest, contribution
	• Change: Science and Practice	• Applied nature, dual contribution
	• Action Research Motivation	• Rationale for AR, limitations, rigor
	• Unit of Analysis, Context of Case	• Clear unit(s), boundaries, • contextual detail
Data Collection Aspects	• Methods, Triangulation, Field Notes	• Diverse methods, triangulation, documentation
	• Researcher Role, Team-Based Approach	• Active participation, team diversity, researcher roles
	• Access and Trust	• Gaining access, mutual trust, and an ethical framework
Data Analysis Aspects	• Structure: Categorization and Pattern Matching	• Themes/coding, pattern recognition, logic building
	• Cyclical Process, Project Reviews	• Reflection, action, iterative loops, joint reviews
	• Presentation: Logical Chain, Frameworks, Contributions	• Logical reasoning, visuals, quotes, literature alignment
	• Rigor and Validity	• Objectivity, confirmability, validity, reliability

Design Aspects

Design Aspect 1: Research Questions

Case studies are particularly effective for answering "what," "how," and "why" questions (Silva, 2008; Marshall & Rossman, 2006; Yin, 2003), which aligns with this study's focus on developing and implementing sustainable supply chain models. The research uses both quantitative (GCM) and qualitative (Action Research, or AR) methods to identify, prioritize, and understand management practices for sustainability. This aligns with valuable and relevant examples in the literature of how an AR study works in practice (Stuart et al.,1998). Ultimately, the qualitative nature of the selected case studies is critical to achieve the depth and richness essential to understand (Ellram 1996; Stuart et al., 2002) the concepts developed from quantitative analysis performed in the initial phase of deploying the GCM.

Design Aspect 2: Change—Science and Practice

AR case studies serve two primary purposes: they support practical transformation within organizations and contribute to academic knowledge. Each project in this study was designed with both practical outcomes and scientific objectives in mind (Greenwood and Levin, 1998; Gummesson 2000).

Design Aspect 3: Why Action Research?

AR is chosen for its collaborative, cyclical process, despite criticism about limited generalizability. Combining AR with quantitative methods helps address concerns about causality and broader application (Argyris & Schön, 1991; Baskerville & Wood-Harper 1996). The participatory nature of AR also increases the trustworthiness and authenticity of results. Features the AR approach deployed in this study, a cyclical, participatory, and collaborative process, "will increase authenticity and trustworthiness" of the research results (Naslund et al., 2010, p. 334).

Design Aspect 4: Unit of Analysis and Context

Selecting the end-to-end supply chain as the unit of analysis allowed for detailed mapping and adjustment as projects progressed. A clear understanding of the research context and timeline was essential for achieving both practical and academic goals in the chosen case studies. Selecting and defining the end-to-end supply chain provides a clear description of the unit of analysis critical to AR research design (Näslund & Williamson 2008). Both case studies also provided the necessary "pre-understanding" of the context of each specific case (Coughlan & Coghlan 2002), a detailed historical timeline, and a set of data points.

Data Collection Aspects

Data Collection Aspect 1: Methods and Triangulation

Consistent protocols and multiple methods are essential for rigorous data collection in AR case studies (Ellram, 1996; Singleton & Straits 1999; Naslund et al., 2010). This study used project management tools,

interviews, workshops, meetings, surveys, and operational data to ensure robust data collection supported by field notes and VSM models.

Data Collection Aspect 2: Researcher Role and Teamwork

Researchers in AR are both participants and observers, which offers opportunities for impact but also requires balancing involvement with objectivity (Checkland, 1993; Näslund 2002; Schein, 1987; Ballantyne, 2004; Dick 2001). Team-based research is common, requiring a mix of industry, functional, and research skills (Benbasat et al., 1987). This study leveraged the lead researcher's extensive management and academic experience, along with stakeholder engagement and expectation management.

Data Collection Aspect 3: Access and Trust

Gaining organizational access and building trust are crucial in AR, as deep insights require close collaboration (Gummesson 2000; Schein, 1987; Ballantyne 2004; Greenwood & Levin 1998; Zuber-Skerritt 2005; Avison et al.1999). Frameworks like Triple Bottom Line (TBL) and formal project management (e.g., PMI, PMP) help align interests and ensure structure. Pre-existing relationships with organizational leaders further facilitated trust and access for the case studies undertaken in this study.

Data Analysis Aspects:

Data Analysis Aspect 1: Categorization and Pattern Matching

Identifying patterns and isolating variables, also known as pattern matching, is essential to understanding potential causal factors and creating frameworks that have predictive potential across a broad range of similar contexts (Stuart et al., 2002).To carry this out, there is a wide variety of methods and tools available which typically fall into one of two basic approaches: within- or cross-case analysis (Cao, 2007; Miles & Huberman, 1994). This study used both. This research created categories, clusters, and themes (Yin, 2003; Dube & Pare, 2003) using three primary methods: themes from the mixed-methods research (cross-case analysis), VSM for visualizing the supply chain (Voss et al., 2002), and brainstorming with affinity diagrams from Lean Six Sigma (within-case analysis).

Data Analysis Aspect 2: Cyclical Process, Project Reviews

Regular and structured reflections were built into the AR case studies via face-to-face and video conference calls, ensuring iterative learning and adaptation throughout the project.

Data Analysis Aspect 3: Presentation: Logical Chain, Frameworks, Contributions

A structured and well-documented chain of events was maintained, using various documentation, such as field notes, meeting summaries, and visual aids.

Data Analysis Aspect 4: Rigor and Validity

Validity and reliability were addressed through robust project planning, contracting, clear documentation, stakeholder communication, and triangulation (Halldorsson & Aastrup, 2003; Yin 2004; Seuring, 2008).

4 Deploying Concept Mapping in the Context of SSCM and GSCM

This chapter used in this dissertation deploying GCM was adapted from my previously published article (McDaniel et al., 2025).

4.1 Research Approach

In the application of the GCM quantitative strand, the methods and research approach are described in section 3.3 Group Concept Mapping Methodology, which is part of chapter 3, Research Methods.

4.2 Problem Domain: Creation of the Concept Map

The GCM has been applied to develop practices, tools, and techniques that are commonly found across diverse manufacturing supply chains, which impact their overall sustainability and sustainability performance. The study has enrolled eight industry participants who contributed to the definition of the problem domain, interpretation, and evaluation of the results.

Based on previous studies conducted by the authors (Ladinig and Vastag, 2021; Silva et al., 2013; Rondinelli & Vastag, 1998), the initial approach was to select a single enterprise as a case study site and select participants within the enterprise based on a cross-functional representation. To carry this out, the authors created a list of industries and geographical regions and, using LinkedIn, selected a search criterion based on first-, second-, and third-degree connections. Based on this, a comprehensive list was compiled of approximately 100 individuals from 8-10 industries and spanning multiple geographic regions in EMEA, the Americas, and Asia Pac. The authors then created a process to recruit companies and individuals into the study. During the outreach and selection process, a short list of approximately 11 people was created, based on the range of industries, geography, and experience. It was then decided that using experts from multiple industries, enterprises, and geographies would create a broader-based representation than a cross-functional group of managers within a single case site enterprise. In this way, a broad-based panel of experts was ultimately selected over a cross-functional group of experts within a single case site.

This approach emphasized a wider set of experts from varied organizations and manufacturing sectors. It also targeted a more comprehensive set of geographic markets and value chain segments. In this way, a more holistic context can be drawn upon, and conclusions are more likely to apply to a broader set of operating conditions. This should facilitate a study that is more relevant to a broader segment, with the potential for greater relevance to a broader population of organizations and manufacturing sectors. Additionally, selecting participants from enterprises that are not connected in any way would increase the likelihood that experts would bring points of view, experiences, and observations that are wholly objective and free from significant bias. Maintaining this would not be easy if all participants came from just one or two companies.

By selecting a panel of individuals with extensive seniority, specific experience within specific supply chain

areas, and across different industries, the study provides a unique and novel perspective on SSCM and GSCM solutions and implementation. Participants were selected based on functional expertise, industry, years of experience, geographical location, and area or segment of the supply chain applicable to manufacturing companies. As part of the recruiting process, individuals were sent a brief presentation outlining the research aims, the general instructions, and the requirements of their involvement.

Seven of the eight participants are male, and one is female – reflecting the general demographics of global supply chain managers. The profile of participants is presented in Table 1.

Table 4: Profile of Participants

Number	Industry	Yrs. Exp.	Supply Chain Segment	Managerial Level	Educ./Cert. Level	Market Focus	Number of Organizations
1	Metals and Mining	18	Primary Processing	Head of Supply Chain Planning	LSS Black Belt	Western Europe	1
2	Metals and Mining	21	Procurement	Procurement Director	EMBA	Latin America	3
3	Cons. Electronics	37	Procurement	Global Strategic Commodity Mgr.	BA, LSS	North America	8
4	Pkg. Cons. Food & Bev.	28	Sales & Distribution	CFO, Partner, Board member	CPA, CMA	North America	9
5	Auto. & Vehicle Mfg.	24	Value-added Mfg.	Global Mfg. Excellence Leader	MSc Eng.	Western Europe	11
6	Auto. & Vehicle Mfg.	26	Value-added Mfg.	Co-founder, Owner	ACDMM, LSS Master Black Belt	Asia	13
7	Pkg. Cons. Food & Bev.	22	Raw Matl. Extraction	Vice President	MBA	Eastern Europe	7
8	Cons. Electronics	27	Sales & Distribution	Managing Director, Chief Sales Officer	MBA	Eastern Europe	9

To ensure all experts participating in the study shared a clear understanding and similar viewpoint of SSCM, and to provide each participant with a thorough understanding of the study, a short presentation was given covering common topics, definitions, concepts, and research aims. The content and topics of the presentation covered both SSCM and GSCM while explicitly balancing both the social and environmental aspects of sustainability. The presentation defined the social aspects of the problem, including food shortages, water insecurity, increased vulnerability to disease, and severe economic inequality. Environmental challenges were also emphasized, including climate change, emissions, soil erosion, deforestation, and biodiversity loss. The presentation also outlined in broad terms the goals and desired outcomes of a sustainability agenda, including the original 1987 definition from the Brundtland report, Our Common Future (Butlin, 1989), which focuses on current and future generations' ability to meet their needs based on natural resources provided by the natural environment.

Additional sustainability lenses were also emphasized highlighting; balanced resource extraction (Meadows, 1989; Odum & Odum, 2008); balanced material production (McDonough & Braungart, 2010; Stahel, 1986); retention of the natural productivity of global ecosystems (Odum, 1969; World Resources Institute, 2005); and fair and efficient use of resources (Sen, 1979; Ostrom, 1990). Each of the eight experts participated in the steps outlined in the table below (see Table 5).

It was clarified that management practices may be framed either positively ("enhancing") or negatively ("limiting"). In SSCM, improvements often result from discontinuing harmful activities rather than solely introducing beneficial ones. Thus, sustainability can be advanced not only by adopting best practices but also by eliminating detrimental practices. For example, two of the 86 statements from the brainstorming (below)—one focused on "eliminating" a limiting factor and another on "deploying" an enhancing strategy—illustrate this dual approach.

- Deploying additive manufacturing (3D printing), which can drive a Sustainable approach by reducing the need for steel
- Eliminat[ing] a centralized manufacturing strategy, which creates more transportation for the distribution of vehicles, parts, and services

Table 5: Research Steps

Step 1 Preparation & Design	Step 2 Brainstorming	Step 3 Sorting & Rating	Step 4 Analysis	Step 5 Interpretation
• Consultation between co-authors. • Defining supply chain segments and industries. • Structure of participants. • Recruiting of participants.	• Individual sessions for SSCM and GSCM overview presentation. • Generating brainstorming statements according to the prompt. • Combining the individual lists of statements and presenting them to the participants. • Checking for redundancy and correcting grammatical and spelling errors.	• Participants sorted statements into groups. • Participants rated each statement based on two criteria.	• Sorting and tabulating statements into a matrix. • Creating potential solutions using MDS. • Selecting the final solution using group consensus.	• Develop latent constructs based on relative spatial distances. • Create a Prioritization Matrix.

These steps followed well-established precedents for GCM (Kane & Trochim, 2007; Trochim, 1989a), including preparation and design, followed by an initial one-hour brainstorming session to develop a list of statements in response to a common prompt. Participants were asked to brainstorm statements by completing the following sentence, which served to trigger thoughts and ideas: "A specific management practice impacting (either enhancing or limiting) industrial value chains to become sustainable is...". Also, participants were explained and encouraged to think broadly and without constraints. To aid the brainstorming process, the visual mind-mapping software and application Miro was used to facilitate and visualize participants' responses.

After the initial brainstorming, duplications, misspellings, wording errors were eliminated, and ambiguities were clarified. Statements were randomized and numbered so that they could be identified at each stage of the research. The list was returned, and participants were asked to identify any similar or repetitive ideas, edit and suggest wording and grammar to be as clear and precise as possible. They were also permitted to contribute additional ideas if they felt it was helpful in the exercise. The final list of 86 statements (see Appendix I), with random numbering, was finalized and approved by experts participating in the study. The statements articulate the conceptual domain for "specific management practices enhancing/limiting industrial value chains to become sustainable".

During the second interview, participants determined the relationship between the 86 statements according

to their individual perspectives, by clustering them using an unstructured process (Rosenberg & Kim, 1975; Weller & Romney, 1988). This involved placing virtual Post-it notes into separate piles "in whichever way seems most appropriate to you." This was also done using the Miro software application. In parallel, participants were provided an Excel spreadsheet and requested to rate each of the statements two separate times on a 5-point Likert scale. The first rating was 'Ease of Implementation' (EoI) with the instruction: "Relative to the other practices mentioned, how easy is it to implement this practice (where 1 is NOT very easy and 5 is VERY easy)?". The second ranking was based on the 'Impact' (I) of the solution/constraint with the instruction: "Relative to the other practices mentioned, what is the impact in terms of achieving sustainability, if a company were to implement/eliminate this practice (where 1 is NOT very impactful and 5 is VERY impactful)?". Scores on the criteria served as the basis for creating the Prioritization Matrix and a qualitative decision-making framework.

Using the results of the sorted statements as input, a binary symmetric matrix was created, with two axes, whereby all relationships were coded. "If statements i and j were placed in the same pile by participant k, then the appropriate cell of the matrix is 1; otherwise, it is 0." (McDaniel & Vastag, 2022, p. 185). After all individual matrices were completed, a summary matrix was then calculated to capture the combined similarity of all participants into one final matrix. Two-dimensional non-metric MDS was subsequently created based on the total similarity matrix. The purpose of this was to visualize the complex data set in a two-dimensional representation.

About Kruskal and Wish, Trochim (1989a) argued (1978) that "Since it is generally easier to work with two-dimensional configurations, ease of use considerations are also important for decisions about dimensionality. For example, when an MDS configuration is desired primarily as a foundation on which to display clustering results, then a two-dimensional configuration is far more useful than one involving three or more dimensions" (p. 58). The result of this was a "point-map" which located each statement as a point on a two-dimensional plane whereby the distance of each statement was determined by how often they were clustered in the same card pile or grouping. MDS had a stress value of 0.178, which is consistent with other concept mapping applications, indicating a good fit (Kane & Trochim, 2007). This two-dimensional configuration explained 83.1% of the total variance.

The expected outcome of the exercise is that individual statements can be clustered on the map such that unique concepts are formed based on similarity and closeness of the statements. By creating a structure of statements on a two-dimensional map, the MDS analysis provides input for the hierarchical cluster analysis (Trochim, 1989a). Generally, it is difficult or impossible to decide, in advance, on the "best" clustering method and the number of clusters to be chosen. Regarding the choice of clustering algorithms, we relied on previous empirical studies. Trochim (1989) found Ward's algorithm to be the most useful. Ward's algorithm,

minimizing the within-cluster sum of squares to the between-cluster sum of squares at each level of joining, generally gave more sensible and interpretable solutions than other approaches (e.g., single linkage or centroid method). All statistical calculations were conducted in SYSTAT 13.2.01, and graphs were created by JMP 17.2.0 for Mac.

A series of five potential solutions was generated, with a varying number of clusters ranging from four to eight. The five solutions were visually depicted in a bottom-up, agglomerative-type fashion, allowing both the authors and participants to interpret the relevance of the different groupings within each of the five solutions (Berg et al., 2018). These results were then distributed to all participants for examination, interpretation, and preparation for group consensus feedback. Participants were instructed to draw on their own experiences and the research aims, and not to overthink their conclusions; instead, they were encouraged to trust their initial instincts when interpreting and deciding on the best solution. A debriefing process was then conducted with participants, allowing for discussion and feedback and enabling them to share their thoughts, ideas, and conclusions. To aid the process, the results of previous interviews, the mind maps, and the individual sorting of Post-it Notes conducted using Miro software were made available to participants. In this way, the "best" cluster solution was determined by group consensus. The group decision was based on a close examination of the statements and their groupings. The solution with eight clusters was deemed most representative compared to solutions with four, five, six, and seven clusters by both the researchers and the experts. Both researchers and participants unanimously agree on the eight-cluster solution, as it provided the most logical balance between the need for precision within specific clusters and the differentiation required to distinguish clusters into separate concepts (Kane & Trochim, 2007). The concept map was then visualized using a polygon representation depicted in Figure 4.

The last step of the research was the evaluation of the results. This consisted of two parts. In part one, the eight clusters were interpreted based on the statements and their relative position to other clusters. This allowed for the development of latent constructs. The latent constructs provide value, allowing for different perspectives or "lenses" for different stakeholders to view the clusters and thus provide insight and context into practical decisions. This is important to ensure a set of solutions that is not "one size fits all" and allows for the specific circumstances of organizations and individual stakeholders who are making implementation decisions. Each cluster was labelled, including a definition according to the consolidated theme of the individual statements. Later, the average ratings were added to complete the cluster rating map.

In part two of the evaluation, the ranking of clusters according to the two scales or axes was assessed. The assessment involved calculating the average ranking for each of the two scales, 'Impact' (I) and 'Ease of Implementation' (EoI) and then mapping these points in a graph. As I and EoI typically form an inverse relationship, assessing each cluster on the two dimensions can lead to the optimal solution.

Appendix I lists the clusters, their number, name, and definition, as well as the individual statements contained in each cluster. Additionally, the average Impact (I) and Ease of Implementation (EoI) values for each statement and the mean ratings for each cluster are also shown.

4.3 Results and Discussion

The result of concept mapping is Figure 4, which shows the 86 statements arranged in two dimensions. These coordinates were used to create the eight clusters chosen by participants and visually represent the conceptualization of leading management practices enabling industrial supply chains to become more sustainable. The group consensus created names and definitions for each of the clusters as follows: '1. Supply Chain Waste', '2. Information Technology', '3. Product Waste', '4. Culture', '5. Suppliers', '6. Circular Manufacturing', '7. KPIs', and '8. Design'.

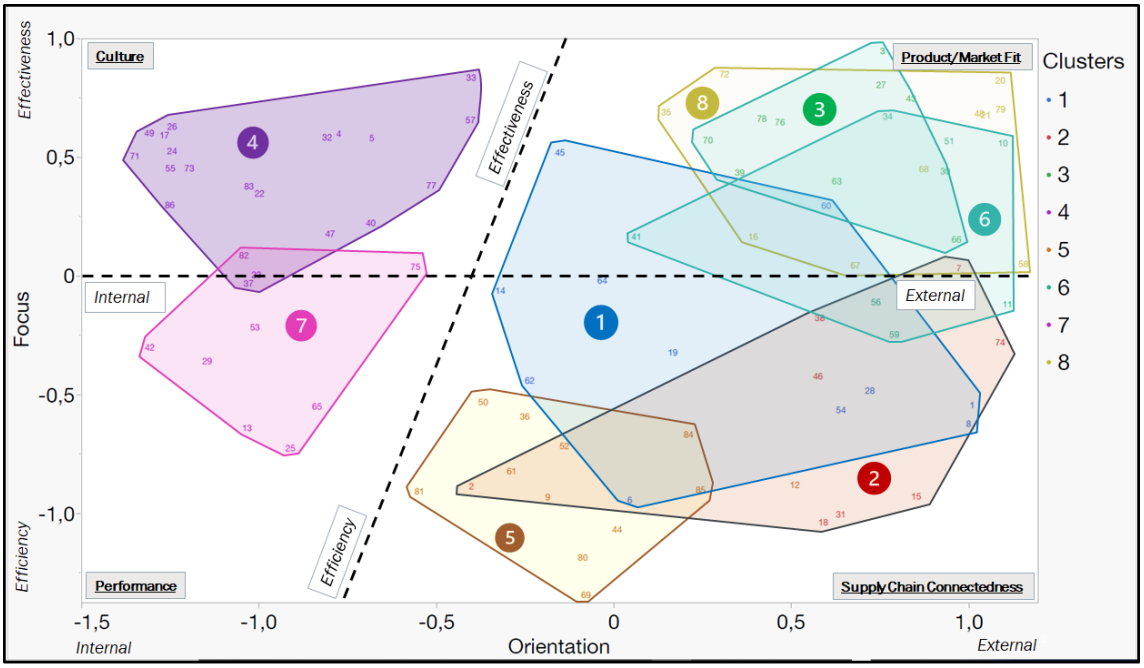

Figure 4: Concept Map of Management Solutions Impacting Sustainability

An additional result of the concept map is the development of latent constructs with two axes and four quadrants, which overlay the conceptualized management practices and their relationship to each other. The horizontal axis – labelled "Orientation" – denotes a continuum of themes and management practices which range from "Internal" to "External". The internally focused practices of performance measurement and organizational culture, centred on the mindset of stakeholders within the organization, represent the internal pole of this axis. The externally focused practices of managing suppliers and producing and designing products to meet the needs of external customers represent the external pole of the axis.

Mentzer et al. (2001) suggests that firms within a supply chain have both internal and external points of view constituting a firm-level perspective within an end-to end supply chain consisting of both customers and suppliers, while introducing the concept of supply chain orientation (SCO), defined as "the recognition by a company of the systemic, strategic implications of the activities and processes involved in managing the various flows in a supply chain" (p. 11). In other words, firms must understand both internal capabilities and external relationships to participate in SCM effectively. Ultimately, this suggests individual firms with a supply chain orientation see themselves as part of an integrated chain rather than an isolated unit.

In this way, the internal point of view focuses on within-firm activities—procurement, manufacturing, logistics, inventory, etc., and seeks to optimize internal operations to support supply chain goals. It involves metrics such as cost, lead time, production efficiency, and internal KPIs. The external point of view, by contrast, emphasizes the firm's relationships and interactions with suppliers, customers, and other partners, and recognizes interdependence with other supply chain entities. It typically focuses on activities like demand forecasting, supplier collaboration, joint planning, and risk sharing (Lambert & Cooper, 2000; Esper et al., 2010).

The vertical axis – labelled "Focus" – shows a continuum of themes and management practices which range from "Efficiency" to "Effectiveness". The efficiency end of the scale focused on the solutions '7. KPIs, '5. Suppliers', and '2. Information Technology', representing the denominator of the productivity equation, as labour, materials from suppliers and information are all inputs, representing the efficiency pole of this axis. The effectiveness end focused on the solutions of '8. Design', '3. Product Waste' and '4. Culture', represents the numerator of the productivity equation, as organizational culture and products are outputs, and therefore represent the effectiveness pole of the axis. This is consistent with Borgström, (2005) who suggests, using resource dependency theory, that in supply chains, *efficiency* often comes in forms like Just-in-Time production—optimizing inputs by way of operational KPIs, managing suppliers, using systems to improve internal processes —while *effectiveness* emerges through customer orientation and innovation, e.g. design, products, culture, etc. —driving outputs.

In this way, effectiveness and efficiency are fundamentally proxies of the productivity equation process, as shown below:

$$\text{Productivity} = \frac{\text{Outputs}}{\text{Inputs}} \rightarrow \frac{\text{Achieving more}}{\text{with Less}} \rightarrow \frac{\text{Effectiveness}}{\text{Efficiency}} \rightarrow \frac{\text{Benefits}}{\text{Resource Usage}}$$

The two axes described above consequently form four quadrants: Q1 Culture, Q2 Product/Market Fit, Q3 Performance, and Q4 Supply Chain Connectedness.

4.4 Priority Matrix of Implementation

Concept mapping helped us to develop specific concepts and clusters, while the Impact (I) and Ease of Implementation (EoI) ratings allowed us to prioritize the actual implementation of concepts.

The Priority Matrix (Figure 5) was created using the average ratings of I and EoI for each cluster, leading to four zones. Zone 1, the highest priority zone, is the 'Value Zone' and has the highest overall score, containing the '6. Circular Manufacturing' cluster, with 6.75 points (the sum of the two rating averages). Zone 2 is the 'Short-term Tactical Zone', containing two clusters, '7. KPIs' with a score of 6.41 points, and '4. Culture', with a score of 6.28 points. Zone 3 is the 'Longer-term Strategic Zone' and contains the '1. Supply Chain Waste' cluster, with a score of 6.30 points. Zone 4 is the 'Risk Zone' and contains the '5. Suppliers' cluster, with 6.02 points, the '2. Information Technology' cluster, with 5.97 points, the '8. Design' cluster, with 5.50 points, and the '3. Product Waste' cluster, with 5.45 points.

As further elaborated in section 4.6, the Priority Matrix is critical for facilitating real implementation. Such initiatives typically require strong backing from a Board of Directors, along with senior stakeholders, a task force from the middle ranks of the organization, and a myriad of lower-level champions and doers. Implementation requires significant financial and human capital (Klassen & McLaughlin, 1996). None of these resources can be deployed without a decision-making framework. In this way, the Priority Matrix can provide maximum impact and value.

While the Priority Matrix offers an initial structure for decision making, it is important to recognise that decision processes within most enterprises are highly complex. This framework should not be viewed as diminishing the intricate nature of organisation-wide decision making and resource allocation. When considering theoretical aspects of implementation, it is essential for any organisation adopting such a tool to either have a predisposition towards, or explicitly define, sustainability as a corporate objective. Explicitly addressing these issues proactively, at the board kevel are paramount for addressing common barriers, such as organizational inertia or resource constraints.

Additionally, varying geographic regions and industries encounter distinct stakeholder and regulatory challenges, which can result in differing degrees of external and internal pressures influencing decisions. This, along with the limited number of participants impacts the overall generalizability of the research outputs. Nevertheless, it is a widely accepted that the context of sustainability, and the urgency to move in this direction, is relatively equal across industries and geographies.

The authors suggest that the Priority Matrix serves as the basis for several hypotheses that can be tested in future research. Given the limitations of this study, such as the limited number of participants and the broad range of industries, geographical regions, and supply chain activities it covers, there are multiple directions

for future research. For example, future research can test the hypothesis that implementing the '6. Circular Manufacturing' concept is the most optimal approach to making supply chains sustainable, as it is easier to implement and has a greater impact than other concept solutions. Alternatively, the same approach could be taken with the concept solutions of '8. Design', '3. Product Waste', '5. Suppliers', and '2. IT Technology' to test whether they are riskier to implement than other concept solutions due to their relatively limited impact and greater difficulty in implementation. Even broader hypotheses can be tested, including whether prioritizing concepts leads to more efficient resource allocation and better outcomes for making supply chains sustainable.

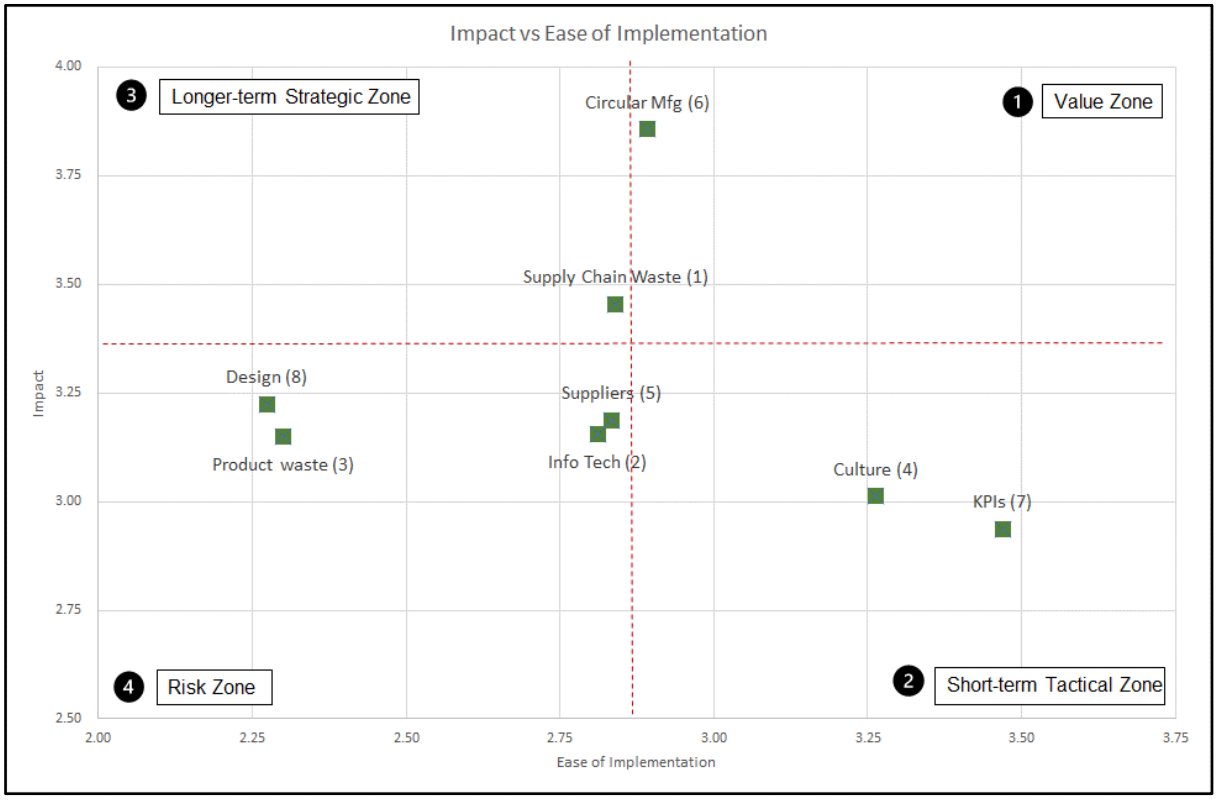

Figure 5: Priority Matrix for Action Planning

4.5 Interpretation of Overlapping Clusters

Figure 4 reveals that clusters overlap: there are statements within the straight-line boundaries of two or more clusters simultaneously. This was a somewhat expected outcome, as the topic of SSCM and GSCM is complex, containing many concepts, elements, and 'lenses' that are not yet clearly defined and universally accepted, based on the numerous definitions of SSCM and GSCM, as elaborated in the introduction. Nonetheless, the authors felt it was essential to assess the impact of these overlaps on the validity of insights from the concept map.

In assessing the overlapping clusters, we considered approaches to reduce the overlaps. For example, consolidating the 86 statements into fewer statements, reviewing overlapping statements to reassign them to a different cluster through a group consensus process, or selecting a solution with fewer clusters.

After analysing the overlapping statements (Appendix II), we concluded that the overlaps were both valuable and justified, as the combination of similarities and differences in both the statements and the clusters provided a greater level of insight and a more accurate reflection of reality.

For example, Statement 6, "Using ISO 14001 to ensure compliance to Sustainable Supply Chain standards," is part of Cluster 1, Supply Chain Waste, but overlaps with Cluster 2, Information Technology, and Cluster 5, Suppliers. All three clusters share the common goal of increasing sustainability by using fewer resources. However, Statement 6 focuses on improving supply chain standards, rather than using technology or collaborating with suppliers. Therefore, it is logical for Statement 6 to be clustered with Supply Chain Waste, yet it still has elements in common with the other two clusters.

To reduce overlapping statements in future research, studies should clearly define concepts both theoretically and practically. Conducting more detailed interviews, applying coding techniques, using mind mapping tools, and allowing additional rounds of statement consolidation can increase clarity. Ensuring precise meanings during interviews may result in combining or splitting statements to avoid overlap and improving context.

The underlying strength of the GCM method is to obtain a set of empirically validated concepts that capture the nuances and complexities of the SSCM and GSCM concepts. Therefore, the solution offers increased value due to its larger number of concepts that contain both similarities and differences in their meaning. We concluded that the eight-cluster solution, which contains 86 original statements, was the most accurate and proper interpretation of the reality of SSCM and GSCM in practice.

4.6 Interpreting Quadrants in the Concept Map and Priority Matrix

The combination of the concept map and the priority matrix helps both practitioners and theorists better understand the context and implications of implementing the identified practices.

The empirically quantified concepts, together with the latent constructs emerging, help to identify the context for how managers might implement practices. Enterprises may choose to focus on different practices given the current situation they face along the given axes, 'efficiency & effectiveness' and 'internal vs. external', identified in the concept map.

Consequently, implementation of specific practices can be prioritized according to the ranking established by the Priority Matrix, which measures optimal combinations of 'Impact' (I) and 'Ease of Implementation'

(EoI). In this way, enterprises and executives may obtain insight and guidance into structuring concrete, practical, and time-bound implementation road maps.

Interpretation of the Culture Quadrant

The Culture quadrant includes cluster 4. Culture is defined by the axes of 'Internal' and 'Effectiveness'. These practices relate to creating awareness around sustainability issues [17, 77, 83]; supporting employees and other non-financial stakeholders [4, 5, 23, 37, 40, 57]; and developing a culture and mindset that drives sustainability behaviour [24, 26, 32, 33, 55, 71, 73, 86]; actions and policies [22, 47, 49].

The mean rating for I (3.01) is the second lowest among the eight clusters. However, the mean rating for EoI (3.26) is the second highest. This places the '4. Culture' cluster in Zone 2 'Short-term Tactical' within the Priority Matrix (see Figure 5 for a detailed explanation), denoted by relatively high EoI and relatively low I.

Interpretation of the Product/Market Fit Quadrant

The Product/Market Fit quadrant is defined by the axis poles of 'External' and 'Effectiveness' and includes the '3. Product Waste', '6. Circular Manufacturing', and '8. Design' clusters.

The practices in the '3. Product Waste' cluster relate to either eliminating unsustainable materials in products and processes including packaging, toxins and other unsustainable raw materials [3, 27, 43, 70, 76, 78]; or improving products and manufacturing processes to become more sustainable by improving product features and performance through practices such as labelling, packaging and involvement of suppliers in reducing product material inputs such as water [30, 39, 63, 66].

For the '3. Product Waste cluster, the mean rating for I is (3.15), and EoI is (2.30). The low score on both axes places it in a low-priority zone of the Priority Matrix, Zone 4, the 'Risk Zone', which implies action should be delayed or else risk investing too much effort for too little reward.

The practices in the '6. Circular Manufacturing' cluster relates to increased deployment of product remanufacturing as a core approach to operations [10, 51]; improved and increased use of material reusage and recycling, especially in electronic waste [56, 34, 41]; and creating supply chain processes that better leverage circular methods and principles [11, 59].

For the '6. Circular Manufacturing' cluster, the rating for I (3.86) is the highest, and the rating for EoI (2.89) is the third highest. The relatively high score on both axes places it as the sole cluster in Zone 1, the Value Zone with the highest priority in terms of taking meaningful action.

The practices in the '8. Design' cluster relate to designing new processes which use more sustainable energy, transport or materials [20, 21, 48, 67]; by deploying new technologies such as additive manufacturing (e.g. 3D printing) or BEV (battery electric vehicle) technology [16, 35, 58, 68]; or designing new processes that

create sustainable products through enabling reusability, remanufacturing, and longer product life [72, 79].

For the ‘8. Design’ cluster mean rating for I is relatively high (3.23); however, the EoI rating (2.28) is the lowest, placing it in a lower priority position. Like ‘3. Product Waste’, the low score for the ‘8. Design’ cluster on both axes places it at a lower priority within the Priority Matrix. Cluster ‘8. Design’ is also in Zone 4, again implying action should be delayed.

Interpretation of the Performance Quadrant

The Performance quadrant, defined by the axis poles ‘Internal’ and ‘Efficiency’, includes the ‘7. KPIs’ cluster. These practices relate to improved use of performance targets generally [13]; linking employee performance to sustainability criteria broadly [25, 29, 42, 65, 82]; and creating specific, companywide goals such as reduced CO2 emissions or meeting criteria to participate in the Dow Jones Sustainability Index [53, 75].

For the ‘7. KPIs’ cluster the mean rating for I (2.94) is the lowest among the eight clusters. However, the mean rating for EoI (3.47) is the highest. This places the ‘7. KPIs’ cluster in Zone 2 the ‘Short-term Tactical Zone’ of the Priority Matrix denoted by relatively high Ease of Implementation (EoI) and relatively low Impact.

Interpretation of the Supply Chain Connectedness Quadrant

The Supply Chain Connectedness quadrant defined by the axis poles ‘External’ and ‘Efficiency’ includes the ‘1. Supply Chain Waste’, ‘2. Information technology’ and ‘5. Suppliers’ clusters.

The practices in the ‘1.Supply Chain Waste’ cluster relate to deploying supply chain methods that reduce transport across the extended supply chain [1, 8, 19, 45, 54]; implementing either general or industry specific sustainable supply chain standards such as ISO 14001 or sustainable mining practices [6, 14, 28]; or creating and designing supply chains which reduce CO2 or use increased levels of renewable energy [60, 62, 64].

For the ‘1. Supply Chain Waste’ cluster, the rating for I (3.44) ranks highly, and the mean rating for EoI (2.84) is the fourth highest. The relatively high scoring on both axes places it in Zone 3, the ‘Longer-term Strategic Zone’, implying action should be taken but at a slightly lower priority than for the clusters in Zones 1 and 2.

The practices in the ‘2. IT Information Technology’ cluster relate to deploying digital processes which focused on the timeliness and quality of information across the supply chain [2, 31, 38, 46]; using hardware technology such as sensors either in the manufacturing process or in the products to provide better information and data [7, 15, 74]; or using software technology to collaborate with suppliers to improve

information about supplier sustainability performance [18].

For the ‘2. IT Information Technology’ cluster, the mean rating for I (3.16) ranks fourth from the bottom. The rating for EoI (2.81) is the third from the bottom. The relatively low scoring for this cluster on both axes places it in Zone 4, the ‘Risk Zone’, which implies action should be delayed.

The practices in the ‘5. Suppliers’ cluster relate to improving relationships with suppliers to be more supportive in achieving sustainability goals, not just financial goals [9, 61]; collaborating, promoting, and developing specific solutions together with suppliers [12, 50, 52, 84, 85]; or increasing control over suppliers through certification schemes or auditing practices [136, 44, 69, 80, 81].

For the ‘5. Suppliers’ cluster the mean rating for I (3.19) ranks fourth from the top. The mean rating for EoI (2.83) is the fourth lowest, placing it in a lower priority position. Like the ‘2. IT Information Technology’ cluster, the low scoring for the ‘5. Suppliers’ cluster on both axes places it in a lower priority position. ‘5. Suppliers’ is also in Zone 4, which also implies action should be delayed.

4.7 Pattern Matching

While the action plan presented above purports to be generally applicable, it is worth considering differences between scores of specific contexts identified in the research. The contexts we explored, ‘Markets’ (Developed vs. Emerging), and ‘Supply Chain Position’ (Downstream vs. Upstream), displayed differences both in the average Impact (I) and Ease of Implementation (EoI) scores among clusters as evidenced by the many crossing rungs of the ladder graphs (see Figure 6 and Figure 7). These findings underly the importance of a “context matters” message and highlight the dangers of “one size fits all” approaches when implementing solutions (Trochim, W. M. 1985). Examination of sectoral differences (metals and mining, packaged consumer food and beverage, automotive and vehicle manufacturing, and consumer electronics) yielded interesting results; however, the complexity of that analysis led the authors not to explore those differences in this chapter.

Examining the Impact (I) differences between Developed vs. Emerging markets, we see significant differences whereby the specific solutions ‘6. Circular Manufacturing’ (3.89 vs. 3.29), ‘7. KPIs’ (3.69 vs. 3.25), Supply Chain Waste’ (3.45 vs. 3.02), and ‘8. Design’ (3.60 vs. 3.35), score higher for Impact in Developed Markets compared to the Emerging Markets segment. Drivers for this difference could be several factors, such as the higher costs in developed markets, the size and complexity of enterprises operating in more developed markets, and the stricter regulatory environment (Zhu, Sarkis, and Lai 2007).

In terms of Ease of Implementation (EoI) for Developed vs. Emerging markets, 6. Circular Manufacturing’ (2.61 vs. 2.36), and ‘8. Design’ (3.20 vs. 3.03), also scored higher for developed markets. It is reasonable to assume that similar factors are driving this outcome. For instance, if costs and regulatory environments are

higher in developed markets, there should be more incentives and resources to ensure these actions are implemented. Some evidence of this has been found in Central and Eastern Europe (Rondinelli & Vastag, 1998).

‘7. KPIs’ (2.50 vs.3.06), and ‘1. Supply Chain Waste’ (2.93 vs 3.05), however, were shown to be more challenging to implement in Developed vs. Emerging markets. The drivers may be similar, but with the inverse effect. For example, size and complexity in Developed markets could make the solution concepts more challenging to implement.

Examining the differences between the Downstream vs. Upstream position in the supply chain, we see significant differences whereby the specific solutions ‘6. Circular Manufacturing’ (3.89 vs. 3.29), ‘3. Product Waste’ (3.45 vs. 3.00), and ‘1. Supply Chain Waste’ (3.36 vs. 3.11) scores higher for Impact in the Downstream segment than in the Upstream segment. Drivers for this difference could be factors such as proximity to end users and dispersion of physical and geographic locations. Proximity to end users, typically found in Downstream components of the supply chain, implies greater connectivity, control, and ability to influence end users with information, transparency, and collaboration opportunities. This could be a potential factor in incentivizing complex relationships and innovative solutions.

In terms of EoI for Downstream vs. Upstream position in the supply chain, the solution concepts ‘6. Circular Manufacturing’ (2.07 vs. 2.89), ‘3. Product Waste’ (2.75 vs. 3.50) and ‘1. Supply Chain Waste’ (2.50 vs. 3.48) paradoxically scored lower for the Downstream position in the Supply Chain. One hypothesis for this could be that scale and complexity, including dispersion of physical and geographic locations, make implementation more prohibitive.

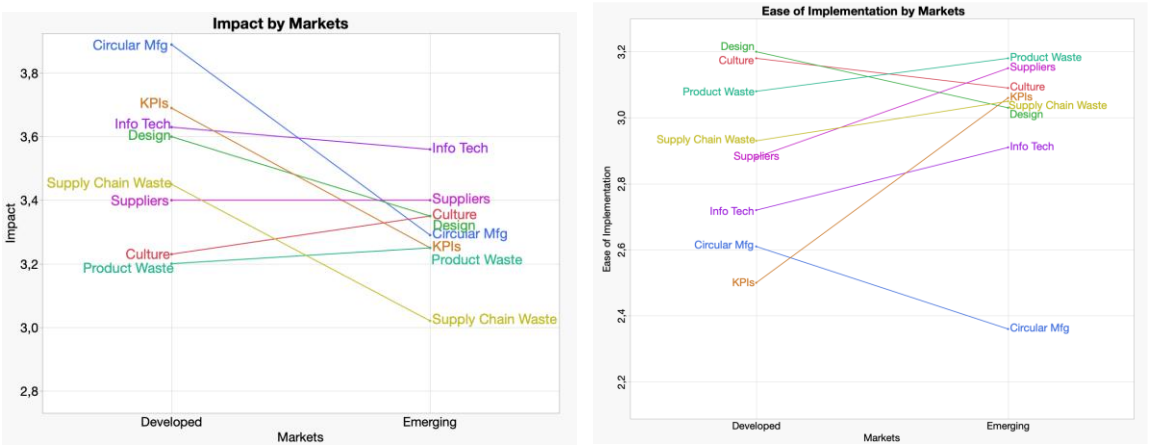

Figure 6: Impact (I) and Ease of Implementation (EoI) by Markets:
(a) Ranking Impact (I) of practices identified by Emerging Market vs. Developed Market participants. (b) Ranking the Ease of Implementation (EoI) of practices identified by Emerging Market vs. Developed Market participants.

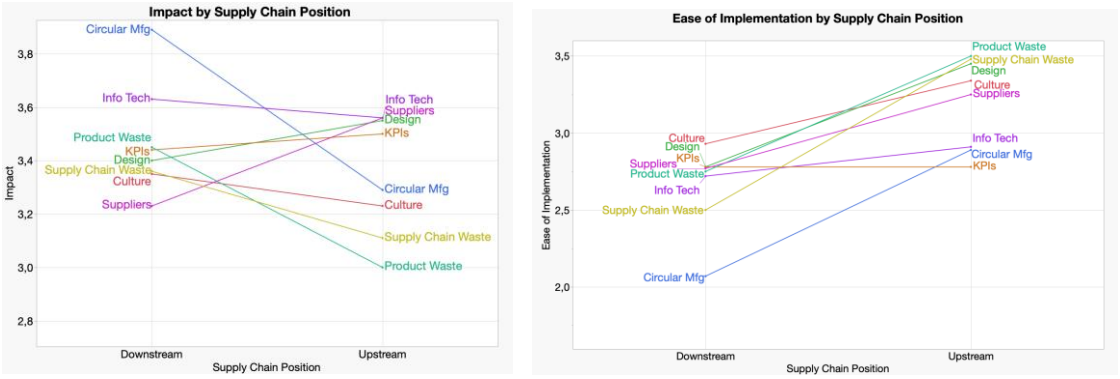

Figure 7: Impact and Ease of Implementation (EoI) by Supply Chain Position:
(a) Ranking Impact (I) of practices identified by Downstream Supply Chain vs. Upstream Supply Chain participants. (b) Ranking the Ease of Implementation (EoI) of practices identified by Downstream Supply Chain vs. Upstream Supply Chain participants.

4.8 Qualitative Analysis and Value Stream Mapping

The focus in the chapter was to examine SSCM and GSCM from a holistic perspective, "addressing the multiple parts of the chain" – a noted weakness in the current body of SSCM and GSCM research (Balkumar et al., 2024, p. 2010). To differentiate this study from other empirical research that employs either theoretically constructed supply chain proxies, single-company and single-site studies, or single-industry research, we selected four industry supply chains with five distinct components, each accompanied by several case examples.

In the multiple interviews conducted as part of the empirical GCM exercise, the interviewees were instructed to provide statements, solutions, and ideas from their specific corporate experience in the companies they worked for. In total, the number of companies used as a source across all participants was greater than 61 based on participants' current LinkedIn profiles. The number is substantially greater, as 3 of the 8 participants spent a considerable number of years in consulting roles, as well as in industry, serving multiple clients. The minimum number of organizations represented, considering only those where participants served in a managerial role, would be 24. Additionally, each participant was able to explicitly identify and visualize their position in the supply chain during the interview process, drawing on their own supply chain executive experience, which was supported using the mind mapping software tool, Miro. This is consistent with the framework and concept of supply chain orientation (SCO) (Mentzer et al., 2001; Esper et al., 2010). In this way, we were able to construct a prototypical industrial supply chain across five different supply chain components – Raw Material Extraction, Procurement, Primary Processing, Sales & Distribution, and Value-added Manufacturing.

To analyze the potential impact of the clusters and individual solution statements, we mapped each statement to the corresponding supply chain components, as described during the interview process. This was facilitated with the help of mind mapping tools in the Miro software that aided the interviews, where supply chain positions were identified and visualized. The result was a qualitative visualization and quantitative impact score to understand better how the specific clusters and solution statements correspond holistically to the various parts of the supply chain. In this way, we avoid a “one size fits all” set of conclusions. At the same time, we can construct a more generalizable model of how solutions can be deployed across not only the whole chain but also in specific places within the supply chain, to achieve the highest level of Impact (I) and Ease of Implementation (EoI).

Below is the visual depiction of the end-to-end supply chain with statements and clusters overlaid (Figure 8) and supported with specific scoring for each component (Table 6).

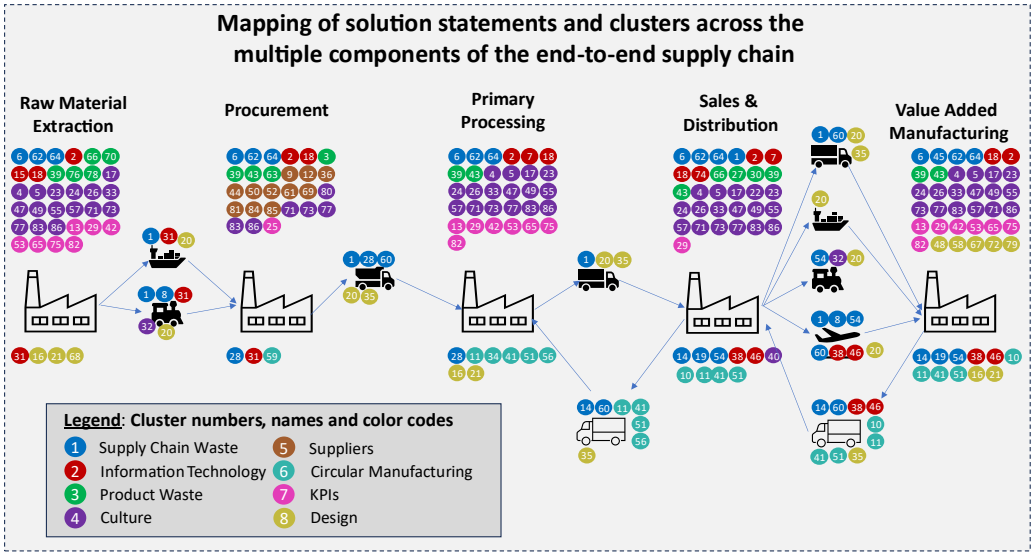

Figure 8: Mapping Solution Statements Across the Supply Chain

Table 6: Scoring the Different Positions and Functions Across the Supply Chain

		Raw Material Extraction	Procurement	Primary Processing	Sales & Distribution	Value-added Manufacturing	Logistics
Ease of Implementation (EoI)	*Average*	2.97	2.82	3.05	3.03	3.01	2.68
	Total	113.00	84.50	119.00	119.00	141.25	45.50
Impact (I)	*Average*	3.01	3.19	3.21	3.21	3.18	3.53
	Total	114.50	95.75	125.25	126.00	149.50	60.00
Total number of solution statements		38	38	30	39	41	17
Cluster represented		1, 2, 3, 4, 7, 8	1, 2, 3, 4, 7, 8	1, 2, 3, 4, 5, 6, 7	1, 2, 3, 4, 6, 7, 8	1, 2, 3, 4, 6, 7	1, 2, 4, 6, 8

Insights from the qualitative analysis show that Impact (I), Ease of Implementation (EoI), and overall volume of applicable solutions are mostly equal across the end-to-end supply chain within the manufacturing nodes of the supply chain. However, when we examine the solutions related to transport and logistics between the nodes, we see that there are significant differences.

The logistics function shows a score between 10 and 17% more Impact (I) and with 7 to 12% less Ease of Implementation (EoI). One interpretation, therefore, is that internodal function and place within the supply chain of logistics is significantly more challenging to implement and has significantly more impact. The total number of statements (only 18 vs. 30 to 42 for all other nodes) and clusters (5 vs. 6 to 7 for all other nodes) represented by Logistics is also significantly less than the other supply chain nodes represented.

This presents contradictory interpretations. Having fewer solutions to apply can suggest a proxy for simplicity, which would have the potential to reduce the complexity in an already highly complex business area. On the other hand, few solutions can also denote higher risk, as there are fewer options and fallbacks should some solutions not work out as anticipated or if external conditions (economic, social, political, environmental) shift.

4.9 Developing Solutions

This chapter explores the first part of the overall study: how to create a practical and sustainable supply chain model for real-world application. The quantitative strand answers the first three secondary questions by identifying and grouping SSCM and GSCM practices into eight solution clusters, then evaluating them with a prioritization matrix to guide implementation. Later chapters address which analytical tools identify challenges and opportunities, as well as assessing the model and framework developed in this chapter in terms of its effective deployments in actual sustainable supply chains.

The 8 clusters developed from the 86 identified practices form independently and empirically derived concepts which are consistent with those extensively identified within the SSCM and GSCM literature. For example, management techniques such as reverse logistics, a circular manufacturing concept (Liu et al., 2018), are viewed as a part of the proactive continuum of management practices (Srivastava, 2007) and are one of several key SSCM and GSCM approaches (Bennekrouf et al., 2013). Dabees et al. (2023) argue that reverse logistics is crucial for enhancing the overall sustainability of enterprises, as well as identifying a gap in theoretical frameworks that need to be further improved in this area if practical implementation is going to become more widespread.

Reducing waste across the end-to-end supply chain is cited as having a significant impact on environmental

performance (Govindan et al., 2014), while Kuo (2010) validates the idea of supply chain waste reduction through management approaches that incorporate recycling processes analysis. Nazir et al. (2024) emphasize the importance of SSCM and GSCM practices in general, with a particular focus on waste reduction across the supply chain, which is highly correlated with environmental performance, especially in the context of institutional pressure. Design is cited as a key SSCM and GSCM approach (Sheu, 2016) for improving sustainability performance, as is the importance of incorporating suppliers into SSCM and GSCM solutions (Dai et al., 2015). Chin et al. (2015) found that green product and process design had the strongest positive relationship with sustainability performance. It outperformed other practices, such as supplier selection or evaluation.

Kannan et al. (2014) and Dai et al. (2015) also highlight the importance of selecting green suppliers, while Brandenburg (2015) emphasizes the need for environmental criteria for introducing new products to reduce product waste. Li & Zhong (2024) find that both green supplier selection and integration strongly correlate with and impact overall environmental performance. Technology as a solution, such as advanced green technology, is considered a crucial factor by Tseng et al. (2013) when incorporating sustainability principles (economic, social, and environmental) into the supply chain. Stroumpoulis et al. (2024) investigate the role of digital transformation, coupled with the implementation of sustainable supply chain practices, and conclude that both have a significant impact on the operational and financial performance of individual firms as well as supply chains.

In response to ‘external pressure from myriad forces ranging from regulators, suppliers, customers, community stakeholders, and companies’, corporate leaders are increasingly attempting to infuse SSCM and GSCM principles into company culture (Jabbour et al., 2014a, b). Gao et al. (2025) investigate the relationship between sustainable transformational leadership, sustainable HR practices, and the development of sustainable values among employees, which in turn positively impact sustainable organizational culture and performance.

Operational Performance Management is also considered a key tool by Vanalle et al. (2017) and King & Lenox (2001) for improving environmental performance and implementing SSCM and GSCM and is cited as a key approach for implementing SSCM and GSCM (Woo et al., 2016; Shahriari et al., 2016). Kumar et al. (2023) demonstrate the impact of performance management on promoting sustainability and the need to improve approaches to measuring SSCM.

In terms of the novel aspects of this study's approach, a new set of concepts or solutions was not necessarily developed or conceptualized, and was not necessarily the goal of the research. Nevertheless, the overall approach of using a GCM cluster analysis based on MDS and HCA brings a new perspective regarding how to categorize a set of SSCM and GSCM practices around specific conceptual themes inductively and

empirically which has not been done previously.

Finally, we attempted to answer the third question, how to develop action plans, by analysing the specific Impact (I) and Ease of Implementation (EoI) of each management practice and consequently extrapolated to the eight solution concepts. In this way, we were able to map the de facto solution clusters into a Prioritization Matrix, which can facilitate management decision-making and deploy action plans.

By ranking the four zones in priority order as described in section 3.5, companies can prioritize solutions indicated by the clusters on an absolute basis or according to their specific goals, for example, short-term vs. long-term. This provides another potential novel outcome: a decision-making framework for developing and implementing solutions for creating sustainable supply chains. The efficacy of this framework and approach is further tested and validated in the qualitative strand of the research.

4.10 From Concept to Action

This chapter conceptualizes a set of coherent SSCM and GSCM solutions that can practically and effectively be implemented in a typical industrial supply chain context across multiple industries and operating environments. The position and relationships among the clusters that emerge have led to the development of latent constructs providing insight into how supply chain experts and corporate leaders can assess different solutions through divergent and opposing lenses. For example, the Internal vs the External lenses, or the Efficiency vs the Effectiveness lenses.

The Prioritization Matrix constructed from the two comparative axes, Impact (I) and Ease of Implementation (EoI), provides further insights into how corporate decision makers can prioritize solutions based on short-term vs. long-term approaches and overall total benefit.

While many of the conclusions are consistent with the SSCM and GSCM literature, several novel aspects of the research include quantitative modelling approaches to identify relationships between solutions and clusters not previously explored in detail, combined with lower-level qualitative analysis of firm-specific examples across multiple parts of the supply chain. A significant limitation of the increasingly rich SSCM and GSCM literature is that many empirical analyses overlook specific firms at the grassroots level, resulting in overly high-level studies that lack practical insights useful to managers in the field and their efforts to implement SSCM and GSCM practices.

Yang et al (2020) note that the literature includes a depth of research covering a wide range of topics from supplier certification and Lean production to design innovation, supply chain models, and customer collaboration approaches (Wong et al., 2020). Analysis has also been developed to aggregate and classify these approaches into comprehensive frameworks (Liu et al., 2021). Nevertheless, this does not fully address SSCM and GSCM from a multi-part perspective that is generalizable across industries, geographies, and the

end-to-end components seen in a complex supply chain. By employing the combination of GCM using interviews across multiple parts of the chain, coupled with a qualitative VSM analysis to identify specific instances of practices at specific firms, the study overcomes a key weakness of a large swath of existing empirical and qualitative analysis in the SSCM and GSCM field. Additionally, the latent constructs and the suggested Prioritization Matrix add new dimensions and insight into potential practical uses of the already identified approaches.

This part of the study has several limitations including the number supply chain exerts surveyed (eight people), the geographic locations (Europe predominantly), the coverage of the different supply chain components (raw material extraction, procurement, raw material processing, value-add manufacturing and distribution) and the industries covered (packaged food & beverage, consumer electronics, mining equipment, integrated steel coil manufacturing). To better control the dimensions, a wider panel of experts and stakeholders can be selected and include a more realistic representation of these demographic attributes.

Although the aim was to create a generalizable supply chain model, the scope proved too broad for this dissertation. With only 8 participants and limited control over geography, market types, and supply chain positions, a fully generalizable model was not developed. However, the research established an exploratory framework and provided initial empirical data, contributing toward that goal.

Despite its limitations, this chapter provides both empirical evidence and practical implications for practitioners and manufacturing organizations to act by developing impactful initiatives and actions to ameliorate negative environmental impacts and create truly sustainable supply chains.

5 Qualitative Strand: Selecting Case Studies and Deploying Action Research (AR) Methods

5.1 Selection of the Case Study

Two case studies—GROW Fairly (GROW) and The Garment Exchange (GX)—were selected as part of a mixed-methods research design. GROW is a macadamia and nut processing business in Kenya, managed from Bratislava, Slovakia, with a global supply chain founded on Fair Trade and sustainable agroforestry. GX is a start-up in second-hand fashion, based in Budapest, Hungary, aiming to "normalize secondhand clothing" and lower the environmental impact of fast fashion. The backgrounds of both case studies are detailed in sections 6.2 and 7.2.

Both GROW and GX are practical examples of sustainable supply chains, each with ambitious goals to drive change within their organizations and industries. GROW offers a global supply chain with operational experience and ongoing innovation, specifically aiming to follow the Triple Bottom Line (TBL) framework, balancing social, environmental, and economic goals. GROW's challenges have been meeting its economic objectives while maintaining social and environmental commitments, especially as it prepares for a brand and operational relaunch. Addressing supply chain issues is vital for GROW's future economic model due to its focus on manufacturing and logistics.

GX, as a younger organization, faces uncertainty but also greater potential for new approaches. Its priority is developing a supply chain model that competes with and addresses the negative impacts of fast fashion. GX stands out by placing sustainability at the core of its mission. During this AR case study, several business models were explored for GX, including how to scale its business in order to compete with major rivals in the sector, and whether to become a non-profit or function as a volunteer-led initiative.

Selecting these case studies supports the study's mixed-methods approach, combining qualitative research with quantitative analysis. The main research question—how to develop and implement an end-to-end sustainable supply chain model—benefits from these cases because they provide real-world examples of management practices and real-world implementation context. GROW's long history and ongoing changes offer insights into SSCM in both established and evolving contexts. GX, though less mature, presents opportunities for innovation and growth.

The case studies also met the 18 criteria specific to the AR methodology for supply chain research, grouped under ‘Research Design’, ‘Data Collection’, and ‘Data Analysis’ (Näslund et al., 2010). This is detailed in Table 7.

The research question aligns with Design Aspects by focusing on how to implement a sustainable supply chain—case studies are seen as ideal for understanding complex phenomena. The methodology defines the use of case studies as “one of the most relevant ways to understand a certain phenomenon [with the] depth and richness ... to really understand the what, how and why . . . about a given situation (Ellram, 1996) (Näslund et al, 2010, p. 333). Both GROW and GX use a global sustainable supply chain as their unit of analysis, described further in section 5.3.3.

In Data Collection, the researcher’s role, Team-based Approach, and Access and Trust were crucial. Employing a Team-Based Approach in AR is important “given the applied and involved nature of an AR project” (Näslund et al., 2010, p. 336). The researcher’s active participation and expertise in supply chain and sustainability helped ensure success in both case studies. The Team-based Approach, including the author, PhD advisors, and organizational members from GROW and GX, improved data collection and analysis (Benbasat et al., 1987; Näslund et al., 2010).

Access was achieved primarily through shared interest in research outcomes (Greenwood and Levin, 1998; Zuber-Skerritt, 2005; Naslund et al, 2010). GROW aimed to enhance performance across all TBL pillars, while GX sought to globalize secondhand fashion and develop a sustainable business model. These objectives are aligned with academic goals, fostering mutual benefits and keeping financial costs low thanks to student-led research and organizational support for sustainability.

Trust stemmed from the researcher’s history with supply chain transformation and expertise in VSM methodology, as well as long-term stakeholder relationships—especially at GX, where the primary contact was a former student. Access is vital to Action Research, offering tacit knowledge unavailable through surveys or observation due to their lack of direct employee interaction (Ballantyne, 2004).

For Data Analysis, categorization and pattern matching were critical (Yin, 2003). In GROW, the team identified over 50 data points, organizing them into seven themes, mainly around Supply Chain Opportunities, Questions, and Risks. This was carried out through a combination of VSM and VCA tools. A second set of themes—Strategic Drivers—emerged based on feedback from GROW’s local stakeholders. For GX, mapping the supply chain and analyzing event data (e.g., total kg of clothes collected and recirculated, participant numbers) provided several clusters of pathways and business models. In the GX AR case study, VSM and CLD were

deployed, as well as two surveys—one with volunteers and another with over 600 participants— which significantly enriched GX's data.

Finally, the SSCM and GSCM concepts from the initial quantitative research were used to help interpret and validate the findings of the case studies. These concepts, developed before the case work, helped triangulate insights and ensure the study's validity. Details of the use of these concepts, drivers, and opportunities are covered in later sections.

Table 7: Selection Criteria for Selecting Cases and Aligning with AR Methodology

Level 1 Aspects	Level 2 Aspects 18 Criteria	How Selected Cases Align with the Detailed Selection Criteria
Design Aspects	1. Research Question	The research question aligns with AR methodology by enabling the discovery and mapping of supply chain variables, using in-depth case studies (GROW and GX) as appropriate structures.
	2. Change: Science and Practice	Research design is mutually beneficial to both academia and practice, fulfilling the criteria for AR through practical engagement and scientific contribution.
	3. Action Research Motivation	AR was chosen for its action-oriented approach with end-to-end supply chains as the units of analysis, across two geographies and timeframes, with substantial on-site involvement.
	4. Unit of Analysis, 5. Context of Case	Unit of Analysis included entire supply chains (GROW and GX), covering diverse locations and detailed contextual settings, including visits, meetings, and workshops.
Data Collection Aspects	6. Methods, Triangulation, 7. Field Notes	Data collection utilized a range of methods, including analog notes, emails, MS tools, and photos. Project management protocols and field notes ensured triangulation and rigorous documentation.
	8. Researcher Role, 9. Team-Based Approach	Roles were clearly defined with a team-based approach, including the lead researcher, the author, ensuring alignment, transparency, and collaborative research across both case studies.
	10. Access and Trust	Access and Trust were achieved through the author's expertise, project value, and long-standing stakeholder relationships at both sites.
Data Analysis Aspects	Structure: 11. Categorization and 12. Pattern Matching	Themes and clusters were developed per case (GROW: strategic and operational; GX: strategic model, surveys, circularity in fashion), enabling pattern development and theory validation.
	13. Cyclical Process, 14. Project Reviews	AR follows a cyclical process with multiple planning-action-evaluation-reflection loops throughout 9 to 15 months, enabling adaptation to stakeholder needs.
	Presentation: 15. Logical Chain, 16. Frameworks, 17. Contributions	In both AR case studies (GROW and GX), a similar methodology for project management was used (based on PMBOK), which included documentation (PowerPoint presentations, field notes, communications) and a clear project plan and project governance.
	18. Rigor and Validity	This was driven by a combination of stakeholder communication processes, documentation, and the use of specific analytical tools (VSM, VCA, CLD), and how they were used in collaboration with team members. Using the results of the GCM exercise from the qualitative strand was also a key aspect of validating the AR case conclusions.

5.2 Design Aspects of the Case Study

The research questions in both case studies were addressed by mapping variables, identifying relationships, and clarifying linkages in the supply chain (Naslund et al., 2010; Stuart et al., 2002). These questions held mutual practical and scientific interest (Coughlan & Coghlan, 2002). Section 3.5 explains why Action Research (AR) was selected, while sections 6.2 and 7.2 detail the chosen Unit of Analysis—the end-to-end supply chain—for GROW and GX. Research time frames spanned August 2022 to March 2023 (GROW) and January 2024 to March 2025 (GX), with activities in Kenya, Bratislava, Budapest, and Senica, including extensive on-site visits and workshops for both studies.

5.3 Data Collection Aspects of the Case Study

The data collection methods in both case studies were designed to address the AR research question rigorously. Primary documentation included analog meeting notes, flip charts, emails, calendars, and digital tools such as PowerPoint and Excel for reporting, planning, and communication. Photos of workshops and plant tours were also used.

A formal project management protocol, based on PMBOK (Guide, 2001), structured communication and accountability throughout both projects (Leong, 1991; Estay-Niculcar et al., 2004). The PMBOK's five-phase lifecycle—initiation, planning, execution, monitoring, and closure—was adapted for the AR approach, mapped to both GROW and GX. This protocol is described in Table 8 below.

Table 8: Project life cycles phases – PMBOK vs. GROW and GX

Traditional PMBOK Project Life Cycle	**Phases 1 & 2** *Initiation & planning*	**Phases 3 & 4** *Execution & Monitoring*				**Phase 5** *Project close*
Structure of GROW and GX AR research projects	Initiation & planning,	Initial site visits & workshops,	Interim debrief and analysis	2nd field visit	Conclusions, and next steps.	Project closure

Key methodologies included VSM, VCA, and CLD, which involved workshops and interviews with 8–12 participants, mapping customer-to-supplier information and physical flows to identify operational and supply chain improvements for social, environmental, and economic outcomes. A two-step process was followed: first, mapping to identify issues; second, developing solutions based on data and participant feedback.

The researcher's role and team structure were clearly defined, ensuring alignment and avoiding conflicts of interest. To ensure alignment and avoid conflict of interest, it was critical to be transparent as well as identify any potential conflicts, for example financial incentives, or any bias in the outcomes. Regarding the financial incentives the only compensation received was the covering of international flights in the case of the GROW case. All expenses for travelling to Budapest for the GX case were covered by existing travel arrangements.

Regarding any potential bias during the process this was mostly ameliorated by the onboarding and chartering process. By careful crafting goals and identifying shared interests the study was designed in such a way to minimize bias. Additionally, by creating a project governance structure based on stakeholders and teams, it ensured that the author would have limited influence on both data collection and analytical outcomes. Despite these efforts there is by definition risk and elements of bias. The intention here is to minimize any bias as much as possible.

Finally, collaboration was emphasized with all team members and the author contributing to research activities. Access and Trust were established through the author's expertise, project value, and longstanding stakeholder relationships, as detailed in the referenced sections.

5.4 Data Analysis Aspects

Data analysis for the AR projects followed a structured process addressing the research questions, with key conclusions summarized here. Both case studies developed clusters and categories around strategic and operational supply chain issues. In GROW, new strategic clusters emerged beyond the original scope, proving valuable to stakeholders and researchers alike. GX's clusters focused on future strategic models, informed by team workshops, surveys, and student projects, along with reviews on circular manufacturing in fashion and textiles. These thematic categories and pattern matching enabled within-case analysis and informed explanatory answers to the original research questions, supporting key theories on GSCM, SSCM, SCM, and TBL (Stuart et al., 2002).

A final set of clusters was used for cross-case analysis, applying the concept mapping experiment from Chapter 4 to both case studies for broader explanatory conclusions. Unlike linear consulting projects (Spiggle, 1994), AR case studies are cyclical, involving repeated loops of planning, action, evaluation, and reflection (Ballantyne, 2004; Coghlan & Brannick, 2001). For both GROW (nine months) and GX (fifteen months), multiple cycles allowed for regular review and adjustment in response to stakeholder needs, consistent with Daudelin (1996).

The AR projects maintained clear logical frameworks, with meetings and workshops documented through notes, presentations, and other records. Frameworks like VSM, VCA, CLD, PM, and GCM structured the research. Both projects contributed to science and practice, ensuring rigor and validity. The dual aims—scientific research and practical solutions—were evident in outputs for both academic and stakeholder audiences. Objectivity and reliability were demonstrated by a transparent project process, including overall project governance, as well as recorded outcomes, while team expertise and stakeholder involvement supported validity and transferability (Naslund et al., 2010). Overall, the structured and cyclical AR approach, combined with robust documentation and pattern analysis, ensured credible and transferable findings.

5.5 With-in Case and Cross-Case Analysis

The concept mapping study in Chapter 4 developed eight key concepts from experienced supply chain practitioners, resulting in a prioritization matrix to address sustainable supply chain implementation. While the group concept mapping (GCM) validated and ranked these concepts, the additional AR case studies provided further explanatory support.

The GROW case study was analyzed using the eight concepts from the quantitative research, offering greater insight and context and enabling more holistic conclusions. Both AR case studies underwent individual (within-case) and cross-case analyses through the lens of these concepts, enabling triangulation and validation of findings as per the mixed-methods design.

Evaluation focused on two questions: first, whether the outputs of each case study supported the existence and relevance of each GCM concept; second, how each concept fit within the prioritization matrix, based on Impact and Ease of Implementation (Forrester, 1958; Mentzer et al., 2001; Elkington, 1998; Seuring & Müller, 2008).

6 GROW Fairly: A Global Sustainable Supply Chain

6.1 Overview of the Case and the Design Framework

GROW is an international distribution and production organization based in Bratislava, Slovakia, focused on operating “fair value chains” for macadamia and cashew nuts. GROW oversees the entire value chain—from seedling cultivation and production quality to crop harvesting, farmer partnerships, processing, and export to global conscious consumers (Our Work - Growfairly.com Fair Value Chains, 2022). Its key facility is in Kenya, serving as the primary production and distribution hub. GROW is owned by a holding company, itself a portfolio investment of the social and environmental Integra Foundation in Slovakia.

The case study ran from August 2022 to March 2023 and included two field trips to Kenya and workshops in Bratislava. The project aimed to improve GROW’s supply chain sustainability, focusing on lessons learned since 2005 and current restructuring challenges. As noted in section 5.3, these challenges are common in TBL (triple bottom line) initiatives, which often falter on economic sustainability despite firms’ social and environmental aims (Carter & Easton, 2011; section 1.1, p.6). Thus, the central question was how to achieve a truly TBL supply chain, maximizing performance in “People, Planet and Profit.”

Cross-cultural dynamics and change management were key, as Canadian and Slovak investors collaborated with Kenyan teams in a complex East African environment. Stakeholders recognized that sustainable TBL outcomes required greater focus on economic issues, alongside social and environmental goals. Literature on SCM, SSCM, and TBL (Forrester, 1958; Mentzer et al., 2001; Elkington, 1998; Seuring & Müller, 2008) supports the idea that strategy, operations, and supply chain management can significantly improve financial performance, which is essential for overall sustainability.

The project’s purpose was twofold: to involve an expert (the author) to address critical supply chain and strategy issues, and to serve as the basis for a PhD research project. Details on project selection and initiation appear in section 5.1 and later sections. Over its nine-month duration, the project progressed through key phases: initiation and planning; initial site visits and workshops; interim analysis; a second field visit and workshops; conclusions and action plans; and project closure. This process followed both AR and PM frameworks, detailed in Tables 7 and 8.

6.2 Background of GROW Fairly’s Operations up to the Current State

Organizational History: Ten Senses - 2005 to 2010

GROW traces its roots to 2005, when the aim was to create sales opportunities for disadvantaged producers and support the fair-trade concept (Fairtrade International, 2024). In 2008, Integra Foundation enabled the export of

the world's first fair trade macadamia nut, building processing capacity and distributing grafted seedlings to Kenyan farmers. Integra also worked with Ethiopian coffee farmers, leading to the establishment of the Ten Senses roastery in 2010.

Organizational History: GROW.fairly - 2017 to Present

A new company was launched in Kenya in 2017 to expand into other countries and products, starting with cashew nuts and later adding dried fruits. Between 2017 and 2021, as activities and partnerships increased, challenges arose: financing investments, aligning stakeholder values, cash flow issues, and the complexities of operating in East Africa. These issues led to a restructuring in 2021, strengthening GROW's financial and operational footing, and uniting stakeholders under a renewed mission and brand.

Persistent challenges over the 16-year history included financing, strategy, and operational gaps—such as cash flow, value misalignment between partners, lack of a robust commercial model, reliance on grants, and regulatory hurdles typical of emerging markets. Stakeholders saw value in assessing lessons learned using TBL supply chain tools, as supported by the literature (Forrester, 1958; Mentzer et al., 2001; Elkington, 1998; Seuring & Müller, 2008). An AR approach was adopted to drive improvement, with objectives aligned to SSCM and GSCM concepts.

Current Operating Model and Restructuring Plans

During the AR research, GROW was restructuring its legal, board, and ownership structures, which became central to the study and informed lessons learned. The international supply chain continued operations as a going concern, while these governance issues were addressed.

From an operational perspective, Figure 9 illustrates key information, material, and cash flows, contrasting these with social, environmental, and financial benefits within a TBL supply chain model.

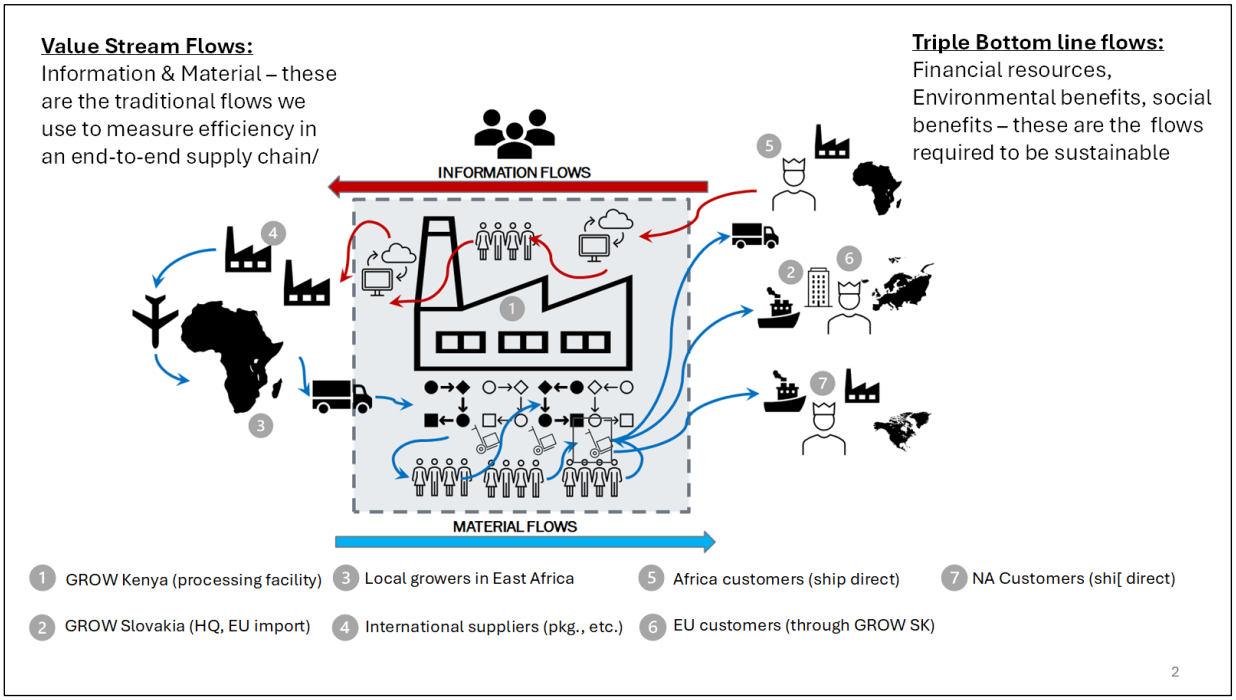

Figure 9: Initial high-level Value Stream map of the end-to-end supply chain

The primary focus and scope of the AR study was agreed as the GROW Kenya processing facility located in Kenya. However, because the assessment was the end-to-end supply chain, the flows and relationships across the various customers, suppliers, and intermediaries necessarily remained in scope in the context of improving the local operations.

6.3 Project Team Members and Roles

The project team consisted of several different groups within the Unit of Analysis across several locations. Table 9 below lists the project team from GROW, their project roles, and the entities within the supply chain they represent.

Table 9: GROW Stakeholders and Project Team Members

Name	Position	Project role
Allan Bussard (Allan)	Director and Founder Integra Foundation and Coop; CoB of GROW.Fairly International	Executive sponsor
Alojz Macsai (Ali)	International Sales Director and CEO of GROW Fairly Slovakia	Primary sponsor
Tom McDaniel (Tom)	Subject matter expert (SME), facilitator and project manager; Author PhD research	Lead Researcher
Veronika Macsai	Marketing Manager GROW Fairly Slovakia	Key participant
Frank Omondi (Frank)	CEO GROW Fairly Kenya	Local executive sponsor
Bonface Nganga (Boni)	COO GROW Fairly Kenya	Local supporting sponsor
Brenda Matete (Brenda)	Quality Manager GROW Fairly Kenya	Key participant
Elisha Abok (Abok)	Logistics Manager GROW Fairly Kenya	Key participant
Caroline Kiptoo (Caro)	Sales and Marketing Manager GROW Fairly Kenya	Key participant
Vinn Kola (Vinn)	Purchasing Manager GROW Fairly Kenya	Key participant
Henry Ochieng	Project Manager GROW Fairly Kenya	Key participant

6.4 Cyclical Process: Overview of Initiation, Stakeholders, and Strategic Focus

The TBL supply chain project for GROW Fairly Kenya was initiated as part of a research collaboration between the author and Integra Foundation, aiming to improve the supply chain with financial, social, and environmental sustainability. The project's scope evolved through strategic meetings involving key stakeholders, ultimately aligning on a practical, implementable action plan. Below in Table 10 is a summary of the main events, discussions, and focus areas.

Table 10: Timeline and Key Steps for Initiating the Project

Event/Topic	Summary
Initial Proposal (June 8, 2022)	Concept of supply chains in vulnerable geographies proposed for PhD research; Integra Foundation identified as partner.
Preliminary Meeting (June 16, 2022)	Discussion with Allan Bussard about a 3-6 month project, author's involvement, and GROW as the focus.
GROW Background	Organization at a crossroads after restructuring; renewed focus on local value creation, balancing social and commercial goals.
Challenges Identified	Balancing grant funding with commercial incentives; procurement aimed at supporting local farmers versus economic competitiveness.
Stakeholder Meeting	Introduction of key figures: Allan (Executive Sponsor), Ali (Primary Sponsor), Veronika (Marketing), author (lead/facilitator).
Project Initiation & Kick-off (July 1, 2022)	Focus on optimizing manufacturing processes, timing ideal due to recent restructuring and new product launches.
Critical Organizational Issues identified	Procurement timing, production planning for three main products, and need for standardized operating procedures (SOPs).
Follow-up Meeting #1 (July 14, 2024)	Charter review, local CEO and team buy-in, discussion on organizational structure and long-term value retention in Kenya.
Strategic Discussions	Debate over profit allocation, focus on value-added activities staying in Kenya, and alignment with Fair Trade principles.
Project Charter & Scope	Analyze and improve the supply chain for financial, social, and environmental benefits; emphasize practical, real-world implementation.

6.5 Planning the Work

One of the project's initial challenges was agreeing on an agenda with all participants. The team, along with key stakeholders Ali and Allan, intentionally adopted a flexible approach, allowing open and in-depth discussions during the first site visit. This flexibility brought both opportunities and difficulties, notably in deciding whether to prioritize strategic, tactical, or operational issues.

Operational focus promised quick wins through improvements on the shop floor, but without strategic alignment, lasting implementation was unlikely. This dilemma is characteristic of "scope creep"—the expansion of a project's scope beyond initial agreements (Komal et al., 2020; Teye Amoatey et al., 2017). Managing scope creep is essential in project management structures (Adam & Danaparamita, 2016).

As expected, the original plan evolved, delivering both positive and negative consequences, but also valuable lessons. The project's structure and AR (Action Research) methodology incorporated enough flexibility to adapt. As Heron & Reason (2006) note, AR is conducted "with people not on people," and cooperative enquiry

means these projects often wrestle with confusion and ambiguity. Most AR projects diverge from their original scope and involve uncertainty (Riley & Reason, 2015). As evident in Figure 10, the original agenda was revised both prior and during the visit. The impact and lessons learned are discussed in the next section.

		Tue - 6 Sept	Wed - 7 Sept	Thur – 8 Sept	Fri – 9 sept
Morning	8:00 to 9:30		Interviews	VSM workshop	Concept mapping workshop
Break	9:30 to 10:00				
Late Morning	10:00 to 11:30	Kick-off			
Lunch	11:30 to 12:30				
After Lunch	12:30 to 14:00	Exercise			Final Debrief
Break	14:00 to 14:30				
Afternoon	14:30 to 17:00	Factory tour			

(a)

Activity	Timing	Tue - 6 Sept	Wed - 7 Sept	Thur – 8 Sept	Fri – 9 Sept
Morning	8:00 to 9:30	Arrival	Exercise	VSM workshop	Concept mapping workshop (?)
Break	9:30 to 10:00		Kick-off		
Late Morning	10:00 to 11:30		Factory tour		
Lunch	11:30 to 12:30				
After Lunch	12:30 to 14:00		Interviews		Final Debrief
Break	14:00 to 14:30				
Afternoon	14:30 to 17:00		Interviews		
			Debrief		

(b)

Figure 10: Agenda for Site Visit 1 – Preliminary (a) and Revised (b)

6.6 Field work in Kenya: Initial Site Visit

The TBL supply chain project in Kenya began with goals extending beyond process optimization, emphasizing communication, trust, and a shared vision. Initially, the project focused on operational improvements, especially for the new facility, but quickly evolved to include product and funding strategies. The previous business model centered on macadamia nuts, while new products like cashews and dried fruit required adjustments across growing, sourcing, production, and business economics.

A new strategy prioritized immediate addition of cashews, supported by NGO funding and capital investments. These investments, ongoing or under evaluation, significantly impacted strategy, product portfolio, and costs. Stakeholders debated priorities and investment impacts, with alignment to GROW's values being essential. Lessons learned during the project's evolution shaped its strategic and financial direction, as reflected in real-time changes to the agenda (see Figure 10). The flexible approach enabled a strategic workshop, addressing stakeholder needs but limiting operational focus. During the first site visit, the team addressed supply chain improvements, new product integration, capital investments, and alignment to core values. Rapid facility construction and evolving plans highlighted strengths and challenges in communication and organization.

Day 1 and Overview of Visit

Figure 11 and Tables 11and 12 describe the key outcomes of the all activities and describe the processes and observations from the factory floor.

Table 11: Kenya On-Site Visit Day 1

Activity	Observations	Questions & Concerns	Outcomes and Next Steps
Project Initiation & Strategy Alignment	Approach shifted from operational to a more strategic focus; stakeholder priorities varied	Alignment of investment priorities; impact of new products, investments	Reviewed and realigned project direction; focused on strategic and financial planning
On-site Management Meeting	Local leadership is open to improvement but cautious about rapid change	Concerns about communication, organization, and resources	Set expectations, adjusted agenda, recognized need for better HQ-local alignment
Facilities Review	Macadamia line reviewed; cashew production not yet operational; clean facilities	Traceability, quality control, and timing of new production launch	Identified operational strengths and improvement opportunities
Receiving	Raw nuts arrive in various forms; potential for contamination	Ensuring traceability and consistent quality, proper handling	Stressed the importance of segregation and tracking suppliers
Sorting, Cleaning & Drying	Manual process: drying capacity and control are bottlenecks	Level of automation; need for conveyors and additional dryers	Discussed investment in equipment and infrastructure upgrades
Energy & Utilities	Frequent outages impact product quality; old pumps and the boiler	Short-term costs of upgrades; alignment with sustainability goals	Evaluated solar panels and circular boiler projects for long-term savings
Shop Floor Operations	Clean environment; challenges meeting global organic standards	Suitability for large international customers; sustainability strategy	Re-assess export strategy alignment with organizational mission
Packaging & Warehousing	Adopted new packaging standards; risk of obsolete inventory	Execution of new packaging; storage and shipment delays	Need for more transparent processes; importance of packaging as a brand driver
Strategic Workshop (Day 2, Part A)	In-depth alignment between local and global management	Governance, finance structure, role clarity, resistance to change	Generated strategic action plan; documented management perspectives
Functional Workshop (Day 2, Part B)	Mapped value streams: information, physical, financial flows	Empowerment of functional leads; prioritization of quick wins	Identified improvement opportunities across departments
Debrief Sessions & Validation	Workshops and one-on-ones validated findings and priorities	Functional team empowerment; effective opportunity prioritization	Prepared for final visit; set up next steps for action planning and accountability

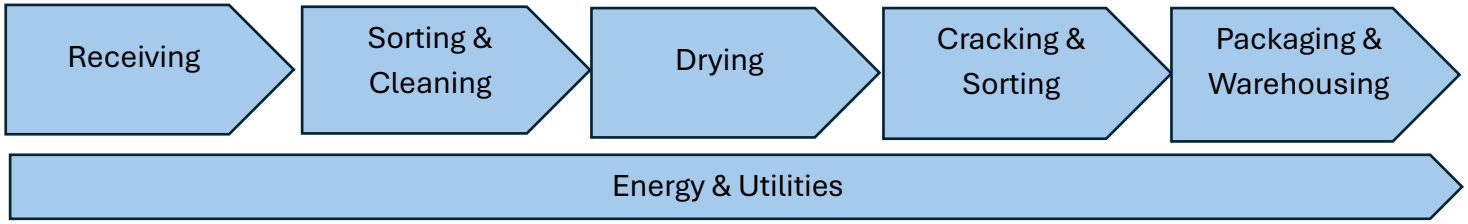

Figure 11: GROW Kenya Value Chain

Table 12: GROW Kenya Supply Chain Activities

Receiving	Sorting & Cleaning	Drying	Cracking & Sorting	Packaging & Warehousing
Raw nuts are delivered by farmers in bags or barrels, and quality issues may arise unless batches are kept separate and traceable.	Sorting and both dry and wet cleaning are completed manually with racks and buckets before materials enter the factory.	Drying is crucial, with capacity and temperature control directly affecting bottlenecks and product flow.	Shop floor operations did not commence on the first day. The machinery and overall condition of the floor were observed to be exceptionally clean.	Packaging should maintain product quality and freshness during storage and transport, using methods like vacuum-sealing, nitrogen-flushed foil pouches, and cardboard cartons for extended shelf life. It must also include traceability information.
Energy & Utilities				
Upgrading facilities helps reduce risks in daily operations. Frequent energy outages and equipment breakdowns lead to product spoilage and lower quality, especially during drying. Water boiler and pump failures cause similar problems, as reliable heat and hot water are crucial. Current pumps and the boiler lack adequate capacity and power and are outdated.				

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Day 1: Conclusions from Factory Visit, Debrief, and Summary of Project Objectives

The management and facilities were in acceptable to good condition, and provided a strong foundation for future development, especially for a small, socially focused enterprise. The speed, flexibility, and innovative approach to constructing the facilities was observed as an organizational strength. However, numerous opportunities for improvement were visible.

After the facilities review, a summary of expected outcomes was created, which were partially confirmed and partially revised, together with key stakeholders, to include the strategic elements mentioned earlier. The overriding objectives were agreed as developing a "picture" of the business, both in its current and future state, including developing a set of lessons learned. Creating a prioritized set of potential actions into a three-year roadmap, as well as the top three actions that could be undertaken during the project timeframe (e.g., the next 3 months), could generate a precise and predictable impact on the business.

Day 2 Part A: Top Management Off-Site Initial Workshop

A notable development was a closed session with top management—comprising the project manager/consultant, executive sponsor (Allan), primary sponsor (Ali), and local CEO (Frank) and COO (Boni). This session was prompted by both the absence of functional managers and the need for better alignment between the Kenyan and European organizations. While initially perceived as resistance by local management, it was accepted as necessary for strategic development. The meeting, similar to the Hawthorne effect, encouraged proactive management and improved communication simply through focused observation rather than any specific action (Diaper 1990). The group brainstormed and documented an initial set of key topics as follows:

- CFO and finance function agenda
- Tax and company holding structure
- Governance and shareholder agreement
- Marketing & Branding
- New Products / R&D
- Local Organizational Structure
- Communication Structure
- Culture / Vision / Mission
- Team Leadership

A standard flip chart was used to capture ideas and preliminary actions for each area, as shown in Figure 12. Although the workshop was not originally planned or part of the project scope, it became necessary for alignment between GROW Kenya and GROW Slovakia management.

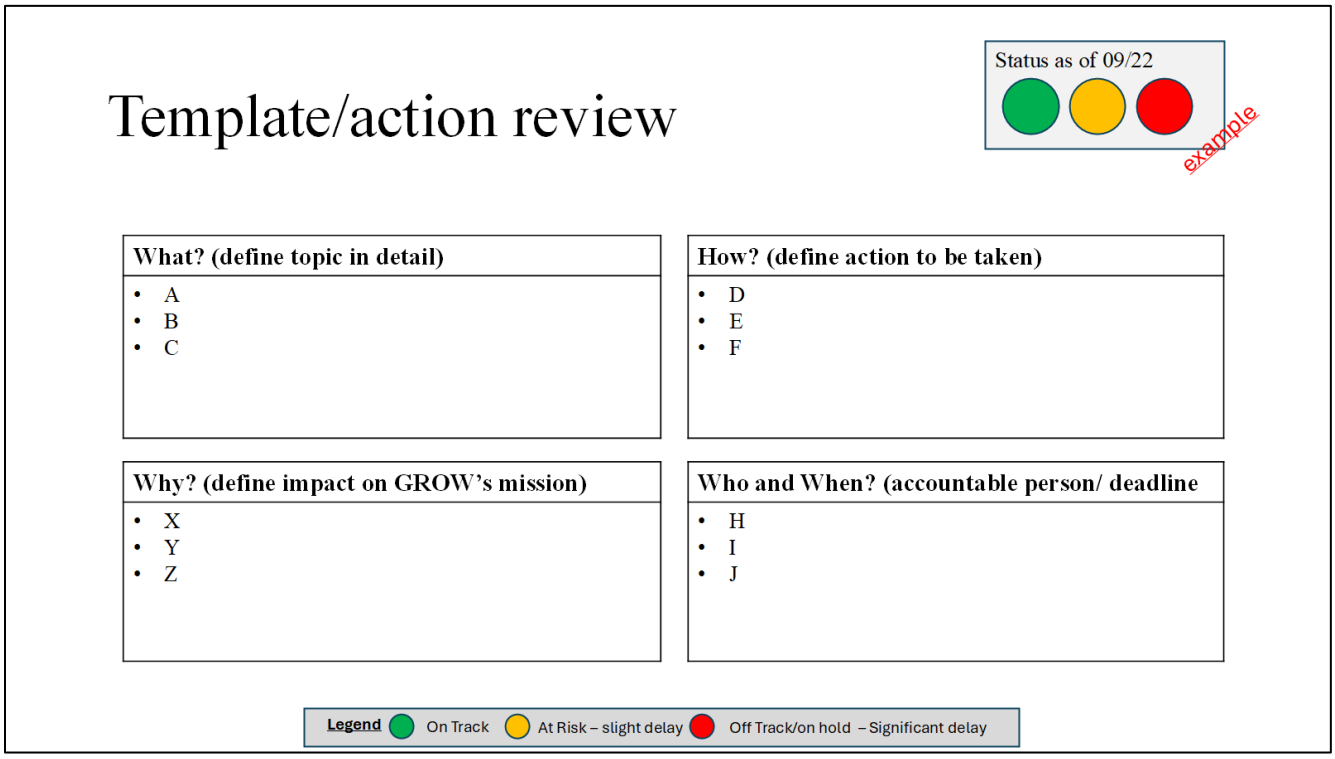

Figure 12: Template Developed during the Strategic Action Planning Workshop

Three distinct perspectives shaped the session: GROW Kenya management emphasized autonomy, flexibility, and access to capital for investment and development; GROW Slovakia (Allan, Ali) focused on incentives, trust, organizational control, transparency, and strategic influence; the facilitator (author), with no financial stake, contributed experience and best practices, aiming for objectivity but influenced by prior experience (Diaper 1990). Key insights for each Strategic Management topic are drawn from the author's notes and summarized in Table 13 below and in detail in Appendix I.

Table 13: Strategic Management Topics and Initial Insights

Strategic Management Topic	Initial Insights & Observations
CFO and Finance Function Agenda	Transparency, cash flow management, and investment prioritization were identified as core needs.
Tax and Company Holding Structure	Creating a transparent, efficient, and ethically optimized structure was critical given the global spread of operations, capital, and markets.
Governance and Shareholder Agreement	Enforced and transparent processes were emphasized for group alignment and incentives.
Marketing & Branding	Alignment between local and global teams and gaining buy-in for new approaches were highlighted as essential.
New Products / R&D	Shifting to a commercial R&D mindset and hiring expertise for innovation and financial sustainability emerged as priorities.
Local Organizational Structure	Balancing local autonomy with global alignment, given talent constraints and market complexity, was seen as a challenge and opportunity.
Communication Structure	The need for clear, consistent, and transparent communication across all levels and locations was strongly emphasized.
Culture / Vision / Mission	Defining and uniting around a common culture, vision, and mission were recognized as ongoing challenges, vital for long-term success.
Team Leadership	The focus shifted towards building a fair and equitable workforce rather than solely on leadership style.

Based on the discussion during the initial workshop a preliminary action plan was developed after the initial field visit and presented in Figure 13 below:

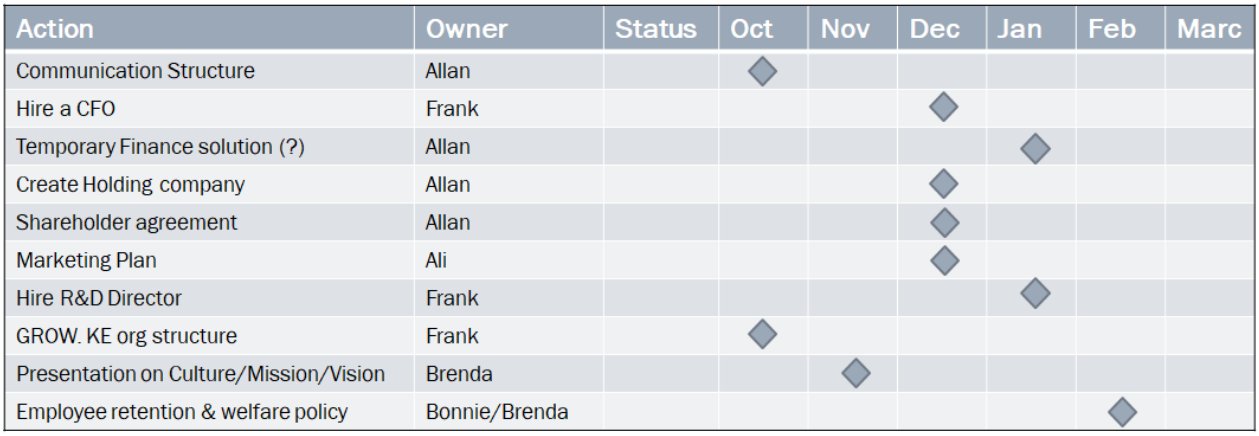

Figure 13: Preliminary Action Plan Developed during the First Site Visit

Day 2 Activities Off-Site Part B: Functional Management Workshop

The second half of the day was a workshop with the key functional managers (Brenda, Vinn, Abok, and Caro), together with key stakeholders (Frank, Boni, Allan and Ali). The workshop focused on VSM methodology to capture three key flows key data including:

- Information flows - from customers into the company and back to the suppliers, including the farmers.
- Physical and material flows – from suppliers including farmers, into and through the factory including the individual processing steps, quality testing and storage.
- Financial flows –timing and volume of sales orders, purchase of raw materials and the impact of payables and receivables on the cash flow during the fiscal year.

Below in Figures 14, 15 and 16 are the detailed maps from the workshop: the original flip cart version (14); the validated version in PPT format (15); and the summary version presented using a VCA analytical approach (16). This approach was used to show the functional aspects of GROW maps to the information and material flow from a VSM perspective. The detailed descriptions are listed in Appendix III. A summary of the key opportunities that tend to cluster along functional lines is described below in Table 14.

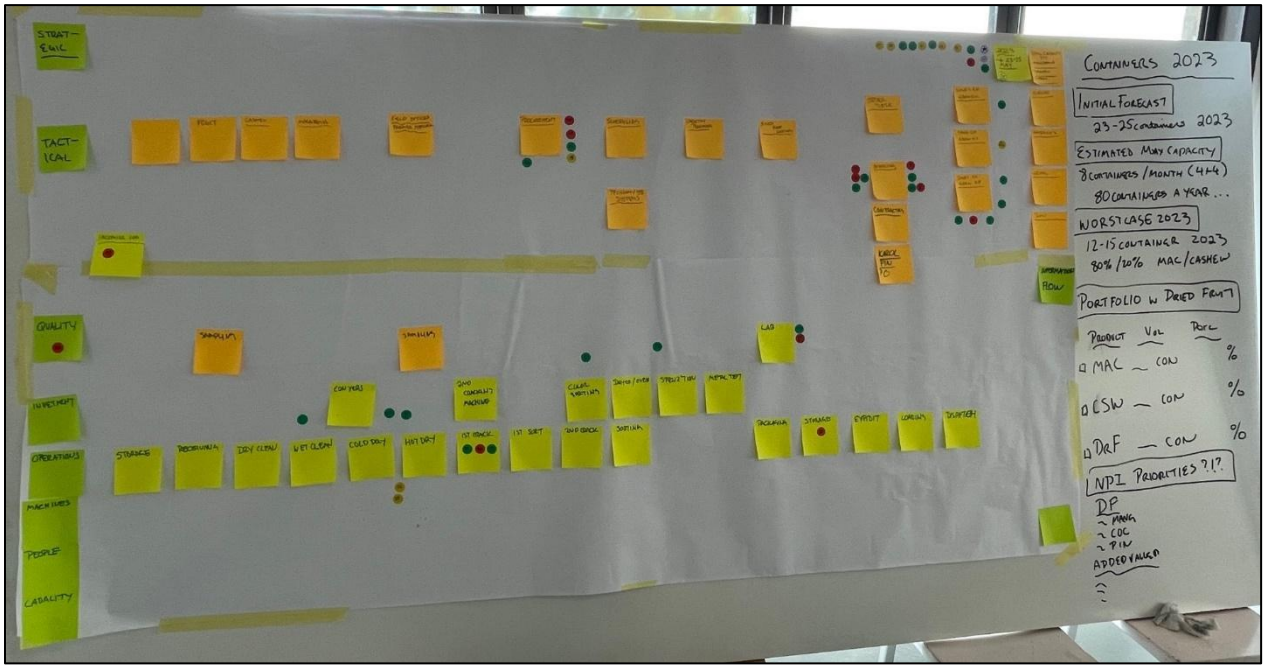

Figure 14: Initial Value Stream Map as Created During The Workshop

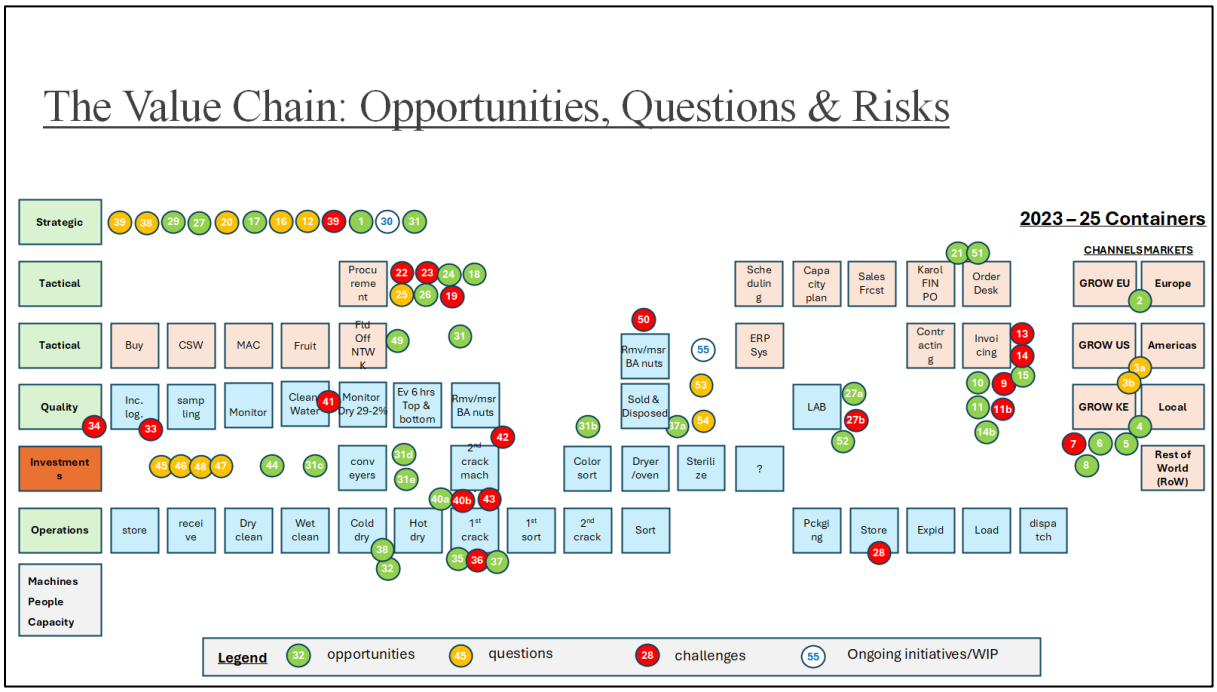

Figure 15: Initial Value Stream Map Recreated in PowerPoint

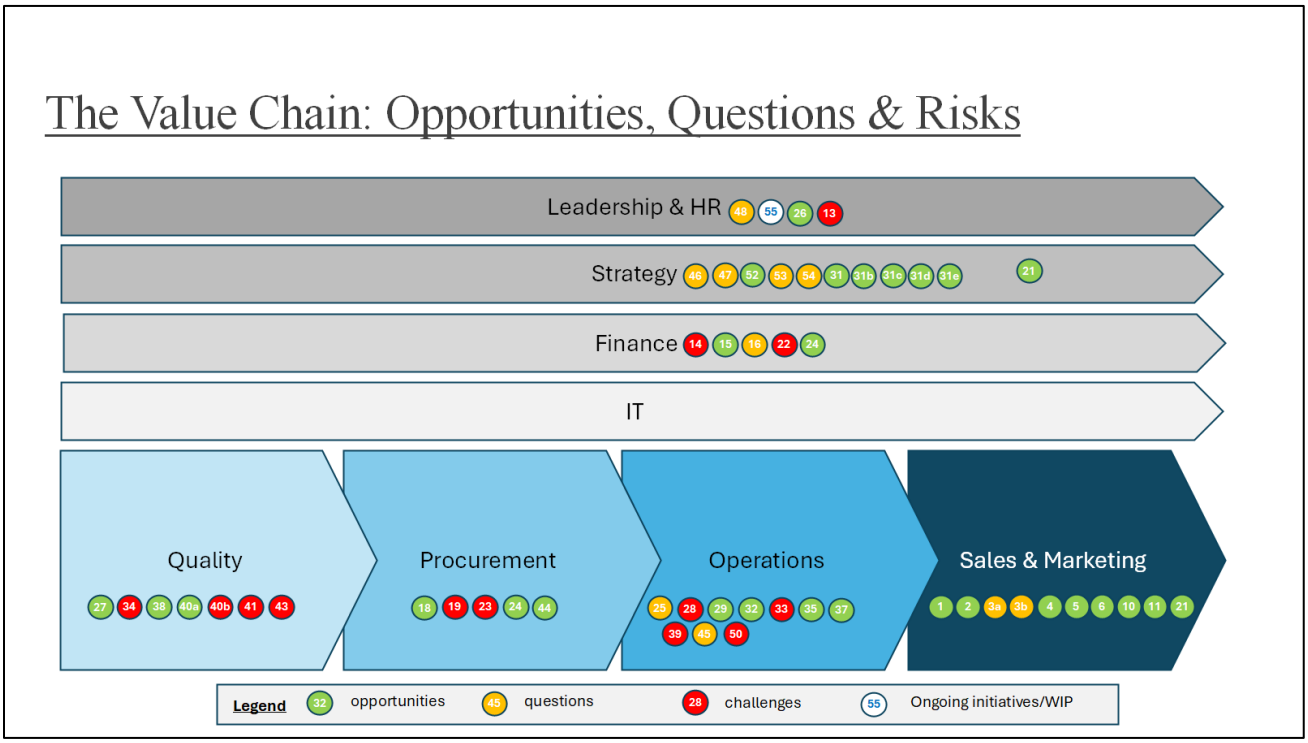

Figure 16: Initial Value Stream Map Summarized in a VCA format

Table 14: Key Opportunities by Function: Initial Conclusions

Function	Initial Conclusions
Leadership	The need for improved alignment between local and headquarters teams was critical.
Finance	Cash flow, the absence of a CFO, and manual financial processes were significant risks.
Sales & Marketing	Portfolio development and customer service improvements presented quick-win opportunities.
Operations	Maximizing capacity and addressing process bottlenecks, especially in cracking, were prioritized.
HR	On-the-job training initiatives could rapidly enhance productivity, but talent shortages posed challenges.
Procurement	Improving supplier relationships and optimizing purchasing for quality and yield were highlighted.
Quality	Investing in both equipment and people was seen as essential to driving consistent quality improvements.

Day 3 Activities On-Site: Debrief with All Stakeholders

On Day 3, the project team—including the author, Ali, and Allan—met to review progress. Everyone agreed that, despite some resistance and lack of full alignment, the stakeholder discussions were productive and moved the project forward. The day focused on validating and clarifying opportunities and challenges identified in the earlier workshop. One-on-one debriefs with functional staff allowed for open discussion, confirming that the main issues had been accurately captured and that setting clear priorities was necessary. A final debrief with both local and HQ leaders highlighted that the structured, collaborative approach was new and valuable. The main task for the next visit would be to prioritize initiatives and establish clear accountability among functional leaders.

Conclusion: Outcomes and Next Steps

The project's adaptive approach brought together diverse perspectives, surfaced critical operational and strategic challenges, and generated a clear roadmap for future action. The alignment between global and local stakeholders, the focus on communication, and the prioritization of both quick wins and long-term investments laid a solid foundation for growth, innovation, and sustainability. Going forward, the emphasis will remain on maintaining open dialogue, fostering accountability, and ensuring that the lessons learned translate into tangible business improvements for all involved.

6.7 Interim Stakeholders Debrief Sessions and Workshops

The interim period between site visits was approximately 5 weeks with 4 meeting held roughly every 1.5 to 2.5 weeks apart. This is summarized below in Table 15. The project leader and key stakeholders agreed an agenda and keys tasks as follows:

- Document and validate the Strategic Management plan
- Document and validate the detailed Value Stream Map (VSM)
- Develop a preliminary prioritization of the specific opportunities from the VSM
- Organize the agenda for the next trip and debrief the Kenya team

A key goal was to synthesize and validate supply chain strategic drivers and operational quick wins. Key questions for each opportunity included:

- Responsible function and individual
- Quick win status
- Strategic impact
- Effort required
- Revenue potential

In terms of organizational resistance and a missed conference call with Boni and Frank was seen as resistance, aligning with sponsor expectations. The decision was to not challenge this resistance and allow the course of activities to flow according to the local organization's needs. It was felt that this was consistent with change management literature which suggests listening to local stakeholders for effective implementation (Sahay 2023).

Table 15: Interim Stakeholder Communication, Analysis and Planning

Debrief #	Date	Main Focus	Key Conclusions/Actions	Individuals involved	Additional Notes
1	Monday, September 26th, 2022	Validation of Strategic plan	Major impact was engagement and communication; list of strategic topics validated; topics "Governance and shareholder agreement" and "Marketing & Branding" need more discussion	Tom, Ali, Veronika, Allan	Improved trust and collaboration
2	Thursday, October 6th, 2022	Validation of detailed VSM	CEO Frank is very dominant; COO Boni not always open; questions on empowerment of management team; focus on supply chain strategic drivers for quick wins		Questions: function/individual responsible, quick win, strategic impact, effort, revenue
3	Thursday, October 24th, 2022	Prioritization of opportunities	More consolidated opportunity list: local team must make final prioritization; having own view helps with coaching		How to validate?
4	Thursday, November 3rd, 2022	Organize agenda and debrief Kenya team	Draft agenda for final site visit; organize debrief with Kenya team; logistics for prioritization workshop; plan for conference call with Boni and Frank did not happen; sign of resistance		Listening to local stakeholders more effective (Sahay 2023)

Activity	Timing	Sun – 13 Nov	Mon 14 Nov	Tues-15 Nov	Wed – 16 Nov
Transport	8:00 to 9:00	Arrival	Governance & Strategy		
Morning	9:00 to 10:30	Travel to hotel Evening meeting optional	Strategy Action Plan: Presentation & Workshop	Value Stream and impact on 2023-24 shipments	Quick Win Deep Dive Priority #2:
Late Morning	10:30 to 12:00				
Lunch	12:00 to 13:00				
After Lunch	13:00 to 14:30		Presentation GROW Mission (Brenda)	Prioritize Improvements	Quick Win Deep Dive Priority #3:
Break	14:30 to15:00				
Afternoon	15:00 to 16:30		Governance & Strategic Execution	Quick win Deep Dive Priority #1	Wrap-up & next steps

Figure 17: Agenda for the Second Site Visit to Kenya

6.8 Field Work in Kenya – Second and Final Site Visit

Four main activities took place on the final site visit:

- Session 1 was a follow-up to the strategic plan
- Session 2 was a presentation developed and delivered by the HR & Quality leader, Brenda, regarding the "leadership & welfare programs"
- Session 3 was the prioritization workshop and detailed action planning
- Session 4 was the overall debrief

Strategic Follow-Up Meeting

The follow up to the strategic develop plan was attended by the author, who acted as project lead and facilitator, the project sponsors, Ali and Allan, and the Kenya leadership team, Frank and Boni. The agenda was to review and finalize the previously developed plan. This was relatively smooth and resulted in productive discussion and agreed activities and timelines.

The other main agenda point was a review of a cash flow model developed by the team, in the absence of a CFO. This was an excellent exercise as it immediately informed the management team and all stakeholders about the key priorities.

The observation and general feeling were very positive and one of surprise by the project sponsors and head office leadership team. The feeling was that the level of alignment between the two teams was higher, and the overall resistance was significantly lower, which was unexpected but well-received, and a validation of the overall success of the project.

Leadership and Welfare Presentation

This presentation, led by HR and Quality Manager Brenda, was viewed as extremely important due to its significant impact on the overall mission and values of GROW. A constant challenge was investing time and resources into the social aspects of the company. Due to financial pressures, these activities were often deprioritized, leading to demotivation among the people who led the initiatives. This presentation was seen as enabling empowerment, motivation, and agreement to act. Everyone was satisfied with the outcome, including the head office management team and project sponsors. It was considered a “coaching win” whereby the presence of the project, in and of itself, elevated the individuals and the teams to carry out specific actions which may have been otherwise forgotten about or severely delayed.

Prioritization Workshop and Detailed Action Planning

To prioritize the action plan, a voting exercise was conducted with the key stakeholders responsible. To execute this, we distributed handouts of all the accumulated ideas, which had already been reviewed, cleaned, consolidated, clarified and validated, and sorted by function. Five functional stakeholders were given handouts of all the ideas and a set of stickers with assigned points which they could use to vote and assign value to the ideas. Participants were given 45 minutes to assign values working individually and these scores were consolidated, reviewed and finalized.

After the finalization of the voting, we created an action plan template and assigned the agreed priorities to different cross functional teams. The prioritizations and action planning template are presented in Figure 18 and Table 16 below.

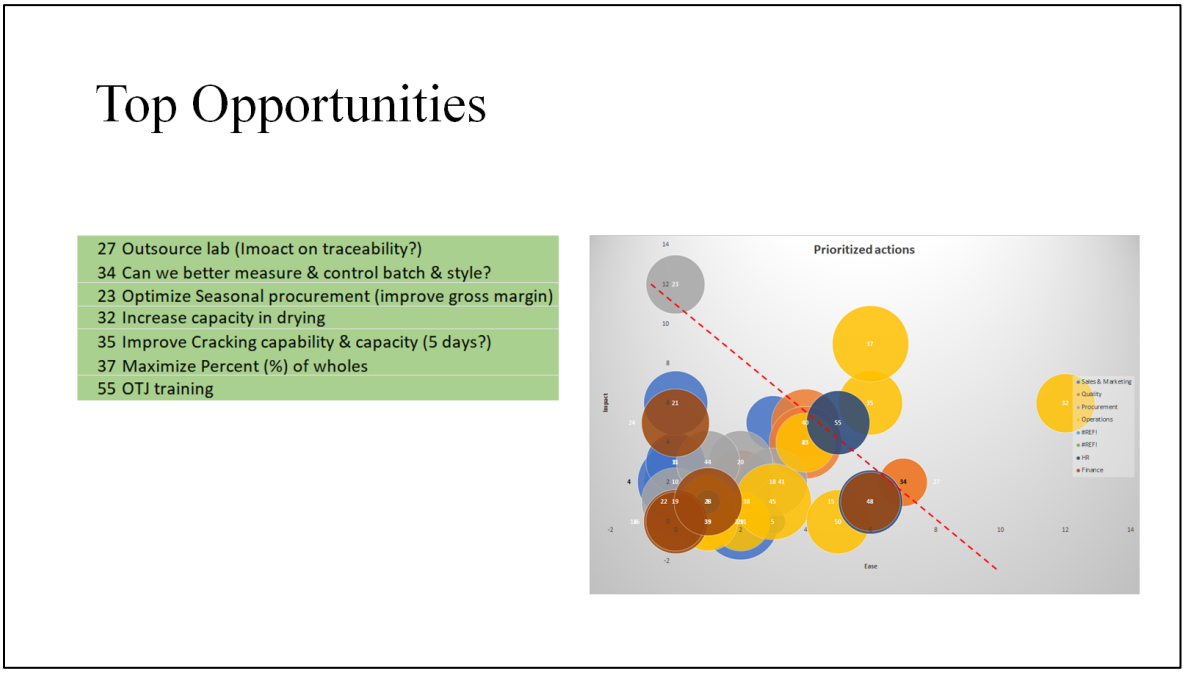

Figure 18: Summarized Result of the Prioritization Workshop and Exercise

Scoring was done for each of the initiatives on two dimensions – "impact" and "ease of implementation". Impact was defined as "to what degree the initiative could improve the business from a strategic point of view in terms of any of the three TBL dimensions – people, planet or profit". Ease of implementation was defined as "the combination of time and human resource effort required to implement an initiative". The more points meant higher impact and higher ease of implementation. There was no specific numerical scale assigned, rather the absolute points for each dimension were added up to determine a relative score. The points available for each participant which allowed them to vote on specific initiatives are described in Table 16 below. Participants were encouraged to assign the stickers/dots in whichever way they wished, e.g., they could put all stickers on one opportunity or spread them across the 55 opportunities.

Table 16: Legend and Description of Stickers for Ranking Exercise

Sticker Color	Point Value	Dimension	Stickers Provided	Points per Color
Green	2	Impact	6	12
Blue	1	Impact	6	6
Red	2	EoI	6	12
yellow	1	EoI	6	6

After the voting and scoring the results were presented to the wider group which included the 5 functional participants (who placed the votes) plus the 4 executive stakeholders, Alan, Ali, Frank, and Bonnie. The priorities were discussed in detail, clarified and assigned to owners. The result was 6 initiatives which corresponded closely to the original voting which are described in Figure 19 below. To fully account for the consensus view some initiatives were consolidated and one was added.

To come up with a detailed plan each of the agreed teams were asked to document a project charter (Figure 20) and plan (Figure 21) based on a provided template. The project charter and planning templates were explained and distributed with the teams given 60 to 90 minutes to make a draft during which time the facilitator was able to walk around and provide coaching and answer questions. At the conclusion the exercise was completed, with an agreement to complete and activate in January.

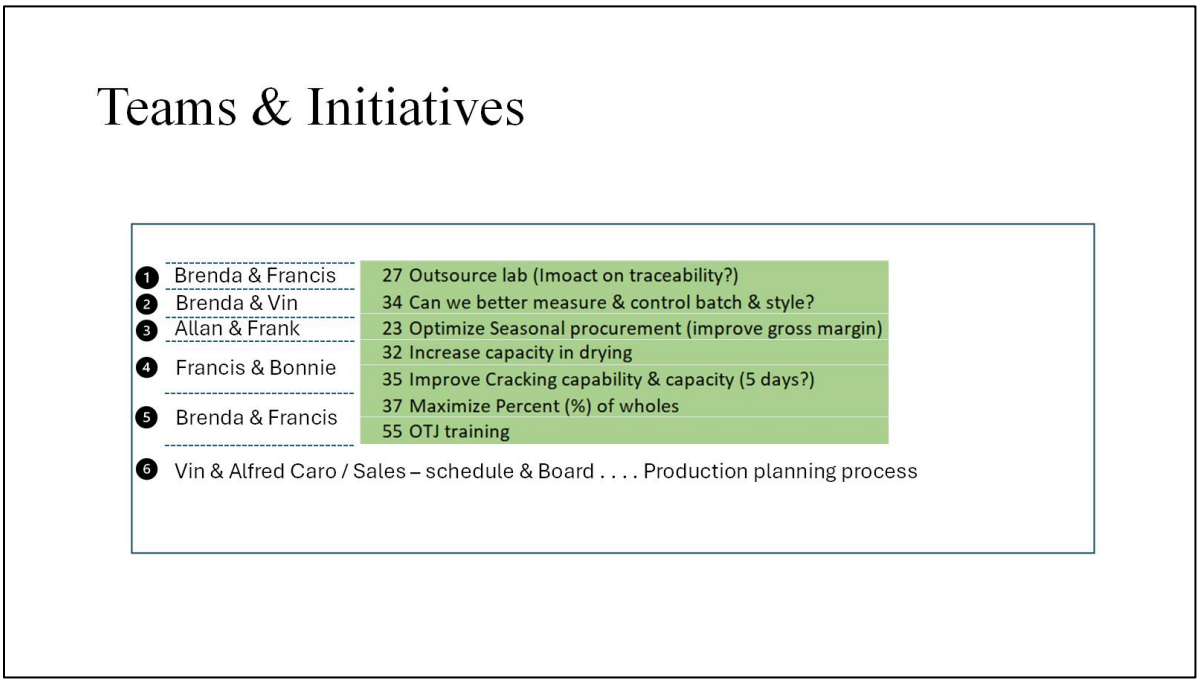

Figure 19: Preliminary Agreed Action Plan Based on Prioritization and Validation

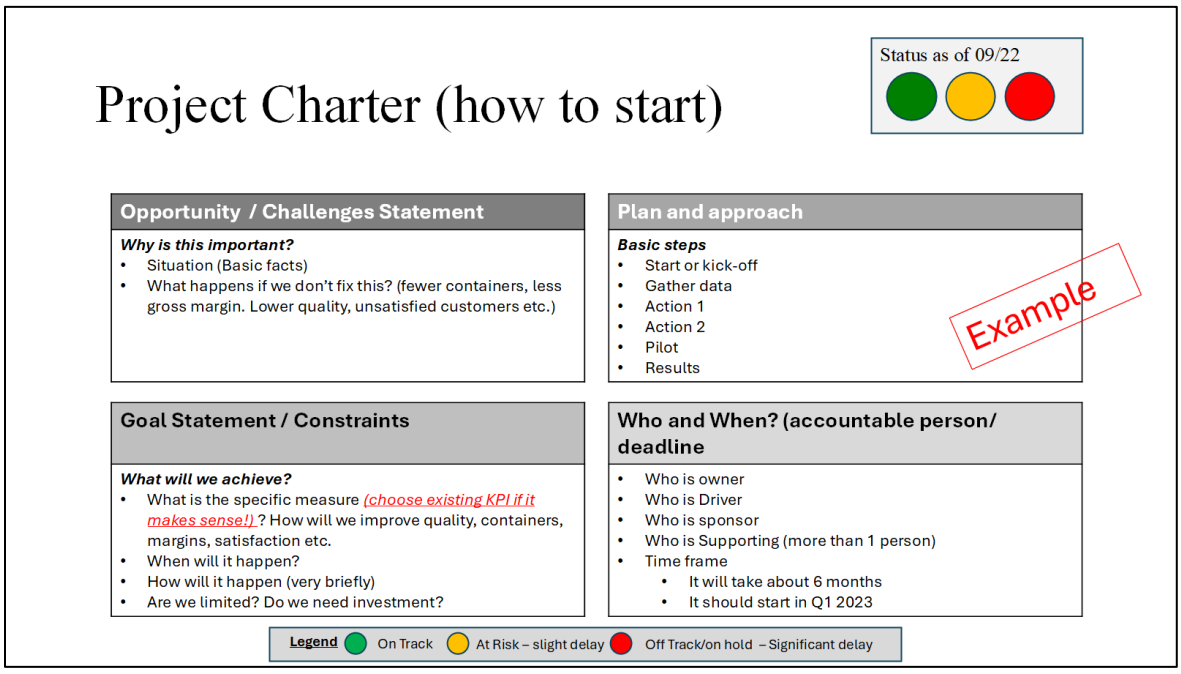

Figure 20: Project Planning and Chartering Template

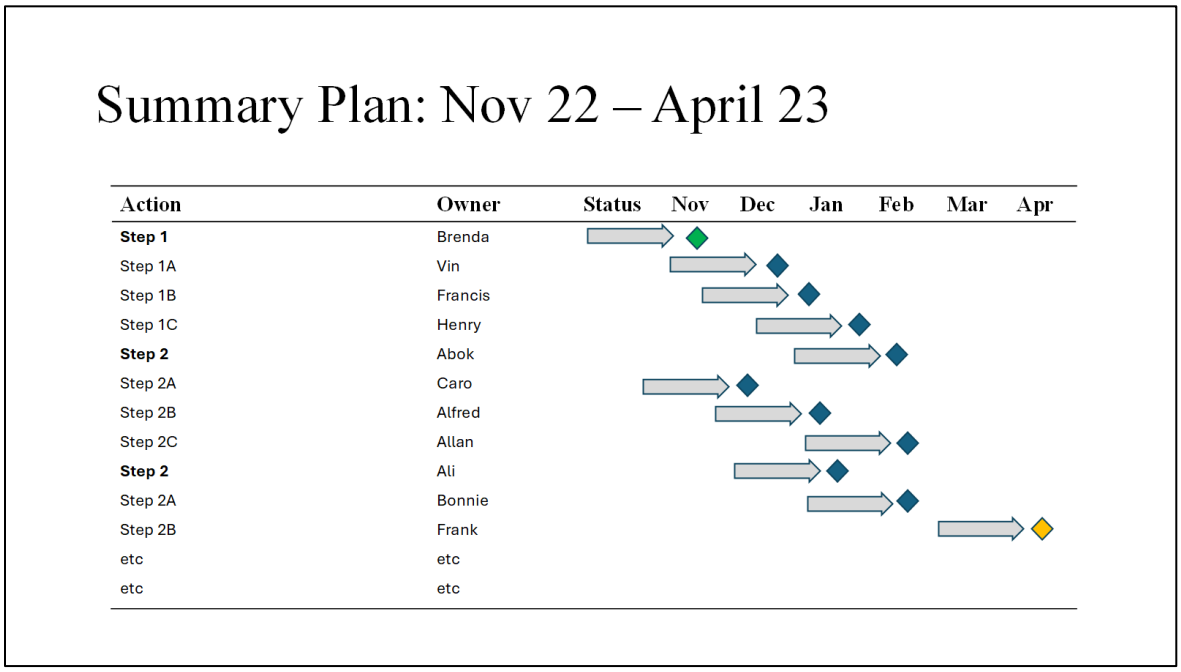

Figure 21: Overall Program Timeline for TBL Implementation

6.9 Concept mapping, the prioritization matrix and explanatory aspects of the case study

Figure 22 shown below displays the key implementation actions for implementing a TBL supply chain for the GROW AR study. This is similar in structure to the prioritization matrix from the GCM exercise (Figure 5 presented in section 4.4). Both the TBL implementation actions and the priority matrix show how the concepts and the actions are ranked in terms of both ease of implementation and impact. In this way we can both qualitatively analyze how the TBL implementation actions fit within the GCM concepts as well as how the prioritization of the grow research team fits with the prioritization matrix from the quantitative GCM.

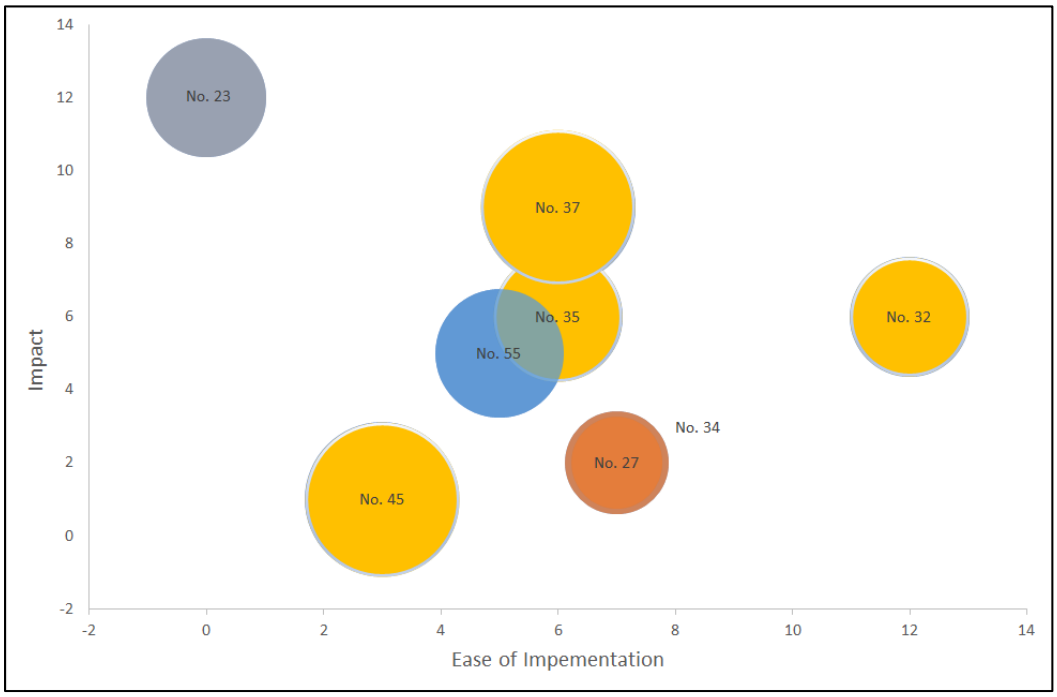

Figure 22: Prioritized Action Plan for Implementing a TBL Supply Chain

Table 17: Top Priority Actions

No.	Name	Description	Function
27	Outsource lab	Outsourcing lab will improve quality and free resources but may impact traceability	Quality
34	Measure & control batch & style	Influence quantities and quality of various production parameters to improve effectiveness and efficiency	Quality
23	Optimize seasonal procurement	Optimize across big seasonal variability (50-20%) to improve gross margin	Procurement
32	Increase capacity in drying	Improve from 70 MT (currently takes 5 days) to 140 MT in 3 to 4 days	Operations
35	Improve cracking capability & capacity	10 MT 2x daily - from 10 days to 5 days	Operations
37	Maximize percent (%) of wholes	How do we get more wholes (getting whole nuts has outsize impact; 3EUR = 15%)	Operations
45	Plan to achieve 16-17% SKR	biggest win of all - upstream influence!!! / grant money / mission relevance	Operations
55	OTJ training	how to do on the job training	HR

The following are the eight concepts developed in chapter 1, followed by an analysis of the GROW TBL implementation actions and how they fit to the GCM prioritization matrix, both conceptually from a qualitative lens, and quantitatively from the view of ease of implementation and impact ranking.

GCM Concept No. 1: Supply Chain Waste

Reducing waste and resource use throughout the supply chain emerged as a key operational focus. Efforts to optimize seasonal procurement, as outlined by Teoman (2020), revolved around achieving the "seven rights of logistics"—delivering the right product, in the right quantity and quality, to the right place, at the right time, for the right customer, and at the right cost. This practice was seen as vital for minimizing waste from overbuying or underbuying nuts, thereby directly impacting gross margins and overall supply chain efficiency. Therefore, the fit between The GCM concept and how it applies to GROW is very high. Yet, the complexity of this initiative was clear: it required the alignment of multiple stakeholders. It had to contend with unpredictable influences such as weather conditions and fluctuations in global markets.

Another important action addressing supply chain waste was focused on improving the cracking capability and capacity of the operation. By enhancing the cracking process, productivity could potentially be doubled, with yields increasing from 10 metric tons in 10 days to 10 metric tons in just 5 days. However, since cracking was just one link in a longer supply chain, its overall impact—while notable—remained more limited than that of procurement optimization.

When the concepts were ranked for their potential impact and ease of implementation, supply chain waste reduction stood out as the second most impactful among the eight concepts considered. Optimizing procurement was recognized as the most effective strategy, albeit the most challenging to implement. Improvements to the cracking process, meanwhile, occupied a middle ground in terms of both potential impact and practical feasibility.

GCM Concept No. 2: Information Technology

Information technology supports sustainable operations through strategies like outsourcing lab testing to advanced external providers—a classic make-versus-buy decision yielding economic gains. Seasonal procurement uses sensors and monitoring tech for real-time supplier data, enabling more intelligent decisions that benefit both economics and the environment.

The alignment between the GCM concept and GROW is strong overall. Outsourcing labs offers a quick, simple win but has limited conceptual fit and unclear impact. Conversely, tech-driven procurement aligns closely with

the ‘Information Technology’ principle and promises significant benefits, though it poses greater implementation challenges and demands extensive collaboration.

Concept No. 3: Product Waste

Focusing on the reduction of product waste, the organization set its sights on improving the shell to kernel ratio (SKR). By raising the SKR from just under 15% to a target range of 16–17%, they anticipated a substantial productivity boost—potentially increasing output by 20 to 30%. This improvement, delivering both economic and environmental benefits, has strong fit and impact but is not without its challenges. In fact, product waste initiatives were considered low in terms of ease of implementation, and efforts to enhance SKR were seen as particularly risky to prioritize given these constraints.

Concept No. 4: Culture

The organization recognized that shaping people’s mindset and fostering a strong organizational culture could be a powerful lever for supporting its sustainability initiatives. By emphasizing on-the-job training, they aimed to nurture employees’ values and well-being, which, in turn, would boost retention and align staff with broader strategic goals. Therefore, the fit between The GCM concept and how it applies to GROW is seen as very high.

Both the overall impact and ease of implementing culture-focused actions were considered high, making them attractive . On-the-job training was seen as an essential element that fit well within the company’s long-term vision, reinforcing the importance of a workforce aligned with its sustainability agenda.

Concept No. 5: Suppliers

Recognizing the pivotal role suppliers play in driving sustainability, the organization turned its attention to optimizing seasonal procurement. By actively managing relationships with suppliers and partnering closely with local farmers, GROW strengthened its alignment with sustainability goals and core values. This approach not only enhanced procurement efficiency but also ensured that the impact would resonate across all three pillars of the triple bottom line—economic, environmental, and social. Therefore, the fit between The GCM concept and how it applies to GROW is seen as very high.

A significant concern however was the incentive to maximize economic impact by negotiating hard with suppliers, consolidating large suppliers in favor of smaller local farmers, and this negatively impacting the social pillar of the TBL framework.

Concept No. 6: Circular Manufacturing

Circular manufacturing emerged as a limited focus for the organization’s sustainability efforts. The ambition was to create processes that not only minimized waste but also closed material loops, making use of by-products

wherever possible. One promising initiative involved repurposing nut shells as boiler fuel, turning what would be discarded into a valuable energy source. For these reasons, the fit between The GCM concept and how it applies to GROW is seen as very high.

To support these changes, the organization considered invested in on-the-job training for employees, equipping them with the skills needed to collect shells efficiently and contribute to the energy generation process. Investing into the equipment to use the shells as input was not prioritized, however. For this reason, its impact was seen as limited as it was neither a high priority action or one that was core to the strategic model or direction of the enterprise.

Concept No. 7: KPIs

Key performance indicators, or KPIs, became an essential tool for advancing sustainability within the organization. By systematically measuring and controlling production parameters—such as batch quality and style—leaders were able to boost both operational efficiency and eco-efficiency. Though the overall impact of KPIs was considered lower compared to other strategies it was nevertheless high overall, and its ease of implementation made it an attractive ‘quick win.’ Ultimately, KPIs play a vital role in laying the groundwork for a more sustainable supply chain.

Concept No. 8: Design

When it came to advancing sustainability through design, the organization saw a clear opportunity to rethink products, technology, and supply chain processes. One standout initiative involved boosting drying capacity: the aim was to elevate output from 70 to 140 metric tons within just three to four days—a leap from 14 to 45 metric tons per day, representing a remarkable 300% increase. This drive for greater efficiency offered significant economic and environmental advantages but came with its own set of challenges. Design improvements, while ranking among the highest in terms of potential impact, were also recognized as some of the most complex and demanding to implement. Nonetheless, the ambition to expand drying capacity exemplified the organization's commitment to high-impact change, even when the path forward required navigating considerable technical complexities.

Table 18: Summary of GCM Concept Fit to GROW Action Plans

No.	Concept Name	Fit based on Concept definition	Relevance based on Impact	Ease of Implementation	Main Challenges	Key Points/Examples
1	Supply Chain Waste	High: strong focus on Lean and SCM best practice prioritizes eliminating waste	High: core aspect of supply chain model	Medium	Coordinating with many stakeholders	External variables like weather and markets, complexity in procurement optimization
2	Information Technology	High: a key requirement in eliminating waste	Mixed: Lab (low) vs. Procurement optimization (high)	Medium	Lack of infrastructure and technology access	Alignment of technology with local needs
3	Product Waste	High: strong focus on waste reduction in growing, buying, processing and storage	High: core aspect of the supply chain model	Low	Difficult to implement	Uncertain impact, risk in prioritizing the action.
4	Culture	High: Influencing people's mindset and organizational culture is core to the mission	High: core aspect of the supply chain model	High (2nd highest)	Translating training and values into measurable outcomes	Maintaining employee engagement and retention
5	Suppliers	High: Social and environmental impact by focusing on supplier (farmers) relationships and collaboration	Mixed: managing farmers for economic benefit can have a negative impact	Variable	Balancing economic, social, and environmental goals	Managing relationships and fair practices
6	Circular Manufactur-ing	High: using product waste (shells) as input for energy generation	Low: was not a prioritized action	Average	Requires capital investment, staff training, and system integration	Indirect fit with some actions
7	KPIs	High: Deploying performance management and measurement systems is key to all TBL pillars	High: core aspect of waste elimination	High (2nd highest)	May not be a differentiator	Focuses on efficiency and short-term wins rather than transformational change
8	Design	High: Improving sustainability through the design of products, new technology, or supply chains	Mixed: prioritized actions (capacity), low social and environmental impact	Low (last ranked)	Complexity and interdependencies in design	High resource requirements; timing and readiness for implementation

Comparing the GCM Concepts to Real-Time Action Plans for GROW

Comparing the GCM prioritization matrix with GROW's TBL supply chain actions reveals a generally strong conceptual alignment, although the relative impact, as evidenced by the prioritization rankings, is only sometimes consistent. Qualitative details often support the GCM exercise's prioritization, but contextual differences in GROW Kenya make some links less clear. Still, many examples affirm the initial GCM findings.

6.10 Project Closing and Future Directions for The GROW AR Case Study

The following is a summary of the key outcomes and conclusions of the AR research study from both a practical and scientific research point of view. These final steps also represent the closing of the project according to the project management protocol.

Expected Outcomes

The following were the practical expected outcomes of the GROW case study:

- Capture a Vision of the Business – including both the "Current-" and "Future-State"
- Capture the "Lessons Learned" from previous iterations of the business
- Brainstorm ideas leading to a set of "Prioritized initiatives"
- Develop an action plan and "Road Map" (covering 18 to 36 months)
- Short-term action plan (3 to 5 initiatives) executed during 3 months

Comparing the initial plan with the actual outcome revealed several differences and alterations. This is described in Table 19 below.

Table 19: GROW AR Case Study Results – Plan vs. Actual

Plan: Analyse the Supply Chain	Actual: Supply Chain plus Strategy
Analyze the supply chain to make it better: financially, socially, and environmentally	The leadership team quickly realized that additional "Strategic Alignment" was missing
Focus on manufacturing activities, such as food processing (cashew, macadamia, and dried fruit), in the new Kenya site	Additional "Strategic" Work Stream added.
Focus initially on operational and financial performance (in support of Social and environmental)	Fundamental business issues captured in this stream (global structures, etc.)
Identify solutions for implementation	Financial issues, including sources of funds and capital investments, were also addressed
Also, identify barriers to implementation	Key organizational issues, e.g., key management hires and roles, culture, and welfare, etc., were also addressed

Actual Project Outputs and Outcomes

The following are the key outcomes and outputs of the project:

- Defined and validated "Strategic Agenda" (9 items), including accountability, timelines, and dashboard/tracker
- Improved Strategic Alignment within the Leadership team
- Clear Delivery plan and product structure for FY 2023 (High Level!)
- Prioritization on cash flow constraints and prioritized capex plans
- Value Chain Analysis with 50+ ideas, opportunities, and challenges identified
- Involvement of the KE Management Team in creating and executing key initiatives and a longer-term Road Map
- Templates for creating project charters and resource planning – executed by KE teams and sponsored by leadership

From a practical point of view, an objective analysis, as well as feedback from the key stakeholders, suggests that the project was successful in delivering project outcomes that provide value of a practical nature and align with the original expectations at the beginning of the project.

From a scientific and research perspective, the key outcomes — specifically, the prioritized actions and their ranking according to both impact and ease of implementation — provided an intense explanatory qualitative

case study that supported the conclusions of the quantitative research strand, the GCM concept mapping exercise.

When considering both the practical and the scientific aspects of the case study, we see that the eight concepts from the GCM exercise fit, and that these concepts have practical implications, highlighting things that work well and things where challenges occur. One of the biggest hurdles to implementing a TBL supply chain, SSCM, or GSCM is Culture. The inherent disconnect between having a value-driven or mission-driven organization with explicit social or environmental goals and trying to align those with the necessary financial sustainability and commercial culture and mindset, which is a fundamental success factor for business enterprises.

Key aspects of the GCM exercise and the concepts that work more easily include the use of KPIs, as both operational and social and sustainable KPIs tend to align relatively straightforwardly. The outcome for the concept ‘Supply Chain Waste’ was similar, as eliminating waste in the supply chain aligns well with each pillar of the TBL supply chain framework – social, environmental, and economic.

The concept from GCM that scored the highest in the priority matrix, Circular Manufacturing, was less clear and less conclusive in the GROW case study. Although some key aspects of the grow business model utilized or had potential to utilize circular manufacturing processes, the overall impact and importance of circular manufacturing to the concept and model were less clear, particularly in comparison to aspects such as Culture, KPIs, or Supply Chain Waste.

7 The Garment Exchange (GX): A Community-Based Supply Chain with Global Scalability Implications

7.1 Overview of the Case and the Design Framework

GX is a community-based clothing exchange in Budapest, Hungary, focused on operating a circular supply chain to normalize secondhand clothing and counteract fast fashion's global impact. GX hosts 7–8 clothing exchange events annually, aiming to reduce waste and mitigate industry effects. Studies reveal fast fashion accounts for 4–8.6% of global carbon emissions, more than aviation and shipping combined (Berg et al., 2020), and 92 million tons of clothing are discarded annually—one garbage truck per second (Szabo, 2024).

From January 2024 to March 2025, an AR case study project included seven field trips to Budapest for GX events, review sessions, and workshops. The goal was to help GX evolve from a grassroots effort to a sustainable enterprise rooted in the three TBL pillars: social, environmental, and economic. These challenges—also common in TBL initiatives—are detailed in Section 5.3 "Background" highlighting the difficulty of economic sustainability alongside social and environmental goals (Carter & Easton, 2011; section 1.1, p.6).

Initial strategies considered included transforming GX into an NGO, scaling globally as a tech-driven alternative to fast fashion, or shifting to a volunteer-run community activity. Change management and cross-cultural dynamics were significant, as GX's team and clientele comprised members of Budapest's international expatriate community. Debate emerged around GX's mission: while many advocated for a nonprofit model, others argued that tackling the fast fashion industry might require scalability, growth, and profitability.

The founder and key stakeholder of GX intended to create economic value to sustain the organization. This recognition of supply chain and strategic operations as drivers of financial performance aligns with supply chain management and TBL literature (Forrester, 1958; Mentzer et al., 2001; Elkington, 1998; Seuring & Müller, 2008).

The project was launched with two main objectives: to involve an expert (the author) in addressing supply chain and organizational issues, and to provide the foundation for a PhD research project (see Chapter 5). Over 15 months, the project progressed through six key phases: initiation and planning, initial site visits and workshops, interim analysis, second field visit and workshops, conclusions with action plans, and project closure. This approach followed the AR and PM frameworks detailed in Table 8, in Chapter 5.

7.2 Background of GX's Operations up to the Current State

GX was launched in January 2024 by founder and key stakeholder Heather Szabo, with its first Garment Exchange event in Budapest. Heather's aim was to apply circular economy principles—defined by the EU as "a model of production and consumption, which involves sharing, leasing, reusing, repairing, refurbishing and recycling existing materials and products as long as possible" (European Parliament, 2023)—to challenge fast fashion practices.

GX targets key issues in fast fashion: promoting excess consumption through short product life cycles, reliance on low-cost labor in developing countries, use of low-quality materials, and intellectual property theft from established brands. These problems result in rapid clothing turnover, poor working conditions, and increased waste.

In its early operations, GX measured success by the total kilograms of clothing collected and redistributed, as well as event participant numbers—data systematically recorded at each event.

Event	Date	Total Available kg	Total taken on the night Kg	% recirculated	Donation Kg	Participants on the night
Burn less, Exchange Clothes	November 4, 2022	178.51	78.7	0.44		41
Green Friday	November 25, 2022	210.5	63.35	0.30		34
Winter Wonderland	January 13, 2023	249.35	71.65	0.29		41
Spring Cleaning and Greening	March 10, 2023	250.75	88.9	0.35		48
May Day	April 23, 2023	167.8	53.55	0.32		39
Summer of Sustainability	June 9, 2023	190.39	78.55	0.41		56
Back to Sustainability	September 15, 2023	200.15	81.6	0.41	99	53
Green Friday	November 14, 2023	211.3	102.36	0.48	35.9	49
Winter Wonderland	January 26, 0204	267.89	103.79	0.39	124.05*	58
Spring Cleaning and Greening 2024	March 22, 2024	226.75	103.77	0.47		57
Earth Day Exchange	April 27, 2024					
Summer of Sustainability 2024	June 14, 2024					
Total to date	**10**	**2,153.39**	**826.22**	**0.39**	**134.9**	**476**
Average to date		215.34	82.62	0.39	67.45	47.60
					*not all from the Exchange	

Figure 23: GX Operational KPIs

Another important aspect of the GX operational model during its initial operations was that Heather systematically presented the mission of GX as a circular economy process specifically addressing the problems of fast fashion and presenting the operational KPIs in a form similar to Figure 23.

Current Operating Model and Restructuring Plans

During the AR research period, the GX team worked to develop a strategic supply chain model that balanced all three TBL pillars while honoring the mission. Three main models were considered: a nonprofit/NGO/Co-op structure, a scalable tech-driven model (like Vinted), or transitioning GX from Heather's ownership to a volunteer-run organization.

Key operational decisions impacting the future included marketing, event hosting, and clothing inventory management. Currently, warehousing and storage occurs at Heather's private apartment, with minimal revenues generated primarily through free exchanges and nominal payments for clothing. Heather leads marketing and events supported by 8 to 15 regular and semi-regular volunteers. However, relying on Heather's donated time and premises is unsustainable, underscoring the need for a strategic supply chain model balancing social, environmental, and economic priorities (Forrester, 1958; Mentzer et al., 2001; Elkington, 1998; Seuring & Müller, 2008).

The following figures illustrate information and material flows, comparing traditional VSM flows (Figure 24: information, materials, cash) with TBL supply chain flows (Figure 25: social, environmental, and financial benefits).

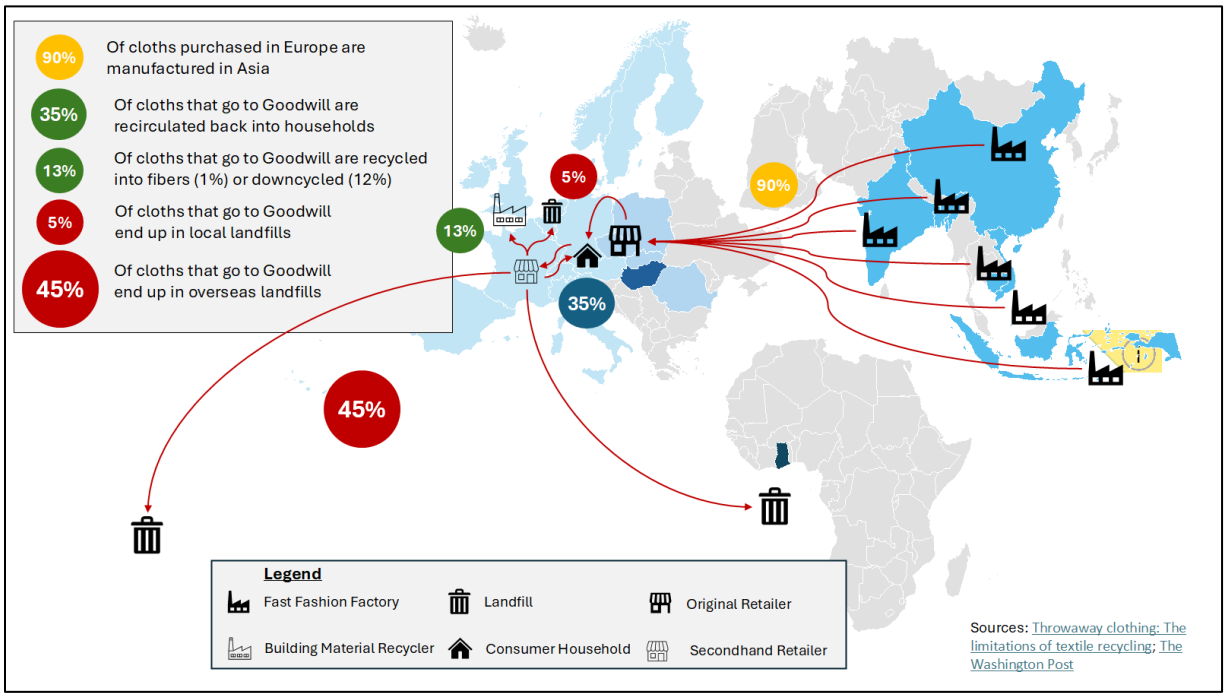

Figure 24: Current State of the Fast Fashion End-to-end Supply Chain

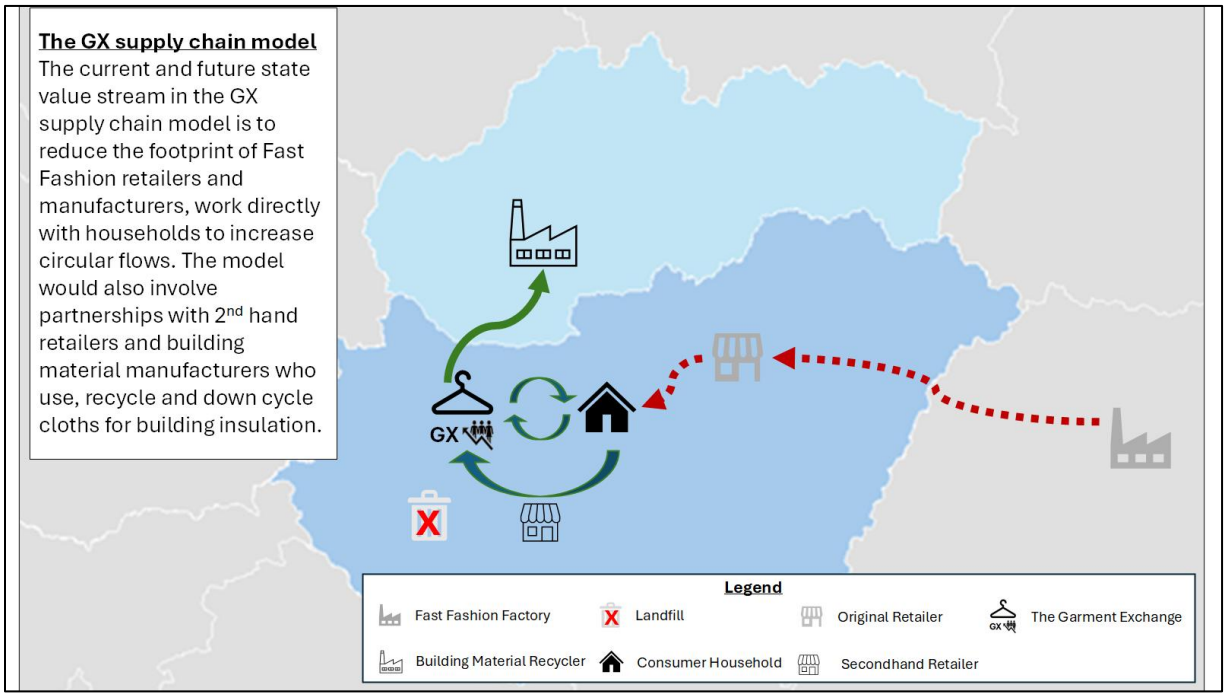

Figure 25: Current State of The Garment Exchange End-to-end Supply Chain

The AR study focused on GX's supply chain operations within Budapest, Hungary. However, because the assessment covered the full end-to-end supply chain, it included relationships with customers, suppliers, and intermediaries, with an eye toward enhancing local operations. This broad perspective allowed for exploration of scaling to neighboring countries, overseas manufacturing, and leveraging technology platforms. As discussed in section 7.7, the GX AR case study also involved supply chain partners such as a building material manufacturer utilizing recycled clothing as a key input .

7.3 Project Team Members and Roles

The project team consisted of several different groups within the Unit of Analysis across several locations. Table 20 below lists the project team members from GX, their project roles, and the entities within the supply chain they represent.

Table 20: GX Team Members and Roles

Name	Position	Project role
Heather Szabo (Heather)	Founder The Garment Exchange, former Senior Lean Project Manager at Raiffeisen Bank Hungary.	Executive and primary sponsor
Victor Holeczy (Vic)	Heather's Husband and primary GX benefactor	Key Stakeholder
Tom McDaniel (Tom)	Subject matter expert (SME), facilitator and project manager; Author PhD research	Lead Researcher
Megumi Anderson (Megumi)	Founding member (now deceased), art degree recipient (Japan), specialist in clothing design, display and organization	Volunteer and founding member
Karin Schulz (Karin)	Procurement Officer Kyndryl Hungary, Kft, detailed knowledge of all secondhand shops in Budapest	Key customer and volunteer
Sandra Franco (Sandra)	Volunteer Corp The Garment Exchange since 2023, specialist in clothing design and display	Core volunteer
Ruth Candlish (Ruth)	Founding member, The Garment Exchange, PhD candidate, Central European University	Volunteer and founding member
Giorgia Brucato (Giorgina)	GX Volunteer Corp since 2023, PhD Central European University	Core volunteer
Catarina Futacsi (Catarina)	GX Volunteer Corp since March 2024, former Credit Risk Analyst for IBM Hungary	Core volunteer
Diane Johnson (Diane)	Industry expert participant. NGO officer, vintage clothing dealer	Key customer and industry expert
Marketa Balkova (Marketa)	GX Volunteer Corp 2023-2024, Consular Officer Embassy of the Czech Republic, Madrid, Spain	Core volunteer
Rita Revy (Rita)	GX Volunteer Corp since 2022, expert in clothing quality and pricing, Project Manager at EU Training	Core volunteer
Mirjam Szendrei (Miriam)	GX Volunteer Corp since 2023, specializing in procurement of secondhand infrastructure for GX	Core volunteer

7.4 Cyclical Process – Initiation, Action, Review and Revise

The activity timeline, detailed in section 5.2.3, spanned 15 months from January 2024 to March 2025. Throughout this period, key activities followed the cyclical project management framework outlined in Table 8. Table 21 lists major events for phases 1 and 2, focusing on planning and initiation.

Table 21: GX Phase 1 & 2 Key Events and Activities

Event / Activity	Phase	Date	Location	Key Stakeholder(s)	Key Outcome
GX exchange event	1	26-Jan-24	Budapest	Heather & volunteers	Observe GX operations; meet GX volunteers
Follow-up discussion	1	27-Jan-24	Budapest	Heather & Vic	Reflection and feedback (see "Vinted" (!))
Discuss potential actions	1	16-Feb-24	Video call	Heather	Executive board; raising seed funding
Formalize the AR project	1 & 2	18-Apr-24	Budapest	Heather	Project scope, timeline, and align common goals
Pre-Planning workshop	2	22-May-24	Budapest	Heather	Review GX background presentation,
Pre-Planning workshop	2	23-May-24	Budapest	Heather	Workshop: 1. Structure 2. Content 3. Goals
Networking call	2	14-Jun-24	Video call	Michael Dheur	Links to circular textile groups
On-line survey	2	15-Jun-24	Survey	Heather & volunteers	Volunteer survey

Initial Discussion – January 26th, 2024

At GX's annual winter garment exchange, Heather and the author recognized shared interests in sustainability and supply chain management. They agreed to collaborate, with the author supporting GX's strategic supply chain model as part of an AR case study.

Follow-up and Preliminary Proposal – February 16th, 2024

Heather and the author proposed forming an executive board to advise and help secure seed funding, dedicating 2–3 days per month over 6–9 months. The plan focused on a core group of 10–15 volunteers but noted that reliance on volunteers limited GX's economic sustainability.

Reference Model: Vinted, with €596.3 million in revenue in 2023 (+61% from 2022's €370.2 million), and a valuation over EUR 5 billion in December 2024 (Vinted, 2024; Moss, 2024).

Key Actions:

- Engage volunteers in a workshop to shape GX's supply chain model
- Seek external network for expertise and funding

Project Initiation – April 18th, 2024

At the kick-off meeting, Heather and the author reviewed GX's partner pitch and agreed to organize a volunteer workshop, focusing on recruiting participants and planning logistics.

Workshop Planning – May 23rd and 24th, 2024

Shared scientific (the work would form the basis of an AR case study, for academic purposes) and business goals (the need to make a viable money-making enterprise) for GX were confirmed. GX, with 11 events over 18 months, aimed to enhance fast fashion sustainability by reducing carbon emissions and waste (measured in kg collected). The project demonstrated a clear mission, strong commitment, and momentum, but it faced challenges in operational workload, volunteer dependence, and scalability.

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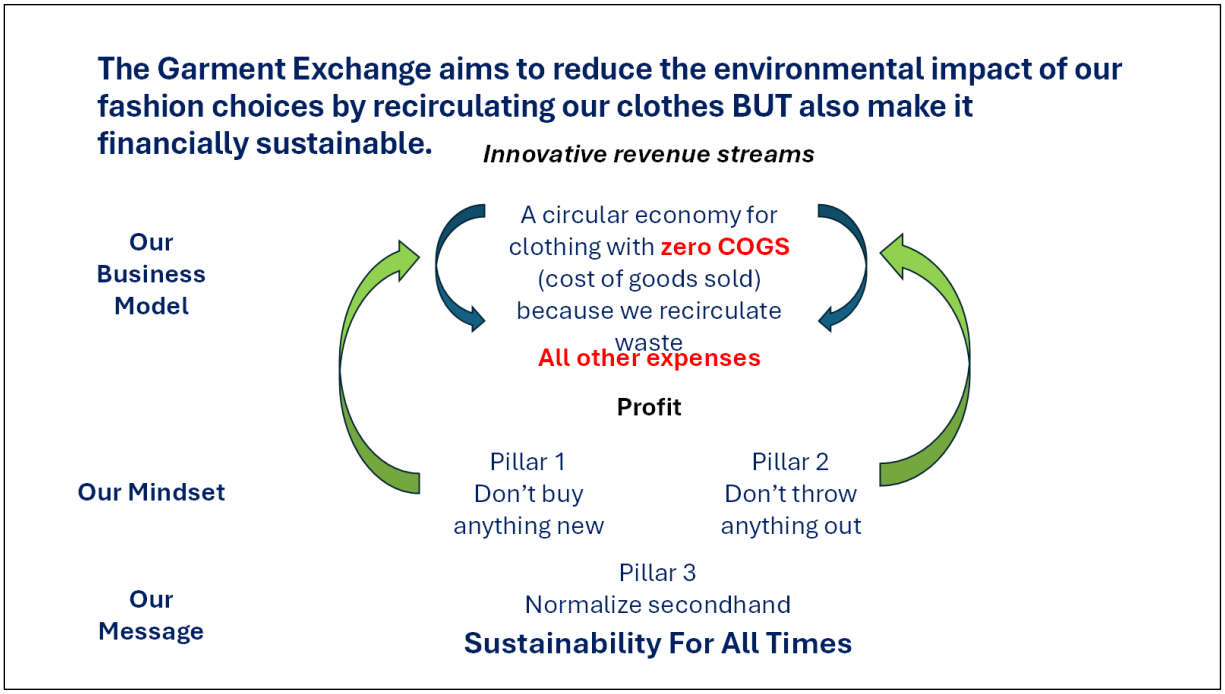


Figure 26: The Garment Exchange Culture – Model, Mindset, Message

Using an affinity diagram—a Lean Six Sigma supply chain tool (Mitchell & Kovach, 2016)—we synthesized key ideas from Heather's presentation. Figure 27 details the brainstorming outcomes and recommended next steps.

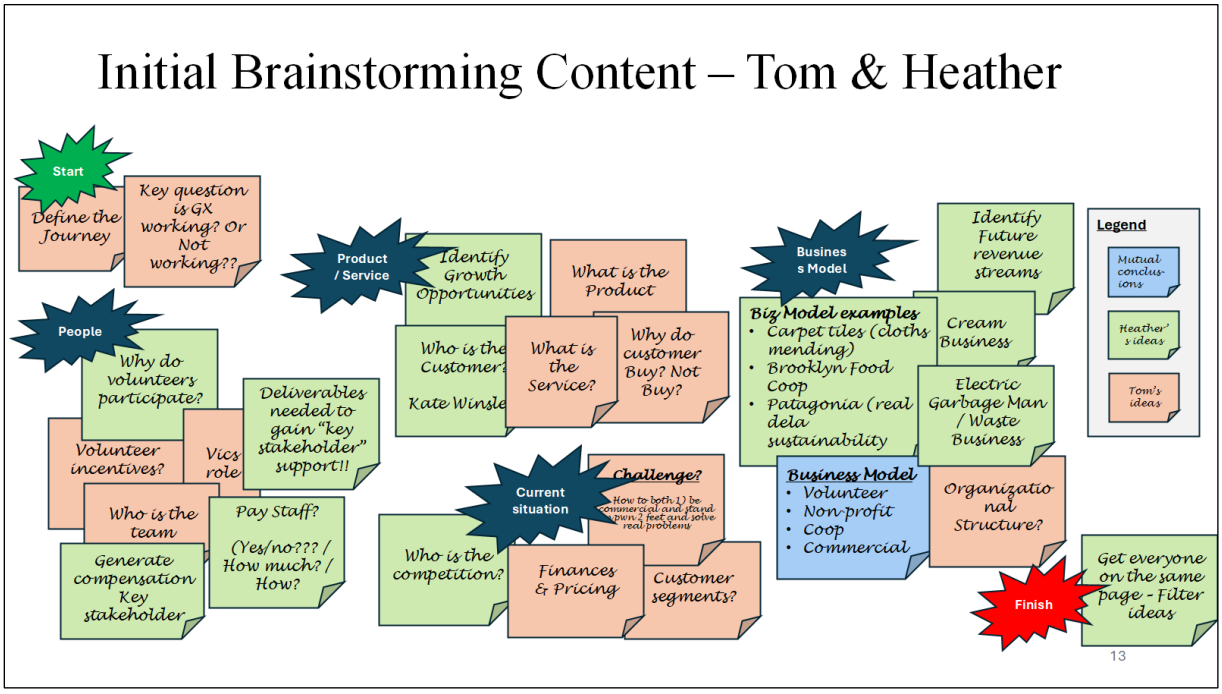


Figure 27: Preliminary Brainstorming

Building on Figure 27, Heather's presentation became the core of a business pitch for potential board members. GX and Heather were positioned as leaders in waste elimination using Lean Six Sigma (Mitchell & Kovach, 2016), linking GX's mission to economic and supply chain best practices to boost commercial appeal.

Three next steps were outlined:

- Conduct industry research on circular economy models and supply chains
- Develop a strategy to normalize second-hand clothing and educate on circular supply benefits
- Map clothing logistics, life cycles, and waste

7.5 Planning the Work

The workshop agenda was developed around a clear problem statement: *How can GX create a strategic supply chain model which is both commercially viable, allowing it to "stand on its own" and at the same solve real problems, not just play lip-service or create feel good perceptions.*

The theme of the workshop was as follows: *How to develop and create a strategic supply chain model which is currently based on volunteers into something more sustainable based on basic statutory legal options available including non-for-profit, a community cooperative organization, or a commercial business.*

Three main workshop areas were identified based on brainstorming clusters and the affinity diagram:

- Future market focus: defining GX's customer base
- Product/service definition: clarifying what GX is offering and its sources of value and revenue (e.g., clothing, events, logistics, or food and beverage services)
- Supply chain structure: deciding between a community event model (like a Tupperware party) or a retail model, and determining revenue sources—commercial, nonprofit, or third-party/government (e.g., carbon credits)

Conclusions and next steps were mapped out in Figure 28.

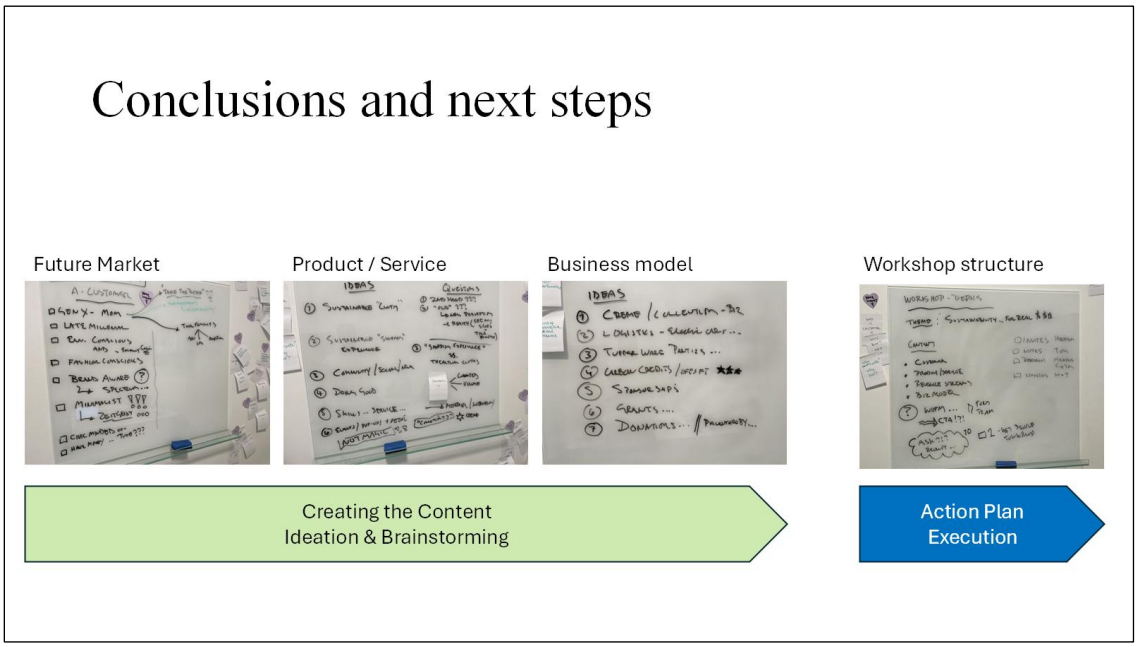


Figure 28: Results of Brainstorming Using an Affinity Diagram

7.6 Volunteer Workshop #1: June 19th, 2024

The first workshop took place in Budapest, hosted by the 6th district government administration, with Heather and the author leading the session. An agenda and presentation were prepared in advance, and eight volunteers completed a survey to inform the workshop's focus.

The workshop was divided into three parts:

- Gathering participant feedback and discussing survey results about the current state and perception of GX.
- Brainstorming around three key questions identified in planning.

- Developing concrete action items based on these discussions.

Key survey findings included:

- Clothing was a major motivator for both attendees and volunteers.
- The mission of GX was valued even more than the clothes themselves.
- The social and community aspects were cited as the most important reason for participating in GX events.

Survey results for Question 1 are presented in Tables 22, 23, 24, and Figures 29 and 30 below.

Table 22: Volunteer Survey Question 1A

Why are you participating in The Garment Exchange (GX) to begin with?
• It's a fun event, love volunteering getting to do something different to my day job, and I'm very on board with the cause
• Interesting promising project
• Because I care about the environment and the planet we are living on for those who come after humans and animals. Fast fashion is one of the biggest agents of mass pollution and resource draining
• Just a flow
• Helping Heather as a friend and supporting the cause
• To reduce the environmental impact of our clothing choices.
• Passion for sustainability, reusing, recycling.
• Because I believe in its key message about sustainability and against waste in the fashion industry, and because of the opportunity to obtain beautiful clothes virtually for free

Table 23: Volunteer Survey Question 1B

What brought you to the Garment Exchange as a volunteer?
• Got involved via the kids' clothes side, toys sales, and then started volunteering
• My relationship to Heather as a student, Sustainability enthusiast and friend
• I saw Heather's post for GX some months ago and knew I wanted to join forces.
• To save the cost of my kids' clothes
• Helping Heather as a friend and supporting the cause
• My Lean Manufacturing and process background
• Opportunity to participate in a great initiative, be useful, meet interesting people with similar mindset
• A friend, my curiosity, my disposition towards social causes, and the nice clothes!

Table 24: Volunteer Survey Question 1C

What kept you here (the Garment Exchange) as a volunteer?
• Enjoy the events and company and love getting awesome new outfits.
• Opportunity around further collaboration, sustainability, entrepreneurship, PhD
• The enthusiasm and effort put in by all the volunteers and Heather, and their will to always improve GX
• Just trying to help
• Helping Heather as a friend and supporting the cause
• It is an inspiring community to work with. So much more has come from creating this community than just clothes. Also there seems to be a lot of momentum.
• Heather's personality, great teamwork, successful events.
• The same things that brought me here ;)

Survey participants leaned toward a nonprofit or NGO model but stressed the need for further research. The group's involvement centered around Heather's leadership, though they acknowledged the limitations of a volunteer-based approach.

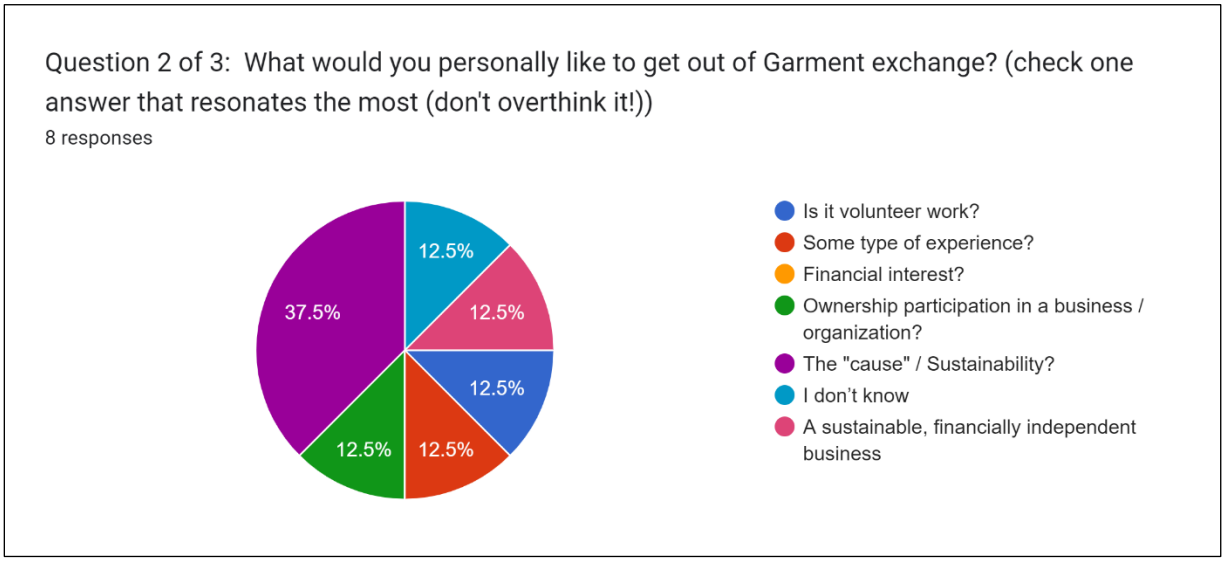


Figure 29: Personal Expectations of GX Volunteers

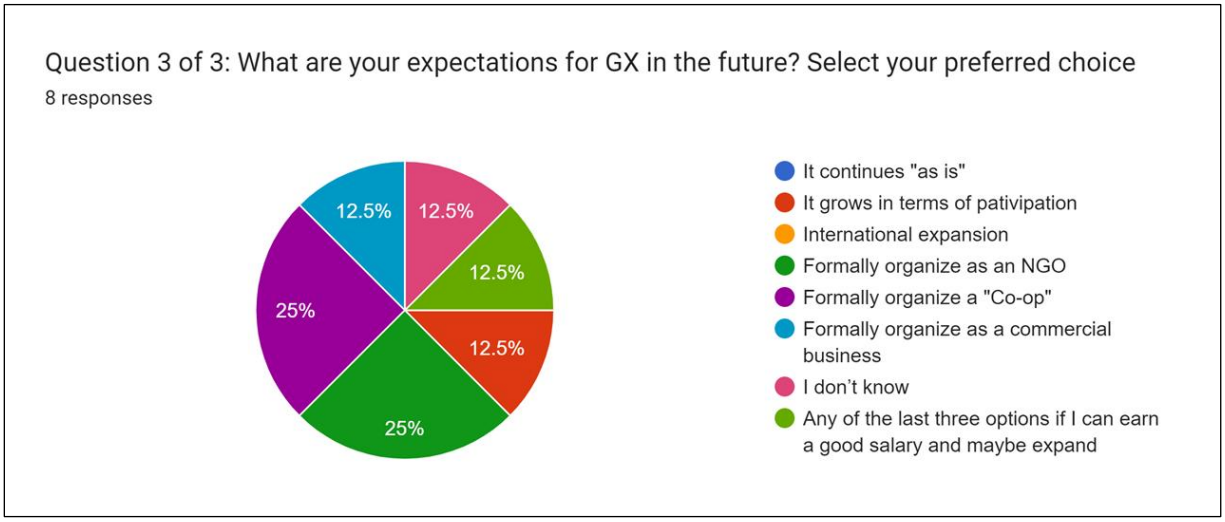


Figure 30: Future Expectations of GX Volunteers

Key discussion themes included the necessity of profit and its alignment with GX's values, referencing the Triple Bottom Line (TBL) model's economic pillar. While participants saw opportunities for easy improvements, they emphasized that GX events and their social/mission-driven focus are core differentiators. The need for a dedicated venue for events and storage was also highlighted as crucial for future operations. Participants were hesitant to pick an organizational structure (e.g., for-profit, non-profit, cooperative) pending further legal and strategic review. Additional service ideas included clothing repair workshops and in-house

stylists to promote clothing circularity and minimalism. The workshop concluded by outlining a preliminary vision and action plan for GX's next 3–24 months, focused around three key questions.

- Who is our customer?
- What are we selling?
- What kind of formal organization should GX become

The key conclusions, actions, observations, and concerns are summarized below in Table 25.

7.7 Interim Stakeholders Debrief Sessions and Workshops

Following workshop #1, Heather and the author reviewed the action plan, assigned responsibilities, and agreed on approaches. The top priority was Action 3C: establishing GX's legal structure. Heather will consult Budapest accountants and lawyers; the author will reach out to business contacts; both will research funding options (corporate, government, and institutional grants).

The second priority was securing venues for clothing storage and events, emphasizing that the social experience is GX's primary differentiator. Heather, with Ruth's NGO network support, will pursue public sector spaces, like district government properties.

Third, the team will further research the market, customer demographics, and business models. The consensus was that GX is not a vintage clothing shop, but it should understand the dynamics of the second-hand clothing market. Heather will focus on Budapest and Hungary (with Diane's local expertise), while Tom will analyze international trends.

A summary of actions between the first and second workshops—including meetings, project reviews, and planning—is presented in Table 26 below.

Table 25: GX Workshop #1 - Summary Table

Key Question	Conclusions	Actions	Debrief & Observations	Risks & Concerns
Who is our customer?	While anyone interested in fashion could be considered, the ideal target is Gen X women—particularly expats—who often manage family clothing decisions and share information within social circles.	**Action 1A**: Demographic research to better define GX's ideal customer archetype. **Action 1B:** Conduct a survey of Budapest's key demographics and expat groups. **Action 1C**: Conduct research regarding why customers buy and what motivates them	The abundance of participant feedback made it challenging to steer the discussion, but the workshop was successful and energized by the volunteers' enthusiasm and support, providing momentum for the GX initiative.	Debate and questions about whether to expand target demographics to new groups or remain focused on the core customer with existing knowledge and success.
What are we selling?	Five key themes identified: • Clothing itself • GX's added services • Event experience • Sense of community • Positive environmental and social impact. GX's uniqueness lies in combined offerings, which distinguish it from retail, second-hand, and online competitors.	**Action 2A**: Research alternative and competitive offerings to the garment exchange **Action 2B:** Develop a distinct advisory service as a key differentiator for GX customers **Action 2C**: Explore venues that support GX's event needs and customer profile	Enhance the customer experience at GX events by providing style advice, tailoring and mending services, and improving changing room facilities. Additionally, organize clothing by item, style, or size to help customers find what they need more easily.	Event experiences are complicated, incorporating social and themed gatherings is challenging — limited to holiday or cultural events — tailoring to specific communities requires effort. Finding flexible venues for both clothing exchanges and social interaction is complex.

Key Question	Conclusions	Actions	Debrief & Observations	Risks & Concerns
What kind of formal organization should GX become	The brainstorming led to five clusters, • Practical improvements • Commercial development, • Enhancing GX's online presence crucial to supporting and improving the in-person experience • Further research into the legal structures • Legal advice	**Action 3A:** Conduct a brief survey of GX volunteers to gather improvement ideas and develop an actionable plan. **Action 3B:** Establish GX's core principles, then define job roles and responsibilities, clarifying whether they are volunteer or compensated positions. **Action 3C**: Further research is needed to evaluate the pros and cons, as well as the requirements, of establishing GX as a commercial organization, NGO, or co-op.	Ideas included volunteer training, defining roles & job descriptions, and establishing an organizational board. Three basic organizational options: • NGO • Coop • Commercial organization Pros and cons for each option; more research is required, as multiple structures are possible.	A primary concern was the strong resistance among some participants to making GX a commercial organization, as they felt profit motives conflicted with sustainability goals—even after discussions on the importance of financial viability within the triple bottom line.

Table 26: GX Phase 3 & 4 Key Events and Activities

Event/activity	Phase	Date	Location	Key stakeholder(s)	Key outcome	Action (Table 25)?
Workshop #1	3	18-Jun-24	Budapest	Heather /volunteers	Preliminary action plan	All
Workshop debrief	4	19-Jun-24	Budapest	Heather	Pro bono legal advice	All
Idea sharing	3	04-Jul-24	text exchange	Heather	Shein & Temu, acceleration of fast fashion	2A
Idea sharing	3	11-Jul-24	text exchange	Heather	"Swappis": circular clothing store in Budapest	2A
Idea sharing	3	12-Jul-24	text exchange	Heather	Secondhand clothing undergoing a shift	1B
Project review	4	03-Sep-24	video call	Heather	Reboot after summer - see agenda	all, 2C, 3C
Board formation	3	04-Sep-24	phone call	James Atkins	Board formation and volunteer interest	3C
Board formation	3	06-Sep-24	video call	Heather	Two-page memo for James Atkins re: GX idea	3C
Circularity insulation	3	09-Sep-24	video call	Mike Stenson	Circular manufacturing, Kingspan Plc	3C
2-page teaser review	3	10-Sep-24	video call	Heather	GX 2-pager for James and the investor community	3C
Circularity products	3	12-Sep-24	Bratislava	Miroslav Futrikanič	Opportunity to collaborate, GX and SK-tex	3C
Board formation	3	16-Sep-24	video call	Norrie Sinclair	Opportunity to collaborate, board formation	3C
VI district support	3	18-Sep-24	video call	Heather	VI district funding application and use of funds	2C
VI district support	3	26-Sep-24	video call	Heather	VI district funding application and use of funds	2C
Next steps	3	08-Oct-24	video call	Heather	Workshop 2, company formation, funding	3C
Circular model	4	09-Oct-24	Budapest	Miroslav Futrikanič	Opportunity to collaborate, board formation	3C
Workshop planning	3	09-Oct-24	Budapest	Heather	Workshop #2, Board formation, funding	All
Circular model	3	09-Oct-24	Budapest	Kevin Jackson	Opportunity to collaborate, board formation	1A, 1B, 1C, 2A
Workshop planning	3	10-Oct-24	Budapest	Heather	Workshop #2, Board formation	All
Board formation	3	11-Oct-24	Budapest	Heather & Norrie	Opportunity to collaborate, board formation	3C

Investigating Potential Legal Frameworks for GX

Initially, neither Heather nor the founder planned to formalize GX as a legal entity. However, after workshop #1, legal and tax advisors were recommended, and both agreed this was necessary, recognizing the process would be complex. The challenge was finding pro bono advisors due to limited funds, but Heather secured free legal support through recommendations.

Possible structures considered included a limited liability entity, sole proprietorship, nonprofit organization, or cooperative. The consensus was that legal compliance, operational capacity, and fundraising transparency mattered more than specific structural details.

Investigating Sources of Funding for GX

Heather and the author identified a need for start-up funding to cover essentials like legal advice and incorporation. Lacking internal resources, they explored:

- Fundraising alongside board formation
- Applying for development funds (e.g., Hungary's 6th district)
- Seeking grants from donors and companies
- Pursuing venture capital
- Considering crowdfunding (no steps taken by study's end)

Initial board member pledges exceeded €1,000, with a matching campaign targeting €2,500–€5,000. Larger sums were to be sought from organizations supporting social entrepreneurship and sustainability. The Integra Foundation (Our Team - Integracoop.com, 2024) provided grant guidance, while the MOL Group (Communities - Sustainability – MOL Group, 2015) was a potential funder.

Heather noted the Sustainability Network as promising, requiring alignment with UN SDGs, high sustainability standards, a "triple bottom line," and conscious leadership (Register to Raise Investment or Find Funding | Sustainable Network | Global Funding & Innovation Platform, 2021).

Soliciting Potential Board Members for GX

Forming a board aimed to build GX's human and financial resources for legal fees and workshops. Heather and the author reached out to prospective members, requesting advocacy, network access, and, ideally, financial contributions. Minimum: support GX's mission; preferred: introduce GX to leaders, offer pro bono support, and help fundraise. Over €1,000 in verbal pledges were made, with matching envisioned.

A formal invitation outlined these expectations. Outreach details are in Tables 26 and 27.

Table 27: GX Board Member Candidates and Outreach

Name	Organization	Role
James Atkins	Planet League; Flite Protein; Wild Power; Zsamboki Biokert; Vertis Environmental Finance; Football for Forest	Advisor RE: sustainable startups; introduction to key people in his network
Norrie Sinclair	Founder @ zöld iq kft.	Advisor re: sustainable startups; introduction to key people in his network
Kevin Jackson	Entrepreneur, Professor at Corvinus University	Access to student resources in his consumer behavior class at Corvinus
Mike Stenson	Kingspan Group, Project Director, *Kingspan Meets Target to Recycle One Billion PET Bottles per Year into Its Manufacturing Processes*, 2025	Advice on the circularity of secondhand clothes into building materials.
Miroslav Futrikanič	Managing director SK-tex (*Miroslav Futrikanič | ODPADY-PORTAL.SK*, 2024)	Advice on the circularity of secondhand clothes into building materials.

In each of the above cases, initial contact resulted in at least a phone call or a meeting, followed by a discussion of next steps. A detailed description of the initial steps taken and potential next steps discussed and/or agreed upon is presented in the larger Table 28 below.

Table 28: Board Candidates and Outreach Participants

Name	Action Agreed	Next Steps
James Atkins	The author communicated with James by phone and through several e-mail exchanges regarding the GX initiative. James was unable to join the board due to time limitations, but offered assistance with introductions.	James requested a 2-page summary of the GX concept. Based on this, James agreed to meet Heather for coffee and introduce her to several former models / sustainable fashion influencers. The first meeting was postponed and rescheduled.
Norrie Sinclair	The author and Heather called and met Norrie for lunch. Drawing from his entrepreneurial background and experience with TBL businesses, Norrie was supportive. His current venture is also a TBL business.	Nori has agreed in principle to join the board and attended the GX event with his partner. We will send Norrie an official invitation soon.
Kevin Jackson	The author met with Kevin and proposed a student research project for Heather and GX as part of his Consumer Behavior class, following the initial workshop's action plan.	The consumer behavior class research project provided valuable results for GX and benefited the class. Heather and GX will use these findings in their action plan. Kevin has agreed to join the board, and we will send him an official invitation soon.
Mike Stenson	The author conducted a preliminary study to research the use of secondhand clothing as an insulation material for buildings. Mike provided positive feedback, noting that Kingspan already has a significant program and that secondhand clothing may eventually replace inputs like PET bottles in their products.	No further steps or invitations have been extended to Mike regarding board participation. Once the action plan and strategic direction are finalized, we will decide whether to contact him and specify any advice, contribution, or involvement in GX that we seek.
Miroslav Futrikanič	The author spoke with Miroslav several times, including a face-to-face meeting in Bratislava. Miroslav provided details about SK-Tex's use of secondhand clothing for insulation, which aligns with their sustainability mission. He supported the GX initiative and agreed to receive school uniforms and other clothing collected by GX. Heather and the author have dropped off clothing at the SK-Tex facility in Senica and toured the site, where they also met a lead engineering executive.	We have not officially invited Miroslav to join the GX board, but we see Miroslav and SK-Tex as valuable future partners for improving GX process circularity. Directly sending excess clothing and uniforms to the SK facility could reduce environmental waste by streamlining logistics and minimizing storage and handling steps.

Market and Competitive Research

We developed the market research approach organically, through project reviews and discussions. A key question was whether technology is essential for GX's scale and impact. We examined local and international competitors and approaches to circular supply chains.

Local Offerings in Budapest, Hungary, for Secondhand Clothing

The main local competitors are second-hand and vintage stores, which operate similarly to traditional retailers but source their clothing from various countries. Swappis (https://www.swappis.hu/), founded by a Swedish expatriate, closely resembles GX with its sustainability mission and points-based exchange system. Swappis differs from GX in that it focuses more on retail, whereas GX emphasizes hosting events. Diane, the second-hand clothing expert, suggests adding styling and repair services to differentiate GX further.

TaxiTuri is another local competitor, accepting donations and curating items for upcycling. Their quality is generally lower, likely due to a younger customer base with less disposable income—their mission centers on supporting disadvantaged groups rather than fashion circularity.

International Offerings

The number of online second-hand clothing platforms is rapidly growing. Most operate as marketplaces or peer-to-peer exchanges, often using a points system. These interactions are typically online rather than face-to-face. Vinted is exceptionally prominent, as noted in section 7.4.2, alongside eBay, Etsy, Poshmark, Depop, and Facebook Marketplace. One similar in-person exchange is Clothing Swap (https://clothingswap.com/), a US-based site with limited activity.

A Hypothesis: What Is the Impact of Online Secondhand Clothing Marketplaces?

We questioned whether online exchanges increase or decrease clothing consumption. We hypothesize that online second-hand marketplaces, combined with fast and on-demand fashion (e.g., Temu, Shein), may lead to increased consumption. This is because consumers believe they can continually resell their clothes, creating a reinforcing feedback loop and increasing overall material use, resource extraction, transportation, and landfill waste.

To test this, we conducted a workshop using CLD as an analytical tool, based on a systems thinking approach, and identified three interconnected feedback loops that drive both supply and demand growth. Such loops increase clothing volume in circulation, intensifying resource extraction, waste, and storage needs.

Reinforcing Feedback Loop: Fast Fashion

Our analysis shows that fast fashion operates as a reinforcing feedback loop. Companies rapidly respond to demand and introduce new styles at low prices, prompting consumers to make frequent purchases without

considering the long-term value. This cycle results in massive clothing waste, with items ending up in closets, storage, intermediary traders, and global landfills.

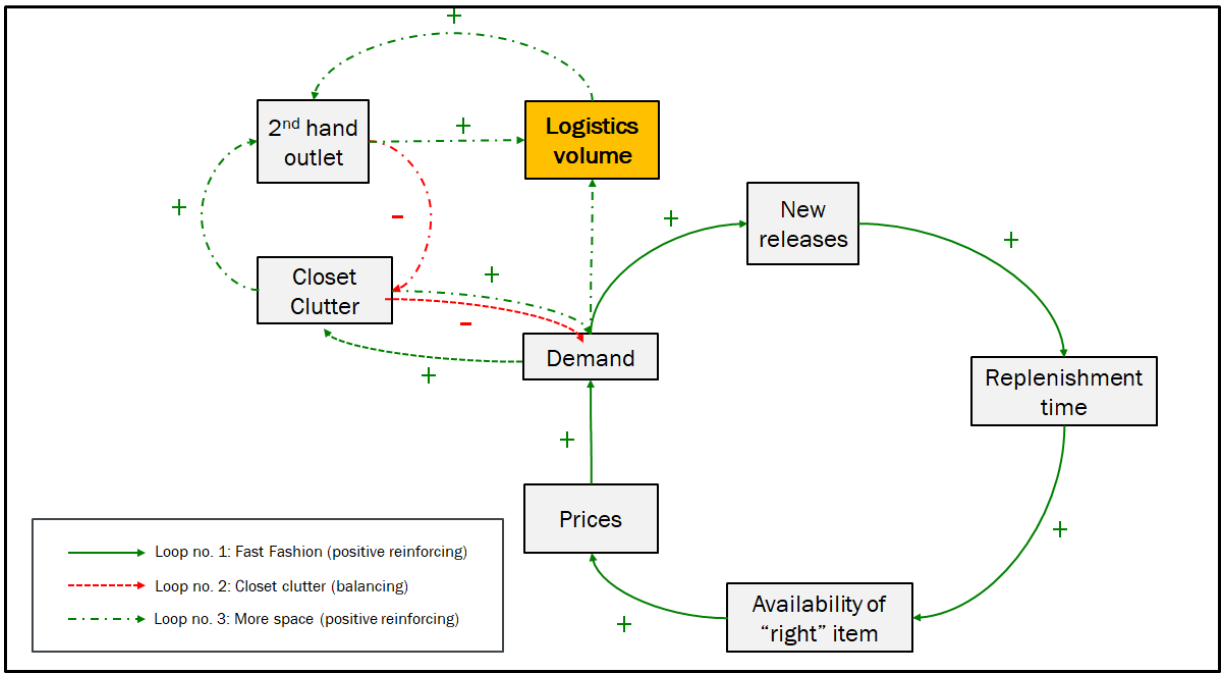


Figure 31: Reinforcing the Feedback Loop from the On-Line Second-Hand Clothing Platform

The second feedback loop, termed "closet clutter," acts as a balancing mechanism: as consumers' closets fill with unwanted clothes, space and living conditions become compromised, naturally limiting further consumption. While fast fashion and second-hand online outlets (like Vinted, eBay, Etsy, Poshmark, Depop, and Facebook Marketplace) create a reinforcing loop that encourages excess, closet clutter imposes a check.

However, online second-hand exchanges can create a false sense of sustainable consumption. As platforms become more accessible, consumers feel they can buy fast fashion and offload unwanted items, but increased demand leads to greater logistics and resource use. Thus, while closet clutter balances growth, online second-hand outlets form a new reinforcing loop, intensifying overall consumption.

A potential solution lies in platforms that emphasize face-to-face clothing exchanges, inspired by indigenous "gift exchange" approaches (Kimmerer, 2013; Daly, 1997). These add friction to the system, strengthen relationships and reciprocity, and may disrupt the cycle of overconsumption, transforming reinforcing loops into balancing ones, as depicted in Figure 32.

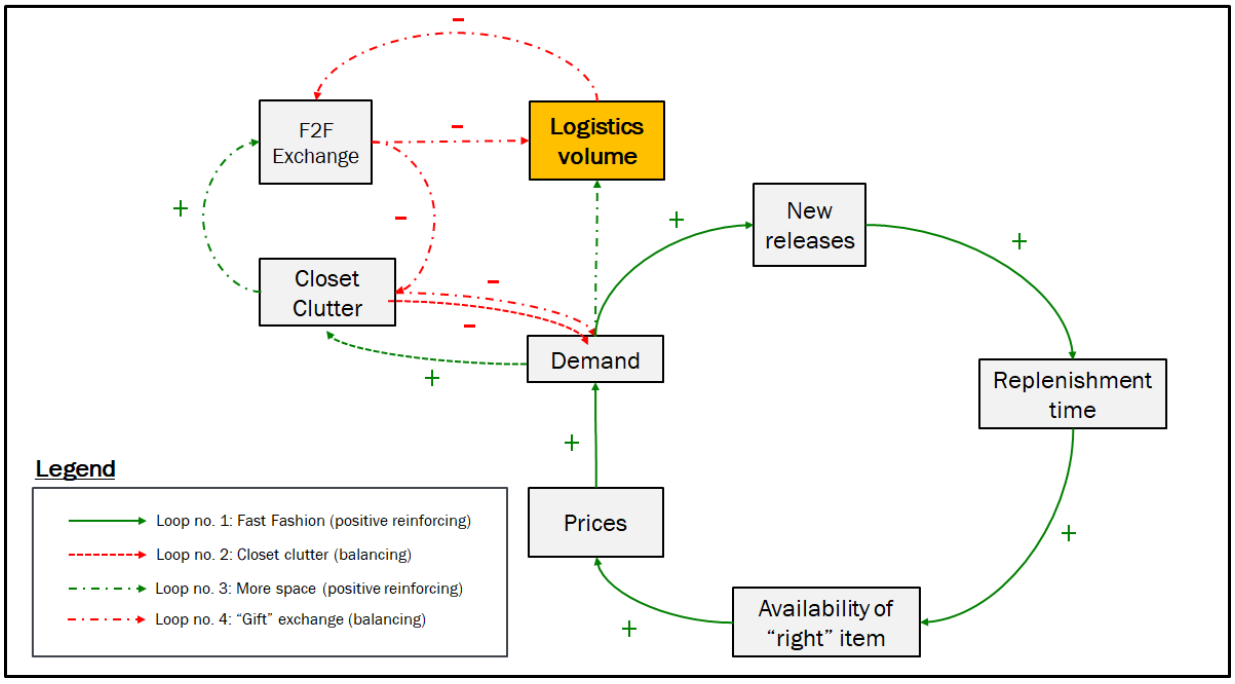


Figure 32: Balancing Feedback Loop from F2F "Gift" Exchange

Money Fetishism and the Gift Economy

The benefits of face-to-face clothing exchanges, as opposed to online platforms, have been explored by scholars such as Herman E. Daly and Robin Wall Kimmerer. Daly's "Beyond Growth" (1997) critiques "money fetishism"—the belief that economic value, unlike physical resources, can grow indefinitely. Daly outlines four stages of economic exchange, from simple barter (Step 1) to today's abstract, commodity-free financial system (Step 4). Daly, referencing Marx and Aristotle, argues that this abstraction leads to unsustainable consumerism because money, untethered from real resources, encourages unchecked consumption.

Kimmerer, in "Braiding Sweetgrass" (2013), contrasts this with the "gift economy" found in Indigenous cultures. She describes how gifts—like the "heart berry" strawberry—create relationships and obligations rather than rights. In this system, value increases as items are shared rather than hoarded, promoting stewardship and reducing excess consumption. Lewis Hyde's work (2019) further supports that treating objects as gifts leads to restraint and abundance.

Kimmerer notes that Native American gifts come with "bundles of responsibilities," unlike European notions of property, which are often viewed as "bundles of rights." Markets based on gift exchange foster reciprocal responsibility, decreasing consumer demand while increasing the perceived value of goods.

Applying these ideas to garment exchange programs (GX), fostering in-person, relationship-centered events can shift norms toward reciprocity and responsibility, countering the overconsumption promoted by online second-hand clothing platforms. Such models may encourage longer clothing lifecycles, greater value, and a culture of more mindful acquisition and passing on of fashion.

7.8 GX Workshop #2

The second workshop built on initial insights, focusing on action steps for the GX program. Key participant feedback included the need for a larger venue, more volunteers, and features such as a "bargain bin," long mirror, improved layout, clearer stickers, and a redesigned floor space. Suggestions also covered style and mending workshops, streamlined check-in, and options for early or drop-in access. While an online platform was considered, concerns arose around resource demands and alignment with the GX mission.

Three supply chain options were evaluated: partnering with companies that have strong ESG credentials, forming a community NGO or cooperative for better funding and mission alignment, or discontinuing operations. The group rejected ending the program due to strong commitment. Next steps included strengthening partnerships and securing more space.

Heather, the facilitator, emphasized that the GX's value is in its social and climate awareness focus, not simply selling clothes. Legal structure (commercial vs. social enterprise) and volunteer support were debated. Financial challenges were noted, including the need for a part-time social media manager, additional storage (currently provided by Heather), and the high demand for community outreach. Event revenues covered refreshments and space, but were insufficient overall; an expense spreadsheet was submitted for 6th district funding.

Three supply chain models were reviewed, with development grants (such as the Leonardo da Vinci exchange program, expected in 3–12 months) seen as most viable. Five working groups were formed to address:

- Venue acquisition
- Fundraising
- Event planning/marketing
- Operations improvement
- Social media

New venues considered included districts 6, 7, 8, 2, Goya, Aurora, Hello Anyu, CEU University, and the Scottish church. Heather presented internal process flows and invited feedback. Demographic targeting focused on Gen X, with suggestions to expand to Gen Z, mothers, and students; further research was recommended. A summary of the workshop sections and conclusions is presented in Table 29.

Table 29: GX Workshop #2 - Summary Table

Workshop Section	Key Points	Comments and Conclusions
Preparation	Agenda	• Gather thoughts on GX, review insights, finalize three supply chain options, process workshop, Leaner Exchange, pricing, next steps
	Roles	• Heather: main presenter; Author: facilitator, note-taker
Execution Part 1	Feedback	• Bigger space, more/new people, bargain bin, long mirror, segment styles/sizes, sticker confusion, floor redesign, workshops (styling, mending), streamline check-in, positive volunteer consensus, drop-ins, online platform concerns
	Strategic Options	• Sustainable org (partner ESG), Community org (NGO/Coop), Discontinue (not realistic)
	Next Steps	• Find partnerships, more space
Execution Part 2	Main Topics	• Who are customers, what are we selling, and what is the strategic supply chain model
	Insights	• Selling experience/event, social cause (climate change), advice workshops (mending, declutter, style)
	Legal Structure	• Divergent views: commercial vs. social enterprise; resource requirements
	Customer Base	• Current customers need market research, resource challenge
	Financial Aspects	• Vision unclear, social vs. financial goals, resource requirements, legal entity needed, cost of legal structure, main costs: social media, stock, community presence, event costs
Execution Part 3	Supply Chain Models	• Discussion of pros/cons, challenge to scale, and grants likely best funding
Execution Part 4	Action Points	• Find/expand space (districts 6,7,8,2; Goya, Aurora, Hello Anyu, CEU, Scottish church), acquire funding (grants, Leonardo da Vinci, 3-12 months), assign tasks (working groups: space, fundraising, events, operations, social media), improve operations (process flows), research demographics (Gen X, Z, mothers, students)

Workshop Debrief and Conclusions

After the workshop, Heather and the author reviewed feedback and planned GX's future. While both agreed GX benefited stakeholders, concerns about financial stability persisted. Heather remained optimistic, but the author expressed concerns about funding, space, and staffing challenges.

The primary issues identified were:

- *Resource constraints*: Without funding, dedicated space, and full-time staff, GX's sustainability was in doubt.
- *Operational burden:* To ensure scalability, Heather needed to delegate event operations to the volunteer core, freeing herself for strategic activities.
- *Inventory management:* To vacate Heather and Vic's apartment (used for storage), several solutions were proposed to end the use of their apartment for storage by late 2025.
  - Reduce inventory via clearance sales
  - Distribute storage among more volunteers
  - Rent external storage
  - Recycle excess items through partners like SK-Tex

Strategic decisions included:

- Delaying final decisions about supply chain models until further resources were acquired
- Forming the executive board promptly to address short-term needs
- Pursuing multiple funding streams: individual campaigns, grant applications, corporate outreach, and social/environmental venture funding
- Focusing on event-based and service-oriented models rather than standard retail approaches

For scalability, leveraging existing technology and infrastructure—following the example of platforms like Airbnb, Uber Green, Olio ("Share more, waste less, and beat waste [by using] the app for finding what you need and sharing what you do not with local people" (Olio, 2023))—was seen as essential. The team agreed to continue experimenting and iterating with these models, prioritizing critical success factors such as funding, space, and volunteer engagement before finalizing GX's strategic direction.

7.9 Strategic Follow-Up Meeting: Consumer Behavior Class Presentation

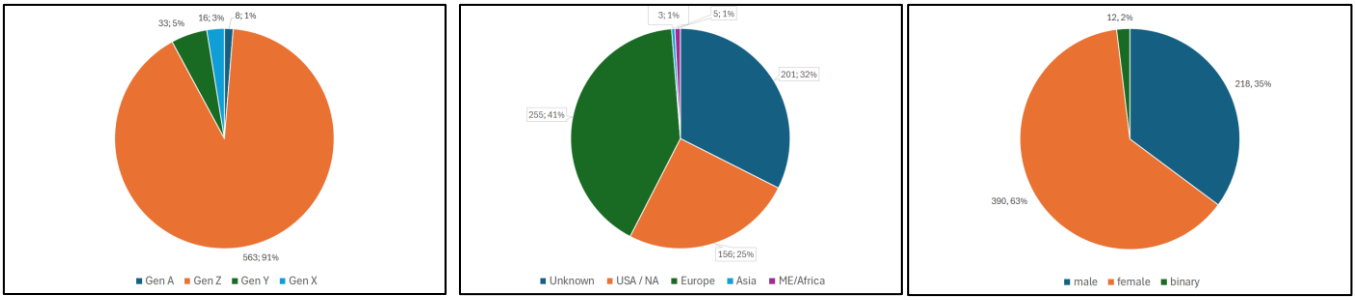
Background and Overview

Collaborative action research brought in Professor Kevin Michael Jackson and his Corvinus University Consumer Behavior class for the GX project. Kevin joined the executive board and involved his students in a Gen Z-focused case study. With approximately 25 students divided into six groups, each group surveyed

over 100 peers, totaling 620 respondents. Their independent analyses and recommendations provided valuable insights that shaped GX's strategy.

Student Survey Data and Results

Six student groups each surveyed at least 100 respondents (total n=620). Question formats varied, so only key demographic statistics were standardized (see Figure 33). Over 90% of respondents were Gen Z, and nearly two-thirds were female. Roughly 25% were from the US/North America, 30% from Europe, and a small percentage from Asia and Africa; the remainder were likely from the US or Europe.



(a) (b) (c)

Figure 33: Survey Demographics GX Consumer Behavior Student Survey

Survey results from the six student groups (n = 620) revealed key Gen Z motivations: affordability ranked highest, followed by originality/trendiness, with sustainability in third place. Other factors, such as convenience, quality, variety, location, support for local businesses, and social experience, were less prominent. Around 60% reported regularly or occasionally shopping secondhand or being open to it. For demographics, over 90% were Gen Z, and nearly two-thirds were female; geographic representation included 25% from the US/North America, 30% from Europe, and a minority from Asia and Africa. (Olio, 2023; Figure 33)

Key Insights and Recommendations

The teams supplemented survey data with interviews, organizing their recommendations (summarized below and in Table 30) into seven key areas:

- *Social Media:* Focus on creating more short-form content like TikToks and OOTD posts, use Instagrammable event backgrounds, and engage influencers. Resource limitations are a challenge, but some quick wins are possible.

- *Brand Positioning:* Emphasize normalizing secondhand clothing and highlight the transformative impact of sustainable choices. Develop a clear online content strategy to raise awareness and reinforce the GX mission.
- *Promotion:* Leverage partnerships with influencers and other vintage shops, offer targeted promotions and discounts, and use loyalty programs and public signage. Some ideas, like merch creation, require more resources or may not fit GX's secondhand ethos.
- *In-Person Shopping:* Expand through pop-up events and themed runways at locations like Corvinus to reach broader audiences and reinforce the focus on live, engaging experiences.
- *Online Shopping:* Enhance online presence via Facebook Marketplace and consider an online check-in system for efficiency. Developing a dedicated app is a potential future goal.
- *Operations and Performance Measurement:* Implement quick wins like better mirrors, fitting rooms, and decorations at events. Track environmental and business metrics, including attendance, clothing volume, and social media analytics, to guide improvements.

7.10 Concept Mapping, the Prioritization Matrix and Explanatory Aspects of the Case Study

Unlike the GROW case study, the GX AR study did not use a prioritization matrix in its workshop, which had both benefits and drawbacks. While GROW's matrix enabled clear comparisons, the more open-ended nature of the GX case study required more qualitative interpretation. However, GX's broader and more collaborative approach resulted in greater stakeholder access and proximity. This fostered richer inquiry, aligning with Action Research principles. Overall, seeing different approaches through the prioritization lens reinforces the value of explanatory mixed-methods research.

GCM Concept No. 1: Supply Chain Waste

Supply Chain Waste is defined as reducing waste and resource use in the supply chain delivery system. The GX clothing exchange has a significant potential to reduce waste at every stage of the fashion life cycle—from unsustainable raw materials, manufacturing, and long-distance transport to end-of-life landfill issues in developing countries. Therefore, the fit between The GCM concept and how it applies to GX is very high. While impact is high, ease of implementation is low, with scaling and standardization has many challenges.

Table 30: Key Insights & Recommendations - Consumer Behavior Class Project

Cluster	Insights & Recommendations	Current Status/Challenges
Social Media	Produce more Tik Toks/shorts, use OOTDs (outfits of the day), create Instagrammable background at events, contact influencers of all generations, promote hashtags, online giveaways, polls, quizzes, gamification	No resources for shorts, Heather focused on still photos, Instagrammable background seen as quick win, influencer outreach underway but resource-limited
Brand Positioning	Create brand identity around normalizing secondhand clothing, "Transform your wardrobe [can] transform the world", focus on consumer life cycle, create awareness of over consumption and fast fashion, clear online content strategy	GX already emphasizing secondhand clothing, confirmation of existing ideas, need to structure and execute content strategy
Promotion	Partnerships with influencers, vintage shops, brands, "Fashion flares" of the month, "sneak peaks", giveaways, promotions for first time attendees and students, loyalty cards, signage, flyers with QR codes, partnerships with ESG corporations, refreshments, photo booth, merch and swag	Resource constraints, some ideas unclear or unfeasible (photo booth, merch), some ideas complex to execute, not everything can be done immediately
In Person Shopping	Pop-ups and special events (e.g. Corvinus), events with models, fashion runway, themed events, cultural and holiday events	Ideas resonated with stakeholders, expands live event focus, synergies with free retail space
Online Shopping	Better use of FB Marketplace, online check-in system, app for online shopping (future idea)	Online check-in could improve efficiency and customer experience, app considered for future, too early for app
Operations	Invest in mirrors, enhance check-in with online pre-check, better line management, pay attention to music, fitting rooms, decorations	Quick wins, logistical challenges for fitting rooms, decorations important for holidays
Performance Measurement	Measure kilos of clothes collected, volume recirculated, number of participants, cash collected, monitor social media analytics, implement CRM, measure marketing ROI, standardize customer check-in times	Current focus on environmental metrics, suggestions to expand business and marketing metrics

GCM Concept No. 2: Information Technology

Information Technology refers to using tech to enhance sustainability. Implementing online platforms, like Olio, can efficiently match buyers and sellers, amplifying impact. Network effects driven by a technology platform have demonstrated that scaling can be rapid in the secondhand clothing space, suggesting any kind of meaningful scaling of GX will require technology at its core. Therefore, the fit between The GCM concept and how it applies to GX is very high. However, the proliferation of resale platforms may also reinforce the fast fashion cycle, shortening product lifespans.

Concept No. 3: Product Waste

Product Waste means reducing waste through the use of second-hand clothing. The GX service offering replaces new production with exchanges and reuse of physical products, enabling waste reduction via less manufacturing, less transport and less disposal. Therefore, the fit between The GCM concept and how it applies to GX is very high. However, hosting events does involve some travel-related waste, though it's minor compared to manufacturing and shipping. The ease of implementation is relatively high on a small scale, but scaling remains a challenge.

Concept No. 4: Culture

Culture centers on people's mindsets and organizational mission. GX builds a strong sustainability culture through consistent messaging, environmental measurement (e.g., kg of clothing collected), and volunteer engagement. Additionally capture the concept of a "gift economy" by prioritizing in-person exchange has significant upside potential to achieve sustainability benefits. Therefore, the fit between The GCM concept and how it applies to GX is very high. The impact is also high, but sustained scaling is limited by resources and reliance on volunteers.

Concept No. 5: Suppliers

Suppliers are the participants who donate or exchange clothes, directly offsetting the need for new garments. High-quality donations differentiate GX from other second-hand channels. Therefore, the fit between The GCM concept and how it applies to GX is very high. Impact and ease of implementation are high initially, but scalability is again the main barrier.

Concept No. 6: Circular Manufacturing

Circular Manufacturing improves sustainability by using closed-loop systems. GX's clothing exchange functions as a circular model, and partnerships with recyclers (e.g., turning textiles into building insulation) add value. Therefore, the fit between The GCM concept and how it applies to GX is very high. Impact is potentially extremely high. Developing these relationships during the AT case study was straightforward with the right networks, but inventory limits and scaling are persistent challenges.

Concept No. 7: KPIs

KPIs (Key Performance Indicators) measure sustainability impact (e.g., kg of clothing exchanged, CO_2 avoided, landfill waste reduced). Therefore, the fit between The GCM concept and how it applies to GX is very high. Regular tracking and reporting motivate engagement and awareness; therefore impact is also high. While calculations are currently straightforward and impactful, scalability of measurement systems is a key concern.

Concept No. 8: Design

Design aims to improve sustainability through innovative supply chain and product design. The GX model at its core is about designing a circular supply chain and product offering which leverages circularity in its supply chain to eliminate emissions, physical waste and slave labor. At the same time the success of fast fashion and online secondhand clothing platforms make clear there is a financial opportunity. Therefore, the fit between The GCM concept and how it applies to GX is very high. Ultimately the strategic supply chain design and leveraging technology (e.g., an app) have high potential impact. However, given the risks and resources needed for scale, ease of implementation remains very low.

The GX case study showed strong alignment with the 8 concepts, mainly because its business prioritized eliminating the waste and negative impacts driven by the fast fashion business model. The fast fashion industry faces well-documented challenges, including environmental impacts such as carbon emissions and physical waste, as well as social issues like child and slave labor in emerging markets. From a financial point of view there are well documented opportunities to create financial value by reselling secondhand clothes.

Table 31: Summary of GCM Concept Fit to GX Action Plans

No.	Concept Name	Fit based on Concept Definition	Relevance Based on Impact	Ease of Implementation	Main Challenges	Key Points/Examples
1	Supply Chain Waste	High: Supply chain focus is aimed at minimizing fast fashion waste	High: reduces manufacturing, logistics, and end-of-life waste, and labor issues	High at low volumes; low at scale	Standardize and scale the GX concept globally	Reduces waste at every stage of the product life cycle; mitigates fast fashion landfill waste
2	Information Technology	High: similar supply chain models and concepts require IT to scale	Mixed: Critical to the scalability of both "reusing" and overconsumption	It can happen quickly, but requires resources	Unintended consequences (e.g., reinforcing the fast fashion cycle), scaling efforts	Online platforms (Olio, Vinted); network effect; leveraging existing infrastructure
3	Product Waste	High: the product offering is fundamentally about "reuse" vs. "make a new one"	Mixed: eliminates the need for new clothing, but encourages travel	High at low volumes; low at scale	Ability to scale. "In-person" aspect can produce emissions	Second-hand clothing as a product; events create some travel waste, but less than manufacturing/shipping
4	Culture	High: Explicit cultural approach and success based on prioritizing sustainability	High: strong mission, volunteer enthusiasm	Low due to lack of resources, volunteer model	Resource limitations, volunteer-based model	Mission: "normalize secondhand clothing"; reporting environmental impact at events
5	Suppliers	High: suppliers are integral to "reuse" vs. "make"	High: participants as suppliers, high quality/selection	High at low volumes; low at scale	Difficulty in scaling to the fast fashion supply chain waste level	Exchange participants donate/exchange clothes; high impact, similar to a product
6	Circular Manufacturing	High: the model is fundamentally circular	High: core element of the GX model	High at low volumes; low at scale	Volume of clothing suitable for circularity, inventory/storage limitations	Recycling/down cycling to building materials; partnerships with producers
7	KPIs	High: Waste is carefully measured and reported	High: easy to report, significant for awareness	High	Scalability of measurement and reporting	Measures kg. of clothing, converts to CO2/landfill waste avoided; reported at every event.
8	Design	High: design of both the supply chain and the product service offering is integral to achieving TBL outcomes.	High: e.g., technology, supply chain, service offering	High at low volumes; low at scale	Enterprise risk, low likelihood of reaching scale	Design of strategic supply chain model/app; comparison to Vinted, Olio

Comparing the GCM Concepts to Real-Time Action Plans for GX

The comparison between the GCM prioritization matrix and the GX stakeholder group's concepts revealed a strong alignment, similar to that with GROW. All eight key ideas from the GCM were reflected in the GX strategic supply chain model and plans. While the impact of these concepts is significant, implementing them remains challenging. Notably, culture, supply chain, and waste KPIs, as well as circular manufacturing, consistently ranked as top priorities across both frameworks.

7.11 Project Closing and Future Directions for the GX AR Case Study

The following is a summary of the key outcomes and conclusions of the AR research study from both a practical and scientific research point of view:

Expected Outcomes

- Initiate and form an executive board
- Involve stakeholders and receive input into future ways of working within GX
- Develop a strategic supply chain model for GX
- initiate and create a formal legal structure for GX
- develop a strategy and approach to scale the GX concept
- develop an approach and initiate steps to achieve funding for the GX concept

When comparing the initial plan with what actually happened, several differences and alterations were made to the plan. This is described in Table 32 below:

Table 32: Plan vs. Actual: Activities for GX AR Project

Plan: Develop a Strategic Supply Chain Model	Actual: Reimagine the Strategic Supply Chain Model
Initiate and form an executive board that could provide specific and practical inputs.	Successfully engaged with prospective board members and received practical inputs but timelines and resource requirements underestimated.
Involve stakeholders and receive input into future ways of working within GX.	Successfully engaged the GX volunteers, achieved strong alignment amongst stakeholders, however differing views created roadblocks.
Develop a strategic supply chain model for GX.	The fundamental requirements of a sustainable supply chain from all TBL pillars proved more complex and time-consuming than originally anticipated.
Initiate and create a formal legal structure for GX.	Complexities of the strategic model needed to be solved before a legal structure could be implemented. Complexity turned into a roadblock.
Develop a strategy and approach to scale the GX concept.	In practical terms, scaling GX is a significant challenge; however, based on the emergence of innovative tech platforms and existing infrastructure, many potential approaches are possible but not yet realised.
Develop an approach and initiate steps to achieve funding for the GX concept.	Various approaches, based on commercial and non-commercial strategies, were identified and are being pursued. A work-in-progress.

Actual Project Outputs and Outcomes

The following are the key outcomes and outputs of the project:

- Primary project initiation and brainstorming
- Series of two workshops with volunteers and identification of key strategic drivers as input to the strategic supply chain model
- Development of an Executive Board concept, including outreach to a series of high-profile executives and members of the local business community, offering tangible inputs and willingness to support
- Consumer behavior research project supported by Corvinus University professor and students
- Development of new partners to extend the circular manufacturing model
- Development of several funding strategies and key contacts for acquiring necessary financial and human resources
- An understanding of the key concepts of the strategic supply chain model and a general overall strategic direction, e.g., technology-driven commercial model vs. an NGO or community model

The project met its objectives, with stakeholder feedback confirming key outcomes. Notable results included insights that GX's value lies in experiences and events rather than apparel, which shaped the strategic supply chain model. New academic and industry stakeholders contributed valuable research and partnerships,

supporting circular manufacturing by repurposing surplus clothing. The project faced stakeholder engagement challenges, prompting a review of alternative models and affirming second-hand items and tech platforms as promising options for sustainable supply chains. Findings mapped to GCM principles and prioritization frameworks, with an emphasis on organizational culture, alignment of KPIs, and integration of mission-driven values with commercial goals across social, economic, and environmental dimensions.

8 Cross-case Analysis

This study adopts a sequential mixed-methods approach to compare outcomes across three research sections. The quantitative phase used GCM-based concept mapping to validate eight sustainability concepts from over 80 expert statements. Next, two AR case studies qualitatively assessed these concepts within sustainability-focused supply chains.

Table 33 presents a cross-case comparison: it lists the eight concepts from the quantitative phase and evaluates the key actions and outputs from each AR case study for relevance and fit. Actions and outputs were graded as strongly aligned, directly linked, or indirectly linked, based on their similarity to concept definitions and impact on the TBL pillars—social, environmental, and economic. Strong alignment reflected both strong conceptual fit and organizational impact, direct linkage indicated moderate similarity and relevance, and indirect linkage showed partial correspondence.

Ease of Implementation was excluded from this scoring approach to avoid imposing constraints, as resources may become available later in the same organisation or exist in another organisation for immediate deployment.

This study's cross-case analysis compares GCM findings with AR case study outputs to offer preliminary explanations. KPIs, Supply Chain Waste, and Culture were consistently relevant across all cases, while Circular Manufacturing lacked solid support in one AR study, suggesting its efficacy as a solution is uncertain. Although closely connected to GX actions, Circular Manufacturing's relevance in the GROW case was limited, indicating that further research is needed.

Companies from varied sectors can successfully implement sustainable supply chains using TBL principles by focusing on KPIs, reducing supply chain waste, and fostering a sustainable culture. The alignment of these three concepts across all case studies reinforces their importance, even though circular manufacturing ranked highest, but it lacked clear evidence.

All eight concepts studied demonstrated fit and relevance, though not equally across cases. In GROW, Circular Manufacturing, Suppliers, and Information Technology showed only an indirect fit. Circular Manufacturing matched its definition well, but was not prioritized for implementation. Supplier optimization was more aligned with economic goals, but it also presented social challenges, primarily related to the impacts of cost reduction. Information Technology's fit was mixed, with relevant actions being economically driven rather than directly supporting environmental or social goals.

Table 33: Cross-case Comparison of GCM Concepts to AR Case Studies

Concepts from the GCM exercise ranked	Relevant TBL Supply Chain Initiatives	Relationship	Relevant Strategic Supply Chain Model Elements	Relationship
Circular Manufacturing (6.75 pts)	• Incinerating processed shells in a bio furnace	Indirect	• Scale local exchanges to other geographies • Recycle unwanted cloth to sustainable insulated building material manufacturers	Aligned
KPIs (6.41 pts)	• Measuring and controlling both the batch and the style of the processing of nuts	Aligned	• Measuring and reporting kg of cloth collected, tons of CO2 saved • Creating operational KPIs	Aligned
Supply Chain Waste – (6.30 pts)	• Optimize Seasonal procurement • Improve Cracking capability & capacity	Aligned	• Scale local exchanges to other geographies • Recycle unwanted cloth to sustainable insulated building material manufacturers	Aligned
Culture (6.28 pts)	• On-the-job training	Aligned	• Normalizing the use of second-hand clothing • Creating a face-to-face community based on social experiences and a cause	Aligned
Suppliers (6.02 pts)	• Optimizing Seasonal procurement	Indirect	• Scale local exchanges to other geographies • Increase the number of exchange participants at local exchange events	Aligned
Information Technology (5.97 pts)	• Outsource lab • Optimize Seasonal procurement	Indirect Aligned	• Use existing platforms and technologies to scale existing exchanges and exchange participants, but also encourage consumption	Direct
Design (5.50 pts)	• Increasing capacity in the drying step of the end-to-end supply chain process	Direct	• Use existing platforms and technologies to scale existing exchanges • Creating a face-to-face community based on social experiences and a cause	Aligned
Product Waste (5.45 pts)	• Achieve 16 to 17% SKR (shell to kernel ratio)	Aligned	• Normalizing secondhand clothing eliminates the need to create new clothing and dispose of old clothing, but also encourages travel and transport	Direct

In contrast, GX strongly aligned with GCM concepts due to its focus on clothing exchanges—a product inherently supportive of TBL, mainly the social and environmental pillars. GX's origins as a community activity allowed for a greater emphasis on social and environmental objectives, whereas GROW operated under more business constraints, despite its NGO involvement.

The cross-case analysis reveals that both AR case studies share strong similarities, with all 8 GCM concepts demonstrating significant fit, relevance, and impact. KPIs, Supply Chain Waste, and Culture are the most closely aligned areas, matching high-impact and ease-of-implementation scores from the GCM exercise. The study's limitations are discussed throughout and detailed in the next section.

9 Insights into How to Implement a Sustainable Supply Chain

9.1 Research Findings

The overarching research question guiding this study was: *How to develop an end-to-end sustainable supply chain model that can be practically implemented across various contexts, including different industries, geographies, and all supply chain components?*

To answer the question, the study uses an inductive approach based on GCM, MDS, and HCA methods, developing eight concepts crucial for implementing a sustainable supply chain. The concepts were based on a wide range of management practices identified by experts in the field. In this way, the study answered the first of five secondary questions: *Which SSCM and GSCM practices, tools, and techniques are deployed across supply chains, as potential solutions, that impact enterprises' efforts to be socially and environmentally sustainable and improve sustainability performance?*

Each of the eight concepts was supported by prior SSCM literature. We further validated these GCM concepts through two AR case studies, applying a specific AR case methodology tailored to supply chain management that addresses concerns of rigor and validity often associated with case studies. A key aspect of the AR methodology emphasizes relevance and impact in both Science and Practice, both in the design of AR studies and in the outputs and analytical contributions.

Further enhancing rigor and validity is the explicit need to ensure Access and Trust among both participants and stakeholders. This is critical to ensuring both objectivity and transparency and is driven by mutual interests. These factors played a significant role in both AR case studies, enhancing the rigor and validity of the research design, helping to mitigate traditional weaknesses in case study methods.

While the concepts introduced in the GCM exercise were not new, the research study itself incorporated several innovative elements. During the quantitative phase, assessing the concepts on a two-dimensional scale—Impact and Ease of Implementation—enabled the creation of a prioritization matrix that facilitates practical application. The development of the prioritization matrix helped the study answer the next secondary research question: What are the potential solutions or solution concepts *that can be implemented to facilitate enterprises' desire to redirect their supply chains to be more socially and environmentally sustainable?* Synthesizing the eight concepts into a decision-making model based on management practices enabled practical testing of sustainable supply chain models.

Both the prioritization matrix and the individual concepts received strong validation through the AR case studies, as demonstrated by both within- and cross-case analyses of specific action plans developed to implement a sustainable supply chain in practice.

9.2 Use of Analytical Tools

The third secondary question of this research study was: *What analytical tools can be utilized to help identify and better understand specific problems across enterprises' end-to-end supply chains?* A primary element of the research methods employed in the AR case studies was a selection of analytical tools, specifically VSM, VCA, and CLD. These tools were chosen due to their established track record in practical applications within real-world supply chain contexts. The visual aspect of mapping tools facilitates clear communication and alignment among participants and stakeholders. Given the varied contexts of the case studies, multiple analytical tools were selected for use. Initially, VSM was identified as the primary tool in the overall research design. However, as the AR studies advanced, it became evident that alternative analytical tools were sometimes more applicable.

The use of specific analytical tools helps this study partially answer the fourth secondary question: How can companies create action plans to deploy recognized practices, tools, and techniques to restructure and fundamentally change unsustainable supply chains*?* The process of developing the specific action plans was strongly driven by the analytical tools that we selected. Each of the tools deployed worked on similar principles, visualizing processes and flows to identify challenges, opportunities, and questions. The specific outcome of each of these tools is to create value by eliminating waste and detecting root causes that can be solved. By successfully deploying the selected set of analytical tools, action plans were created.

The use of multiple tools presented both advantages and disadvantages for the study. One advantage was the flexibility to address different contexts and support the particular scientific and practical objectives required by the study and the AR research methodology. Employing a range of tools enabled the identification of specific challenges, opportunities, and questions for further exploration. Although these tools differ, they share similar aims, such as mapping value flows, identifying inefficiencies, and analyzing root causes to resolve problems.

A limitation associated with the choice of analytical tools is the potential inconsistency across the case studies. Despite some similarities, the implementation varied due to differences in the tools themselves. Additionally, there is potential for bias in tool selection, as the authors' expertise influenced choices and was not grounded in a more rigorous initial design.

Regarding limitations and directions for future research, the analytical tools chosen appear to be beneficial; nevertheless, adopting a more standardized approach for their use could enhance the overall and cross-case analyses.

9.3 Interpreting the Cross-Case Analysis

The fifth and final secondary question was: *How do the conceptual models and action planning frameworks for a sustainable supply chain model, developed in the initial strand of research, compare to genuine world supply chains being implemented in practice?*

In the mixed-method sequential explanatory process, the relevance of the case studies was assessed in comparison to the initial qualitative strand only after the development of action plans specific to each case. The model was found to be effective at both the level of the eight concepts and in terms of their applicability and impact for sustainable supply chain implementation, as well as the validity of the prioritization matrix for selecting appropriate concepts and action plans. Each of the eight concepts demonstrated a degree of conceptual fit and relevance with the corresponding action plans. Additionally, three of the top four ranked concepts in the prioritization matrix displayed strong alignment across both case studies. KPIs, Supply Chain Waste, and Culture were the only three concepts identified by cross-case analysis as strongly aligned and highly relevant in both case studies.

Based on the GCM exercise, Circular Manufacturing emerged as the highest-ranked concept; however, it demonstrated strong relevance only in the GX case study, with a limited connection in the GROW case study. While conceptual analysis highlighted its importance, empirical data supported this alignment in just one of two AR studies. Although Circular Manufacturing is already well-researched within sustainable supply chains, its role in the prioritization matrix identified here suggests it is a potential topic for further investigation.

9.4 Critical Learning for Mixed-Methods Research Design

This study highlights several key findings from the GCM exercise and AR case studies. The research adopts a mixed-methods approach—relatively rare in SSCM and GSCM literature—using GCM supported by MDS and HCA, which is an uncommon strategy in this field. Combining two AR studies with robust analytical tools adds further novelty to the work. An additional major strength is focusing on the end-to-end supply chain as a unit of analysis, a recognized gap in the literature. Additional novel elements include spanning multiple industries and geographies, rather than a single entity. Based on participant selection and case sites, the study achieved many of its objectives.

A key strength of the sequential explanatory mixed-methods approach is its rigor and validity, which in this study were achieved in part by selecting the case studies only after the GCM exercise was completed. This

ensured objectivity, as the specific outcomes did not influence the selection of the case studies. Criteria such as Access and Trust are further supported by the requirement for scientific and practical contributions based on both the design and analytical outcomes of the study. This potentially reduces bias that could arise from a parallel case study selection.

However, the approach also had weaknesses. The limited scope and scale meant that research participants were not carefully selected for variables such as industry, geography, or supply chain experience, potentially limiting the relevance of the GCM to the specific case studies. A broader study with predetermined independent variables could yield stronger results; for example, aligning participant selection in the quantitative phase with targeted case sites.

Another limitation is the organizational context: most GCM participants came from large, publicly listed firms that prioritize shareholder value, while the AR case studies focused on smaller organizations that are able to emphasize environmental and social sustainability. Despite many SSCM and GSCM definitions that apply more broadly to all types of organizations, including small, entrepreneurial enterprises and those in emerging markets, these contextual differences suggest areas for future research. Furthermore, while large corporations often prioritize financial goals, small entrepreneurial organizations must first achieve financial stability before advancing environmental and social objectives. This aspect of the TBL outcome is a potential weakness but also a strong learning point, as small, innovative, mission-based organizations need to pay stronger attention to the financial pillars of sustainability.

Selecting GCM participants and case studies sequentially, without thoroughly preselecting variables, was not ideal but necessary due to the PhD's hands-on nature. Preselecting AR case studies before the quantitative strand could have yielded more relevant results. Designing each research strand upfront might have led to clearer outcomes, although the overlapping approach allowed for useful cross-influence between methods. As this is a unique, first-time study, future mixed-methods research would benefit from both its conceptual framework and initial findings.

10 Appendices

10.1 Appendix I: Statements and Clusters from Group Concept Mapping Exercise

Cluster		Statement	EoI (E)	Impact (I)
1. 'Supply Chain Waste': *Reducing waste and resource usage in the supply chain delivery system.*	1	Using 3D printing to print parts for the customer to reduce transport and fuel consumption	2.75	3
	6	Using ISO 14001 to ensure compliance with Sustainable Supply Chain standards	3.25	3.25
	8	Product distribution approaches that utilize rail (more local) versus air (e.g., overseas, China, etc.)	3	3.5
	14	Compliance with relevant regulations for electronic waste	3.25	3.25
	19	Investing in Green infrastructure, e.g., green warehouses and facilities which use renewable energy, water recycling, automated lights, and waste recycling	2.5	4
	28	Deploying Sustainable mining practices	2	3.5
	45	Prioritizing battery electric vehicle (BEV) products to encourage less energy consumption during use	3.75	2.25
	54	Reducing JIT delivery practices, which rely on air transport (less Sustainable) vs rail transport (more Sustainable)	2.25	4
	60	Investing in fuel efficiency for our products and our customers	2.75	3.75
	62	Actively seeking to reduce the carbon footprint of the Supply Chain - mainly for financial reasons	2.75	3.5
	64	Investing in technologies to measure and reduce carbon footprint	3	4
Mean			**2.84**	**3.45**
	2	Supplying information in a timely manner to support Sustainability practices	3.75	3

Cluster		Statement	EoI (E)	Impact (I)
2. 'Information Technology': *Using technology to gain information to help be more Sustainable.*	7	Using equipment (e.g., refrigerators in supermarkets) with sensors to save energy as well as money	3.25	3.5
	15	Sustainable farming which uses sensors to analyze soil and weather enables more efficient production using less water	2.5	3.25
	18	Using software (Eco Vadis) to screen suppliers based on Sustainability criteria and ensure compliance with code of conduct and Sustainability criteria, the Health and Safety criteria, and the circularity of the Supply Chain	2.5	3.75
	31	Promoting a Connected Farm/Connected supply chain, which uses resources more efficiently	2.25	2.5
	38	Implementing systems which allow our Parts & Services division to know where the equipment is located / what phase of the life cycle it is in / and customers' demand for parts and services	3	3
	46	Digitalization, which can help replace parts with less downtime, less material consumption, less space, energy, and fuel	2.5	3.5
	74	Using equipment (e.g., pipe cleaning in pubs, necessary for brand attributes) with sensors to save energy money	2.75	2.75
Mean			**2.81**	**3.16**
3. 'Product Waste': *Reducing waste and resource usage in products.*	3	Eliminating consumables that are contaminated with non-recyclable elements, toxins, etc.	2.5	3
	27	Eliminating the use of unsustainable packaging to meet consumers' demand for convenience	3	3.25
	30	Increased use of Sustainable packaging to meet consumers' demand for reusability and recyclability	2.75	3.75
	39	Utilizing sustainable labelling initiatives, such as fair trade, eco-rating, and FSC labels.	2.75	3
	43	Eliminating plastic materials due to plastic waste, which is difficult and expensive to recycle	1.75	4
	63	Sustainable procurement, which uses less water in the product	2.5	3.25

Cluster		Statement	EoI (E)	Impact (I)
	66	Packaging standards that incentivize producers NOT to use GMOs	2	2
	70	Eliminating GMO-based food products despite the costs of doing so	1.25	1.75
	76	Eliminating unsustainable raw materials for food products, like palm oil, which are cheap	2.75	4
	78	Eliminating products, even if they are profitable, that rely on unsustainable mining practices	1.75	3.5
Mean			**2.30**	**3.15**
4. 'Culture': People's mindset culture	4	Employee benefits program that supports/encourages Sustainable commuting (e.g., EV charging points made available)	4.25	2.75
	5	Using diversity programs to drive awareness of ESG practices through better reporting, making companies more desirable to work with	3.75	2.75
	17	Creating awareness: e.g., the CEO has declared that Sustainability aligns with the company's vision and "must win battles"	4.25	2.75
	22	Renewable initiatives driven by salespeople - via regular monthly brainstormings	4	2.25
	23	Valuing 'Fairness' to stakeholders, including communities, suppliers, etc.	4	2.75
	24	Nurturing a collaborative mindset that promotes businesspeople/functions and Sustainability people/functions working together	3.5	3.75
	26	Creating a Sustainability culture	2.5	4
	32	Management behaviors leading to responsible choices, such as replacing road transport with rail transport	2.5	3.5
	33	Innovation and design mindset that promotes the idea that innovation and Sustainability work together	2.25	3.5
	37	Incentivizing employees to practice Sustainable procurement	3.5	4

Cluster		Statement	EoI (E)	Impact (I)
	40	Incentivizing the use of EVs (electric vehicles) for salespeople	3.5	2.75
	47	Creating Sustainability policies that go "beyond compliance"	3	3
	49	Building Sustainability into the Corporate Mission	3.75	3.25
	55	Management behaviors leading to responsible choices, such as increased use of renewable energy	3.5	3.25
	57	Investing in safety, both for employees and in our products, to provide safety to customers	2.25	2.25
	71	Creating a company culture based on Sustainability, by creating and documenting behaviors, training, etc.	2.5	3
	73	Fostering a mentality and culture that incentivizes investment and innovation and moves away from being cost-conscious	1.5	3.25
	77	Communicating and prioritizing Sustainability messages in standard and high-profile communications	4.5	2.5
	83	PR and business values based on "being Green"	3.25	2.5
	86	"Walking the walk" and not just "talking the talk"	3	2.5
Mean			**3.26**	**3.01**
5. 'Suppliers': *Increasing sustainability by focusing on suppliers.*	9	Not putting undue economic pressure on our suppliers	1.75	2.75
	12	Promoting supply chain solutions to manufacture products based on renewable energy	2.5	2.75
	36	Certifying not only your suppliers but also that your suppliers' suppliers are compliant with Sustainability practices	3.25	4
	44	Certifying supply chains to become Sustainable	3	2.75
	50	Creating awareness or understanding of the cost/benefits or trade-offs from using Sustainable Procurement approaches	3.5	2.75

Cluster		Statement	EoI (E)	Impact (I)
	52	Sustainable procurement practices that lead to better relationships with farmers, which promote more Sustainable practices at the local level	2.5	3.5
	61	Supporting suppliers in their target setting and implementation	2.5	3.5
	69	Regular assessments & audits of suppliers	3.5	3.75
	80	Procurement practices using Sustainability certification and Traceability	2.75	3
	81	Strictly following up on the performance targets of suppliers	3.75	2.25
	84	Procurement practices actively seeking out local packaging solutions	3	3
	85	Eliminating or significantly reducing procurement and outsourcing to LCCs (low-cost countries), which leads to long transport routes and less compliant policies for people and the planet	2	4.25
Mean			**2.83**	**3.19**
6. 'Circular Manufacturing': *Improving sustainability by creating circular manufacturing processes.*	10	Remanufacturing in all product lines	3	3.5
	11	Implementing circularity in our supply chain processes results in more efficient material usage and remanufacturing	2.75	3
	34	Eliminating the inefficient processing of returned materials - e.g., burning motherboards for gold - leads to pollution	2.25	4
	41	Recycling and reuse of materials	3.5	4.5
	51	Moving back to remanufacturing products due to cost and availability reasons	3.5	4.25
	56	Processing and reusing electronic waste	2	4.25
	59	Sustainable procurement practices ensure recyclable steel or other recyclable components	3.25	3.5
Mean			**2.89**	**3.86**

Cluster		Statement	EoI (E)	Impact (I)
7. 'KPIs': *Improving Sustainability through deployment of performance management and measurement systems, e.g., KPIs or other forms of measurement.*	13	Strictly following up on company performance targets	3.25	3
	25	Establishing Sustainability criteria for decision-making in different functions and departments, for example, procurement	3.5	3.5
	29	Considering Sustainability targets in every target-setting group or department	3.75	3
	42	Target setting for Sustainability in a top-down way, to all departments, individual ratings, and compensation	4	2.75
	53	Having a goal to reduce CO2 significantly in the next decade	4.5	2.75
	65	Using KPIs that connect business to Sustainability	3.25	3
	75	Participating in the Dow Jones Sustainability index to enforce accountability on companies to meet Sustainability KPIs from fund managers	3	3
	82	Sustainability goals that impact or correspond broadly to many individual jobs	2.5	2.5
Mean			**3.47**	**2.94**
8. 'Design'*: Improving Sustainability through design processes in product design, new technology, or supply chains.*	16	Using promising new technologies that are still immature or in initial phases of development	1.75	2
	20	Product development practices & processes which support Sustainable Transport	2.5	3
	21	Designing products that use renewable energy	2.25	4
	35	Making [Sustainable products, e.g., battery electric vehicles (BEV) a priority	2	4
	48	Reducing the weight of our products by redesigning parts with less weight, so less fuel is consumed	2.5	2.5
	58	Deploying additive manufacturing (3D printing), which can drive a Sustainable approach by reducing the need for steel	2.5	3

Cluster		Statement	EoI (E)	Impact (I)
	67	Eliminate a centralized manufacturing strategy, which creates more transportation for the distribution of vehicles, parts, and supplies	2	3.5
	68	Prioritizing battery electric vehicle (BEV) products to promote cleaner air in a mine, e.g., less pollution and greater health & safety, less energy during use	2.5	3.25
	72	Product design processes incentivizing refurbishment or Design for disassembly	2.5	3.25
	79	Designing products for a long life	2.25	3.75
Mean			2.28	3.23

10.2 Appendix II: Description of Overlapping Statements and Concepts from the GCM Exercise

Cluster No.	Overlapping Statements	Similarities of Each Cluster	Explanations for Specific Statements and Their Association with a Specific Cluster
1 & 2	1, 8, 28, 46, 54	The '1. Supply Chain Waste' cluster is about reducing waste. The 'Info Tech' cluster is about increasing sustainability. These are similar concepts.	Statement #46 ('2. Info Tech' cluster) emphasizes digitalization. All other statements focus on supply chain-specific practices.
2 & 5	2, 9, 12, 61	The '2. Info Tech' and '5. Suppliers' clusters are both about increasing sustainability and becoming more sustainable.	Statement #2 ('2. Info Tech' cluster) focuses on 'supplying information in a timely manner', an IT concept.
3 & 8	27, 43, 70, 76, 78	The '3. Product Waste' and '8. Design' clusters both pertain to the sustainability of products.	Statements from cluster #3 ('3. Product Waste') pertain to unsustainable elements of products in use rather than in the design phase.
4 & 7	23, 37, 82	The '4. Culture' and 'KPI' clusters are both about improving sustainability through behaviors within an organization.	Statement #82 ('4. Culture' cluster) is about creating goals, which is part of performance management systems, as opposed to culture.
6 & 8	51, 10	The '6. Circular Manufacturing' and '8. Design' clusters both pertain to improving sustainability through better processes.	Statements from cluster ('6. Circular Manufacturing') pertain specifically to remanufacturing, a core principle of circular manufacturing
1 & 2 & 5	6, 5, 84, 85	The '1. Supply Chain Waste' cluster is about reducing waste. The '2. Info Tech' and '5. Suppliers' clusters are both about increasing sustainability and becoming more sustainable, similar concepts.	Statement #6 ('1. Supply Chain Waste' cluster) emphasizes increasing sustainability using supply chain standards such as ISO 14001 certification, rather than collaborating with suppliers or leveraging IT.
1 & 2 & 6	38, 56, 59	The '1. Supply Chain Waste' cluster is about reducing waste. The '2. Info Tech' and '6. Circular Manufacturing' clusters pertain to improving sustainability and becoming more sustainable, all similar concepts.	Statement # 38 emphasizes digital technology, an IT concept, rather than circular manufacturing concepts such as reusing, recycling or remanufacturing.
1 & 6 & 8	16, 67	The '1. Supply Chain Waste' cluster is about reducing waste. The '6. Circular Manufacturing' and '8. Design' clusters pertain to improving sustainability, all similar concepts.	Statements #16 (promising new technologies) and #67 (centralized manufacturing), both part of '8. Design' cluster, emphasize design principles rather than reducing waste or circular manufacturing.
2 & 3 & 6	7	The '3. Product Waste' cluster pertains to the sustainability of products. The '2. Info Tech' and '6. Circular Manufacturing' clusters pertain to improving sustainability and becoming more sustainable, all similar concepts.	Statement #7 ('2. Info Tech' cluster) emphasizes using equipment with sensors, rather than to unsustainable elements of products in use or circular manufacturing processes.
3 & 6 & 8	30, 34, 39, 51, 63, 66, 68	The '3. Product Waste', '6. Circular Manufacturing' and '8. Design' clusters all pertain to reducing waste and increasing sustainability through various aspects of product and process, whether in the design phase or in use.	Statements #34 (material returns) and #51 (remanufacturing) emphasize circular manufacturing processes. Statements #68 '8. Design' cluster) emphasis the design of new products and technologies (battery electric vehicle (BEV).
1 & 3 & 6 & 8	60	The '1. Supply Chain Waste', '3. Product Waste', '6. Circular Manufacturing' and '8. Design' clusters all pertain to reducing waste and increasing sustainability through aspects of product, process and the supply chain itself, whether in the design phase or in use.	Statement #60 ('1. Supply Chain Waste' cluster) emphasizes the carbon footprint of the supply chain itself rather than focusing on the product, process or design elements.

10.3 Appendix III: Strategic Drivers Brainstorming Outputs

CFO / Finance Agenda	
What? (define topic in detail)	*How? (define action to be taken)*
• Set up the function. • Strategy for sources of Finance (debt/equity/grants) • Budgeting & cost accounting • Cash flow (must be clear before CapEx decisions, CapEx – investments & prioritization	• Hire a CFO • CapEx plan & Prioritization • Cash flow & reporting template (in progress via Iveta (owner) & Slavka (driver))
Why? (define impact on GROW's mission)	*Who and when? (Accountable person/ deadline*
• Transparency & reporting • Risk reduction	• Frank (owner) • Bonnie (driver) • Andrew (externa support) • December 2022

Tax & Holding Structure

What? (define topic in detail)	*How? (define action to be taken)*
• Create a holding company for individual companies in Kenya, Slovakia, and the US • Follow the principle of 50/50 of 50/50 joint holding. • Legal compliance AND transparency (not avoidance) • Policy based on tax advice from advisors. • * See "EPZ" issues (Frank) * Who can procure?	• Find a Tax advisor (have local, need a global one) • Ali to meet with the German Chamber of Commerce • Iveta speaking with Lawyers. • "Manage" Tax advisor –watch expenses and value. • Review recommendations • Discuss and agree - shareholders and board
Why? (define impact on GROW's mission)	*Who and when? (accountable person/deadline)*
• Failure to do this right could be disastrous. • Important for new investors • Legal compliance • Understand consequences before holding structure is set up – efficient but transparent. • Consistency with the aims of the new organization	• Allan (owner) / Global aspects • Ali (supporter) / Global aspects • Frank (driver) / Kenya • Iveta (driver) / Slovakia • Discuss now / complete December

Governance & Shareholder Agreement

What? (define topic in detail)	*How? (define action to be taken)*
• One binding agreement • Process for how to govern the agreement. • How to balance flexible vs. formal working structure • How to ensure meetings add value • Structure / lack of may be an issue . . .	• Draft an agreement. • Develop a governance process? •
Why? (define impact on GROW's mission)	*Who and when? (accountable person/deadline)*
• Need to be consistent with our principles. • GROW mission. • Mirrored shareholding	• Use our existing Lawyer. • After Tax advice • Owner (?)

Marketing & Branding

What? (define topic in detail)	*How? (define action to be taken)*
• Distinguish Marketing & Branding from Sales and Sales support. • Common Marketing strategy across all Grow entities, three levels (Global, Kenya, Europe) – separate but aligned messages. • Global planning and outputs – aligned locally. • A Marketing plan, including Positioning, documentation, social media standards, etc. • Differentiate products, e.g., bulk vs. retail, etc. • Also includes Business Intelligence	• Develop a Marketing plan – this will be owned by Ali overall and driven by Veronica on a global level. • Complex implementation of brand infrastructure, including PR storytelling, audience differentiation, channel strategy, etc. • Bonnie and Carol will support this globally and own it locally
Why? (define impact on GROW's mission)	*Who and when? (accountable person/deadline)*
• Ease of content creation in one "center of excellence" • Saving and sharing of resources – better & less duplication, e.g., "the boxes" • Strategic Flexibility (can "pivot" when market shifts demand a reaction). The standard must be ready and flexible. • Operational flexibility (modular approach) (what does this mean?) • Create clarity – one message to the market and key relationships	• Develop a Marketing plan – this will be owned by Ali overall and driven by Veronica on a global level. • Complex implementation of brand infrastructure, including PR storytelling, audience differentiation, channel strategy, etc. • Bonnie and Carol will support this globally and own it locally

New Products / R&D	
What? (define topic in detail)	*How? (define action to be taken)*
• Manage the "process" of new ideas. • Define time-to-market – must be better than 4 to 6 years! • Develop product pipelines. • Develop skills and capabilities – not just products	• Hire and R&D Director (rather than a grant director) • Who will manage Grants (could it fall through the cracks? – locally, this should be R&D) • Commercial focus rather than NGO focused • Create Job description and requirements (based on existing document - needs an update)
Why? (define impact on GROW's mission)	*Who and when? (accountable person/deadline)*
• Critical to the long-term viability of the company • Critical to the Mission • Will create a Commercial mindset. • Will help Grow to become strategic in business rather than opportunistic with Grants. • Help to keep the company and product value local.	• Frank owns. • Andrew supports. • Can this happen in December? Or is January/February more realistic?

Local Organizational Structure	
What? (define topic in detail)	*How? (define action to be taken)*
• Organizational chart • Reporting lines • Clear roles and responsibilities • Rewards and recognition/promotion? • Retention • Leadership development of key talents	• Review existing structure. • Deep Dive key roles • Bonnie – owns Customer Service, Delivery, Ops • Frank owns Vision / NPI / Strategy • Vin owns Sourcing. • Abok owns Production. • Brenda owns Quality
Why? (define impact on GROW's mission)	*Who and when? (accountable person/deadline)*
• Top priority is to fill key roles. • Lessons learned from the previous company	• Individual owners per area above • Needs to be completed by October 2022

Communication Structure

What? (define topic in detail)	*How? (define action to be taken)*
• Meetings and reporting (see meeting structure|) WoW (ways of working) . . . WGLL (what good looks like, e.g., best practice . . .) • Intercompany communication on three levels • Global (board level) – more difficult / lacks structure • Local / EU – goes well. • Local / KE / Eth – goes well. • Functional (Sales, Ops, Fin, Mktg, etc.) • Must learn lessons. • Is there a kind of Matrix needed?	• Create small teams for functions/levels. • Assign areas of responsibility to board members • Create templates to keep reporting streamlined. • Decide frequency
Why? (define impact on GROW's mission)	*Who and when? (accountable person/deadline)*
• Coordination required. • Better decision making • Better outcomes	• Allan must own this. • This is an area Tom can support as a consultant with tools experience

Culture/Mission/Vision

What? (define topic in detail)	*How? (define action to be taken)*
• Articulate the purpose of the project/company • Define operating principles. • An overarching "Why" • Articulation of what / who we are	• Brenda will make a presentation on this topic. • Tom has some templates and a potential supporter (Zsolt) to run a workshop.
Why? (define impact on GROW's mission)	*Who and when? (accountable person/deadline)*
• Will incentivize desired behavior. • Facilitate team feedback. • Will be a vehicle for storytelling – internally and externally	• Brenda (owner)? • Veronika (supporter/ driver)

Team Leadership	
What? (define topic in detail)	*How? (define action to be taken)*
• Drives staff retention and welfare. • How to develop and reward people • How to train staff at all levels	• Focus on welfare (Malika) • Meals, for example
Why? (define impact on GROW's mission)	*Who and when? (accountable person/deadline)*
• Essential for executing on vision, mission, brand promise	• Bonnie • Brenda

10.4 Appendix: Detailed Activity Descriptions

No.	Name	Description	Function
1	High Value direct retail	leave out the traders, sell nuts directly to retail	Sales & Marketing
2	Finance US Orders	Can we use Grow Slovakia - SK EXIM Bank to finance US orders	Sales & Marketing
3	A&B - role of US	US still being set up - WIP	Sales & Marketing
4	Local sales / lower styles	Use lower styles for local sales (Dicing Machine!)	Sales & Marketing
5	Value-added processing	chocolate-covered, roasted, salted - keep value in KE	Sales & Marketing
6	Proactive / Systemized selling	Proactive selling - standard e-mail templates	Sales & Marketing
7	Customized selling	personal but same style - otherwise it is confusing	Sales & Marketing
8	1 e-mail address sales@grow		Sales & Marketing
9	too many customer platforms	i.e., WhatsApp group for one customer	Sales & Marketing
10	Automate correct Invoices	have a control for invoices w/o a checklist (automated)	Sales & Marketing
11	Google Docs / physical board	2x Boards (Google and physical) - see Frank's examples and drawing	Sales & Marketing
12	How to finance retail operations in the USA	need to finance cash flow and returns	Sales & Marketing
13	Timely communication	problems are communicated	Leadership
14	A&B - 3-way matching	Batch/time/weight - time stamps (weight changes!)	Finance
15	Inv boxes not weight	Avoid weight differences, which are relevant for customs, by holding inventory in boxes.	Finance
16	How to Finance?	Determine the optimal level of financing/trade / SCM / CAPEX for trucks, etc.	Finance
17	SK Organic	What can we do with retail / Organic / Slovakia / KE - Mac/CSW	Sales & Marketing
18	Buy Tanzania	Can we buy converted cashews from Tanzania?	Procurement
19	Logistics Tanzania	Can we get it out of Tanzania? Customs etc.	Procurement
20	Cashews in KE?	How many Cashews can we get in KE/Africa	Procurement
21	Pricing	2% more in price = 20% more in profit	Sales & Marketing
22	Cash Bottleneck	Procurement is at a disadvantage	Finance
23	Optimize Gross Margin	How to optimize with considerable seasonal variability 50-20%	Procurement
24	Cash flow modelling	One week's delay can be 500k Cash flow	Finance
25	A&B - Timing & Storage	Timing and storage of purchases	Operations
26	Communication	Use a team for synchronous/asynchronous communications	Leadership
27	Outsource lab	If we outsource the lab, will that impact traceability	Quality
28	Warehouse space	Do we have enough finished goods storage?	Operations
29	Measure downtime	Link to capex and Ops / measure downtime	Operations
30	Capacity model	Frank's capacity model	Operations

No.	Name	Description	Function
31	A - investments - size grader		Leadership
31	B - Invest - discing machine		Leadership
31	C - invest in a second cracker		Leadership
31	D - Raise the roof		Leadership
31	E - Boiler	capacity and environmental	Leadership
32	Capacity in drying	How to get from 70 MT (5 days) to 140 MT: NOW - 3-4 days	Operations
33	Transport is a Bottleneck		Operations
34	How to measure control batch/ style		Quality
35	Cracking capability	10 MT 2x daily 10 days	Operations
36	Cracker BN get to 5 days?	Can we reduce the bottleneck to 5 days?	Operations
37	Maximize wholes	How do we get more wholes	Operations
38	Phase 2 air flow containers	Control insulates 600 (?)	Quality
39	(also 38?) manual paperwork - willing?	How much manual paperwork? Certifications of farmers vs. container documents?	Operations
40	(A&B) size grading before cracking?	needs space	Quality
41	too low on moisture		Quality
42	3EUR = 15%	Getting whole nuts has an outsized impact	Operations
43	Check and benchmark quality	Get improved cracking skills	Quality
44	training tool kit and certs	Certification and training are a key way to lock in farmers	Procurement
45	16-17% SKR (?)		Operations
46	Hire agronomist	Need job description!	Leadership
47	Invest in quality with farmers	This has an outsized impact	Leadership
48	Training securing quality		HR
49	FO has an impact on 10-13-15% recovery	sample 100 buy 70+ (SKR = sound kernel ratio)	Procurement
50	over/under sorting	experience and impact/quality and pricing	Operations
51	Changing customer standards and specs		Sales & Marketing
52	"Aflitoxin meter" on-site lab		Leadership
53	Infrared scan		Leadership
54	Dicing and new styles		Leadership
55	OTJ training	How to do on-the-job training	HR

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