

SUSTAINABLE AND RESILIENT SUPPLY CHAIN

Environmental Accounting and
Management Focus

Edited by Arun A. Elias, Matthew Pepper,
Anand Gurumurthy and Avanish K. Shukla

ADVANCES IN ENVIRONMENTAL
ACCOUNTING & MANAGEMENT

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SUSTAINABLE AND RESILIENT SUPPLY CHAIN

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ADVANCES IN ENVIRONMENTAL ACCOUNTING &
MANAGEMENT VOLUME 12

**SUSTAINABLE AND
RESILIENT SUPPLY CHAIN:
ENVIRONMENTAL
ACCOUNTING AND
MANAGEMENT FOCUS**

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INVESTOR IN PEOPLE

Arun A. Elias dedicates this book to his wife Preetha and his children Ananya and Alaap.

*Matt Pepper dedicates this book to Alison, Camilla, Abigail and Buffy.
Anand Gurumurthy dedicates this book to his gurus, parents (Gurumurthy and Lalitha) and family (Sowmiya, Raghav, Nandhana and Soundarya).*

Avanish K. Shukla dedicates this book to Professor Arun Elias, Abha and Kushagra.

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SUSTAINABLE AND RESILIENT SUPPLY CHAINS: OPPORTUNITIES FOR RESEARCH

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ABSTRACT

*Resilient and sustainable supply chain management is emerging as a focused area of research in the field of supply chain management. This article aims to introduce this edition of *Advances in Environmental Accounting and Management* and explore opportunities for research related to resilient and sustainable supply chain management. A critical analysis of literature found the need for developing the theory underpinning resilient and sustainable supply chains and the need for rich empirical studies. The six articles included in this edition present a variety of contexts including food supply chain, environmental accounting models, energy sector, human resources, modern slavery, horticultural worker exploitation and sustainable transport in jurisdictions like Australia, European Union, Fiji and India. Overall, this edition contributes to both theoretical and empirical literature on resilient and sustainable supply chain management and presents a repository of research that explores this area using an accounting and environmental management perspective.*

Keywords: Resilience; sustainability; supply chain; resilient and sustainable supply chains; environmental accounting

Sustainable and Resilient Supply Chain

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INTRODUCTION

The global economy is passing through a period of major disruptions (Meyer & Li, 2022). The pandemic, environmental impacts linked to climate change and numerous geopolitical issues are disrupting the world at an unprecedented level (Singh et al., 2021). Consequently, supply chains across the globe continue to be affected by these disruptions (Katsaliaki et al., 2021; Olivares-Aguila & ElMaraghy, 2021). Disruptions affect the ability of supply chains to be sustainable. A sustainable approach to supply chain operations incorporates considerations of environmental impacts and natural resources, social implications and public policies beyond the conventional economic focus (Ahmed et al., 2022; Linton et al., 2007; Sarkar et al., 2021). During major disruptions, when core activities face unprecedented uncertainties, and even survival itself is challenged, maintaining supply chain sustainability intensely becomes difficult.

Notwithstanding the daunting circumstances, several sustainable supply chains and supply networks manage to find creative ways to be resilient and survive the times (Elias et al., 2021). Issues around supply chains, especially during disruptions such as the COVID-19 pandemic, have gained research and policy traction in recent times (Ahmed et al., 2022; Salama & McGarvey, 2023). However, specific insights into the resilience of sustainable supply chains and their interconnectedness to accounting and environmental management, especially during disruptions, are sparse in the literature. Thus, worthy of further research to develop our understanding of the issues and their workable solutions.

Accounting for and the management of sustainable supply chains are distinct yet related complex processes. The reasoning perhaps is a contradiction of the traditional value creation perspective and a more inclusive accounting incorporating social and environmental values (Ahmed et al., 2022; Burritt & Schaltegger, 2014). Accounting for resilience and sustainable supply chains is complex, especially under periods of uncertainty. Further, the implications of supply chain activities on the environment, given the interconnectedness of global economies, are by no means an easy task to unravel. Hence, the need for additional insights that can help us understand these impacts, particularly the role of accounting and management in highlighting the implications of supply chain strategies on the environment is timely in addressing global concerns linked to the Sustainable Development Goals (SDGs) (Ahmed et al., 2022; Moses et al., 2022; Moses & Tauringana, 2022).

In this context, the purpose of this chapter is to introduce this edition and to explore opportunities for research related to resilient and sustainable supply chains during and after the times of disruption. After this introduction, the chapter reviews the existing literature on resilient and sustainable supply chains. This is followed by an analysis of the six articles presented in this issue before providing a set of conclusions.

REVIEW OF LITERATURE

This section provides a brief review of the existing literature. As the concept of sustainability continues to gain prominence, organisations endeavour to make their operations and supply chains sustainable. Sustainability is considered as an organisation's responsibility to balance social, economic and environmental issues involved in human development (Kaptein & Wempe, 2001). However, this is not easy to achieve. A core element of social responsibility is community involvement and development. According to Zhalechian et al. (2016), increasing employment opportunities and ensuring a balanced economic development for local communities remain the main goals of social responsibility. However, if an organisation invests in community development, it has to make additional investments. This, in turn, would reduce the profitability of the organisation. Hence, organisations shy away from social commitment despite its importance. Zahiri et al. (2017) reports that the social aspects have rarely been addressed in the literature as well as in practice.

Zahiri et al. (2017) also mentions that the stakeholders acknowledge that if environmental impacts are left uncontrolled, it may result in major changes to the climate and the environmental systems. Hence, governments worldwide are under immense pressure to enact legislation to curb these impacts. Naturally, organisations are forced to bring changes that minimise the environmental impacts caused by their operations and supply chains to demonstrate compliance with such legislation (Ding et al., 2016). Moreover, enacting changes in their operations and supply chains requires companies to increase their investment in the same. They have to redesign their products by opting for environmentally friendly practices such as repair (set the damaged product right and use again), reduce (say, energy consumption), recycle (using recyclable materials), reuse (findings alternate use for the product), refurbish (making the existing product look new) or redesign and revamp of processes such that they consume less energy, and shift to renewable sources (Gharfalkar et al., 2016). They can also find alternative eco-friendly delivery modes or redesign packing materials to reduce environmental impact within their supply chains. These changes also require the organisations to invest, thereby significantly impacting their economic capabilities (Bui et al., 2020).

It is evident from these discussions that 'for-profit' organisations would find it challenging to balance the three aspects of sustainability. In addition, these organisations and their supply chain members have to protect themselves from global financial and other crises and increasing natural and anthropogenic disasters (Fahimnia & Jabbarzadeh, 2016). Therefore, to quickly adjust to disorders and disruptions, today's organisations and their supply chain networks must be more resilient (Tipi & Elgazzar, 2021). In particular, there is a need for management approaches and optimisation strategies to establish resilient and sustainable supply chains (Elias et al., 2021; Fahimnia & Jabbarzadeh, 2016). Adding these resilient aspects to the supply chain would also make the organisations invest in redundant capabilities, thereby disturbing the balance among the three pillars of sustainability. Nevertheless, considering the ever-increasing

disruptions through economic recessions, wars and pandemics, it is inevitable for practitioners and researchers to consider resilience as a crucial dimension of sustainability along with its three pillars (Nüchter et al., 2021).

In this context, researchers have attempted to integrate, balance and establish trade-offs between sustainability and resilience (e.g. Roostaie et al., 2019). Following is a brief review of recent papers that dealt with various issues in designing and developing resilient and sustainable supply chains.

Modelling Resilient and Sustainable Supply Chains

Lotfi et al. (2021) noted that energy supply is essential for supply chain (SC) to function. Hence, they attempted to design a resilient and sustainable supply chain by considering renewable energy sources. They found that organisations having their own renewable energy source in addition to the government-supplied energy can improve resilience and contribute to sustainability. They created a new two-stage robust stochastic optimisation model for a resilient sustainable supply chain network design based on renewable energy (RSSCNDRE). The first stage of their model identifies the facility location and the source of renewable energy, while the second stage defines flow quantity between supply chain components. Their research suggested that equipping supply chain and renewable energy ensures that supply chains become resilient against demand fluctuation, and the use of renewable energy helps in having a sustainable energy resource.

Sazvar et al. (2021) designed a resilient, sustainable supply chain (RSSC) using a case study of the influenza vaccine manufacturer. They used a multi-objective mathematical model to proactively plan for an optimal configuration of supply chain to satisfy customer demands when the firm is highly vulnerable to operational and disruption risks. They included capacity planning in their models to account for redundancy, which contributed to resilience. A robust fuzzy optimisation approach is employed to cope with uncertainties, which was followed by a multi-choice goal programming with a utility function approach to solve a multi-objective model. They found that having redundancies in the supply chain does not always increase the total costs.

Modelling resilient and sustainable supply chains is now a significant literature stream in this area. While there are some interesting works in the area, as shown in the examples above, this literature stream needs further research, covering a broader set of aspects relating to resilient and sustainable supply chain management.

Building Conceptual Foundations

Negri et al. (2021) commented that confusion about concepts, implementation methods and measurements for resilient and sustainable supply chain remains. Hence, they carried out a systematic literature review of this domain. They found that the concept of sustainable supply chains is well established and possesses necessary theoretical foundations. However, supply chain resilience is relatively less mature. They pointed to the need for more clarity on what practices could

jointly advance both areas, as sustainability generally focuses on efficiency, while resilience seeks effectiveness. They identified some research gaps apart from recommending that a performance measurement system need to be developed to assess supply chain sustainability and resilience performance, taking explicit considerations of time horizons considered in these measures.

Negri et al. (2022) collected data from six firms through semi-structured interviews to understand how to develop resilient and sustainable supply chain practices. They also explored how to advance knowledge on synergies and trade-offs between sustainability and resilience. They concluded that firms more explicitly implement sustainability practices, while resilience practices are sometimes neglected. They also highlighted that the most widely implemented practices, such as green logistics, certifications, and eco-design practices, can be considered both sustainable and resilient.

Ruiz-Benitez et al. (2019) studied the impact of lean and resilient supply chain practices on the three dimensions of sustainability. They utilised the aerospace sector and its supply chain as the context. They attempted to develop relationships between lean and resilient supply chain practices with the three dimensions of sustainability through Interpretive Structural Modelling (ISM). They found synergetic effects between lean and resilient practices, with lean practices acting as the driver of resilient practices.

Performance Measurement

Hervani et al. (2022) employed the resource-based view to theorise a performance measurement framework for organisations to measure their supply chain resilience capabilities and social sustainability. This performance measurement framework is based on (i) digitalisation using blockchain technology to improve supply chain process sustainability and resilience and (ii) the valuation of environmental goods to assess social sustainability. They encouraged future researchers to further evaluate the effectiveness of the proposed performance measurement framework and advance it theoretically.

Vergara et al. (2023) found that there is no agreement regarding the measures for performance evaluation of sustainable and resilient supply chains. So, they used a hybrid approach, comprising of a literature review and 'Fuzzy Delphi Technique (FDT)', to identify a total of 15 criteria, and categorised them into four major dimensions of resiliency, economic, environmental and social. Among these dimensions, they found that the most important criteria as visibility, flexibility, supply chain risk management, culture, work conditions and communication.

Research Gap

Although the literature review presented above is brief, a critical analysis found some significant gaps in the literature. For example, it was seen that the theoretical underpinnings of resilient and sustainable supply chains are not fully developed. As resilience and sustainability have already been studied by

researchers from different bodies of knowledge, resilient and sustainable supply chain management can benefit from using theories from other fields, developing it into a multidisciplinary area (Moses & Tauringana, 2022). Additionally, researchers are finding the problems related to resilience and sustainability to be complex and ‘wicked’ (e.g. Braga Marsola et al., 2021). This situation calls for research that takes a holistic approach, based on theories that capture the interconnections between different aspects and dimensions of resilient and sustainable supply chain. Here, systems thinking is proposed as a possibility (Elias, 2022).

Secondly, some of the literature streams discussed in this section will benefit from further research. For example, supply chain modelling researchers who attempted to optimise between sustainability and resilience practices used a number of assumptions and are limited to very narrow aspects such as capacity planning and renewable energy. They also ignored other crucial aspects to reduce modelling complexity. Naturally, the optimal solutions they provided using their models may not deliver realistic results in practice. Another literature stream that calls for further attention is performance and impact measurement. While some researchers have identified a few criteria for measuring the performance of resilience and sustainability in a supply chain, other issues, such as the impact of integrated resilience and sustainable supply chain practices on the firms’ performance, understanding the effect of resilience and sustainability on environmental impact, and short-term and long-term effects of resilience and sustainability on competitive advantage, are yet to be explored.

Thirdly, the field of resilient and sustainable supply chains will benefit from more empirical studies, including quantitative, qualitative, and mixed methods, covering different aspects and problems facing it. For example, researchers can further explore the cost-benefit aspects of incorporating resilient and sustainable practices in operations and supply chains. Implementing sustainability and resilience in the operations and supply chain of an organisation may require significant investment, which tends to pull back the managers of for-profit organisations in effectively achieving sustainability and resilience. Empirical studies exploring the implementation of sustainability and resilience practices from an accounting perspective is another space where this field can grow. For example, the effectiveness of accounting approaches like triple bottom line and carbon tax may differ in different countries and contexts (Moses & Hopper, 2022). Finally, this field would also benefit from in depth case studies highlighting the benefits and challenges of resilient and sustainable supply chains in different parts of the world.

MULTIPLE APPROACHES TO RESILIENT AND SUSTAINABLE SUPPLY CHAINS

This section summarises the contributions to this special issue through six articles. These articles provide multiple approaches to resilient and sustainable supply

chains. Each article is briefly summarised here, and its unique features highlighted.

In the first article, [Krishnan et al. \(2024\)](#) presents a multi-objective optimisation model for an integrated sustainable and resilient food supply chain. They propose four objective functions, considering the three dimensions of sustainability and one for resilience. They solve this model using an augmented ϵ -constraint method. Compared to the previous models available in the literature, they show the trade-off between the sustainability dimensions and resilience. For example, they show that an exclusive focus on economic dimension may negatively impact the environmental, and social sustainability, as well as resilience of a food supply chain. Similarly, when the focus is purely on a single dimension of sustainability or resilience, other dimensions are negatively impacted. Overall, this study aims at helping the decision maker to develop a balanced solution considering both sustainability and resilience. In doing so, it helps in addressing the research gap related to the need for an integrated model in the literature stream pertaining to modelling resilient and sustainable supply chains.

The second article, by [Deo et al. \(2024\)](#), considers the practical implementation of two environmental accounting models, the Triple Bottom Line (TBL) and Carbon Tax. The benefits and drawbacks for each are examined within the context of two Australian case studies. Using discourse and content analysis, this article seeks to provide further understanding of the practical implementation of such disclosure frameworks. In order to achieve transparent disclosures from supply chain actors, the authors advocate for a comprehensive approach that leverages the strengths of both models within an integrated framework. This is considered the most appropriate way forward to foster resilience and sustainability for organisations seeking a more systemic approach to environmental disclosures and offsetting environmental and social impacts in their supply chain network. Overall, this paper helps in addressing the research gap for more empirical studies, by providing an Australian study on the effectiveness of accounting approaches like triple bottom line and carbon tax.

The third article, by [John et al. \(2024\)](#), analyses the cascading impacts of supply chain disruptions on energy sector and in turn on the security of supply of energy from a European Union standpoint. As this is a complex issue, they point to the need for an analysis at a much broader level, using a systems thinking approach to study the effects of supply chain disruptions on energy services. More specifically, they develop a qualitative systems model in the form of a causal loop model to gain further insights into how supply chain disruptions caused by COVID-19 affects the coping capabilities of society, focusing on its effect on critical and essential services. Overall, this study contributes to the literature on sustainable and resilient energy systems, by explaining how the pandemic has prompted discussions about the future of the energy industry and the need for a more sustainable and resilient energy system. It also addresses the research need for additional empirical research, by presenting a European Union perspective on the resilience and sustainability of energy services.

The fourth article, by [Kumar et al. \(2024\)](#), investigates employee learning agility as an antecedent of knowledge sharing in supply chains. They base this study on

conservation resource theory, which postulates that resources of employees like knowledge, ability, and skills act as motivational factors that they strive to protect, retain, and at the same time invest in favour of obtaining more resources. They collected data from participants based in public sector organisations in Fiji, and analysed it using structural equation modelling. The results confirm that employee learning agility is a significant aspect for knowledge-sharing behaviour in supply chains. Overall, this paper adds to the discussion on the importance of human resource management on sustainable and resilient supply chains. It also addresses the research gap for theory development, showing how a theory from another field, namely conservation resource theory from human resource management, can contribute to the theory development on resilient and sustainable supply chain management.

The fifth article, by [Mackay \(2024\)](#), explores supply chain sustainability and its links to resilience through the lens of ethics. Taking sustainability as a wicked problem, this paper proposes the need for systems thinking approaches to acknowledge and navigate the inherent links between ethics, sustainability and supply chain resilience. Two examples within the Australian context, modern slavery legislation and horticultural worker exploitation, are used to illustrate the utility of systems thinking approaches to capture the underlying complexity of these issues. The paper concludes by advocating for a holistic lens to analyse how morality of actions influence supply chain sustainability practices. This paper also contributes to theory development, by using the principles of systems theory, to understand the complexities in resilient and sustainable supply chain management.

The final article, by [Joseph and Elias \(2024\)](#), presents the Kochi Water Metro as a pioneering project in sustainable urban transit, integrating cutting-edge technologies and innovative management practices. This study underscores the project's success in addressing complex urban challenges, like traffic congestion and pollution, through a sustainable transport solution. It highlights the importance of stakeholder collaboration, particularly in government and community engagement, in achieving such transformative initiatives. The Kochi Water Metro emerges not only as a model for sustainable transportation but also as a catalyst for broader urban development and environmental stewardship, but in doing so, acts as a key driver for the development of a more sustainable and resilient supply chain in the region by presenting the benefits of sustainable transportation. Overall, this paper also aids in addressing the research gap for further empirical research in the field, by providing a South Indian case of sustainable transportation.

These six articles highlight different contexts and aspects of resilient and sustainable supply chains. These contexts include food supply chain, environmental accounting models, disruptions in the energy sector, employee learning agility, modern slavery legislation, horticultural worker exploitation, and the case of a water metro. These studies also present the contexts of different geographies like India, Australia, European Union, and Fiji. Overall, they provide a variety of empirical and theoretical approaches to understand the complex nature of resilient and sustainable supply chains.