Received: 30 May 2023 | Revised: 4 September 2023 | Accepted: 5 November 2023

DOI: 10.1002/bse.3637

RESEARCH ARTICLE

Business Strategy and the Environment

WILEY

Investigating sustainability tensions and resolution strategies in the plastic food packaging industry—A paradox theory approach

Amna Farrukh [1] | Aymen Sajjad [2]

[1]FAST, School of Management, National University of Computer and Emerging Sciences, Lahore, Pakistan

[2]School of Management, Massey Business School, Massey University, Auckland, New Zealand

Correspondence
Aymen Sajjad, School of Management, Massey Business School, Massey University, Auckland, New Zealand.
Email: a.sajjad@massey.ac.nz

Abstract

Increasing food waste, natural resource depletion, and climate change issues have forced plastic food packaging (PFP) companies to align their business strategies with sustainability aspects. At the same time, however, companies operating in the food packaging industry continue to face tensions while pursuing divergent sustainability goals simultaneously. Drawing on paradox theory, this study aims to examine paradoxical sustainability tensions in the PFP industry and propose potential resolution strategies to resolve diverse tensions arising from addressing competing social, economic, and environmental concerns simultaneously. To this end, we employed a qualitative research methodology and interviewed 15 senior corporate managers and consultants in the PFP industry. Based on the empirical data, we develop categories of sustainability tensions related to operations and supply chain, recycling, and external stakeholders associated with performing, organizing, learning, and belonging paradoxes. Further, we propose resolution strategies including multi-stakeholder collaboration, research and innovation, circular economy, and use of integrated business strategies which are aligned with the acceptance, spatial separation, temporal separation, and synthesis approaches of the paradox theory. To the best of our knowledge, it is one of the early studies that embrace a paradox lens to investigate the sustainability tensions and resolution strategies in the PFP industry. Further, the study results could guide practitioners and policymakers in the PFP industry to comprehend underlying paradoxical sustainability tensions and promote resolution strategies to address divergent yet desirable economic, social, and environmental considerations simultaneously.

KEYWORDS

integrated business strategies, New Zealand, paradox theory, plastic food packaging, resolution strategies, stakeholders, sustainability tensions

Abbreviations: 5S, seiri, seiton, seiso, seiketsu, shitsuke; ARL, Australian recycling label; D4ACE, designing for a circular economy; DFR, design for recycling; DFSS, design for six sigma; DMAIC, define-measure-analyze-improve-control; GHG, greenhouse gas; LCA, life cycle assessment; NZ, New Zealand; PE, polyethylene; PFP, plastic food packaging; QR, quick response; R&D, research and development; SDG, Sustainable Development Goal; SLR, systematic literature review; VOCs, volatile organic compounds; WOS, Web of Science.

1 | INTRODUCTION

Managing complex and multifarious social and environmental issues such as climate change, natural resource depletion, biodiversity loss, and social inequality has become a challenging endeavor for companies given the paradoxical tensions involved in addressing these wicked problems. While contemporary organizations are increasingly incorporating economic, environmental, and social aspects into their business strategies (Chen et al., 2021; Farrukh et al., 2022a), addressing divergent yet desirable sustainability concerns often creates conflicts and tensions (Hahn et al., 2015). In particular, food waste is a critical sustainability issue (e.g., Dhir et al., 2020; Talwar et al., 2023) that involves tensions associated with simultaneously addressing opposing socioeconomic and environmental aspects (Pålsson & Sandberg, 2022). In this regard, the UN Sustainable Development Goal (SDG) 12–Responsible Consumption and Production emphasizes that food waste is a major environmental sustainability issue (Pauer et al., 2019) and target 12.3 of SDG 12 particularly stresses the need for reducing food waste to 50% by 2030 (Ardra & Barua, 2022). Notwithstanding, in this context, inadequate plastic packaging contributes to a large amount of food waste (Bayus et al., 2016; Büsser & Jungbluth, 2009), and according to an estimate, 20%–25% of household food waste is attributed to food packaging (Bayus et al., 2016). Recent studies have also emphasized the importance of improving packaging in the context of food supply chains to reduce food waste associated with perishable goods such as fruits and vegetables (Pålsson & Sandberg, 2021; Sasaki et al., 2021). According to the New Zealand Ministry for the Environment (2023), approximately one-third of all food produced globally—1.3 billion tons of food—is either lost or wasted each year.

Plastic food packaging (PFP) is primarily used for preserving and protecting food products including dry powder milk, pasta, biscuits, vegetables, fruits, dairy, and meat (Evans et al., 2020; Siracusa et al., 2014). The PFP industry is a major consumer of plastic, hence facing increasing environmental sustainability issues (Gopal & Muthu, 2022). However, the current literature on the management and conservation of plastic products mainly focuses on relatively easily managed objects such as plastic bags compared to complex objects such as PFP, which has gained less attention (Sundqvist-Andberg & Åkerman, 2021). Prior studies suggest that the PFP industry continues to face competing demands simultaneously when addressing environmental, social, and financial objectives both at inter- and intra-organizational supply chain levels (Pålsson & Sandberg, 2021). Accordingly, PFP companies are increasingly seeking new ways and strategies to manage complex sustainability tensions arising while responding to divergent stakeholder concerns and operational requirements (De Koeijer et al., 2017). Such conflicts are recognized as paradoxes that need to be identified, understood, and effectively managed (Pålsson & Sandberg, 2021; Schad et al., 2016). The PFP companies, for example, are facing the challenges of reducing packaging waste, increasing supply chain performance, and minimizing food waste simultaneously (Farrukh et al., 2022b). Dealing with these issues in an integrated fashion creates tension and paradoxes such as excessive packaging helps protect the product and reduce food waste but at the same time increases the environmental burden due to the packaging waste (Pålsson & Sandberg, 2021).

It is pertinent to note that there is a paucity of empirical research exploring sustainability tensions and paradoxes in the real-world context. In particular, only a few studies explored such sustainability-related tensions in the production and operations management context (e.g., Daddi et al., 2019; Harper, 2022; Katic & Agarwal, 2018). In addition, limited research has been conducted in the PFP industry to understand sustainability paradoxes originating from production operations management, material handling, waste management, and multi-stakeholder requirements (Sundqvist-Andberg & Åkerman, 2021). Therefore, in-depth exploration is required to obtain an understanding of the emerging sustainability paradoxes in the PFP industry and how best such tensions be managed in the organizational context towards achieving sustainability (Pålsson & Sandberg, 2021, 2022).

To address the above research gaps, we adopted a qualitative research methodology, and semi-structured interviews were conducted with senior corporate managers representing PFP companies in New Zealand (NZ). Further, we interviewed senior consultants having experience in implementing operational, environmental, and circular economy practices in the PFP industry. We selected the PFP industry owing to its environmental implications primarily linked to the extensive use of petroleum-based raw materials and increased greenhouse gas (GHG) emissions that cause human toxicity and also contribute to marine, soil, and air pollution (Ahamed et al., 2021; He et al., 2021; Horodytska et al., 2018). The NZ PFP industry is facing several sustainability issues including food waste, plastic waste, gaseous emissions, and landfill issues (Diprose et al., 2023; Farrukh et al., 2023b; Sharp et al., 2021). According to the NZ's Ministry for the Environment (2022), food waste is significantly contributing to GHG emissions. Approximately 157,398 t of food waste per year is generated in NZ, which is equivalent to a value of NZ$1.17 billion per year. Much of this waste ends up in landfills releasing around 409,234 t of carbon emissions such as methane (Diprose et al., 2023). In addition, a recent recycling ban on plastic waste from China has also created additional recycling-related challenges on the waste management infrastructure of NZ since a large quantity of plastic waste was sent to China for recycling before January 2018 (Farrukh et al., 2023b; Perrot & Subiantoro, 2018). While the PFP industry in NZ is continuously working on sustainable packaging materials, it is still facing issues related to the processing, identification, and health and safety aspects due to the contamination in the PFP materials such as bioplastics and compostable packaging (Diprose et al., 2023). Similarly, despite the government efforts towards improving recycling practices, providing funding opportunities, banning single-use plastic, and landfill levy for plastic waste, the PFP industry is struggling to achieve a circular plastic economy (De Bhowmick et al., 2021; Sustainable Business Network, 2021). The lack of reliable data on recycling volumes is also creating challenges to identify potential opportunities for reusing, recycling, and remanufacturing materials and making effective funding allocation decisions (Sustainable Business Network,

2021). It is further noted that owing to the lack of industrial composting standards in NZ, mainly overseas standards are followed which are not adequate according to the compostable packaging requirements (Ministry for the Environment, 2022).

In recent years, scholars have utilized a paradox theory lens to study paradoxical tensions to investigate competing social, economic, and environmental issues in varied organizational settings. For instance, a study by Erthal et al. (2021) draws on the paradox theory to examine the management approaches to address the organizational tensions in implementing lean manufacturing in the healthcare industry. Conversely, Dieste et al. (2022) investigated the organizational tensions in the execution of Industry 4.0 and different resolution strategies to manage these tensions using a systematic literature review methodology. Accordingly, we have adopted a paradox theory to examine the underlying tensions faced by the PFP industry and propose resolution strategies to manage the sustainability paradoxes. In particular, the paper addresses the following research questions.

RQ1. What are the key sustainability tensions in the New Zealand PFP industry and what are their underlying reasons?

RQ2. How do firms in the New Zealand PFP industry address sustainability tensions?

The study offers valuable contributions to the current literature. First, this study provides scholars with an opportunity to gain fresh insights into the continuous process industry—PFP industry that is currently facing serious sustainability tensions. Second, the study contributes to the food packaging literature by examining the paradoxes through an empirical study in the NZ PFP sector using the knowledge of the practitioners and consultants. Third, building on the paradox theoretical lens, this study explores various sustainability tensions related to operations and supply chain, recycling, and external stakeholders and different resolution strategies including multi-stakeholder collaboration, research and innovation, circular economy, and use of integrated business strategies. Fourth, the study offers practical implications for corporate managers, consultants, and policymakers in understanding the conflicting requirements of stakeholders and aids in decision-making while maintaining economic, environmental, and social performance simultaneously.

2 | LITERATURE REVIEW AND THEORETICAL BACKGROUND

A systematic literature review (SLR) was carried out to understand the pressing sustainability tensions in the PFP industry. SLR is a distinct, coherent, and widely used scientific approach to creating knowledge and information in a particular subject domain (Petticrew & Roberts, 2006). The SCOPUS database is selected as it produces reliable results while exploring multidisciplinary topics (Farrukh et al., 2022b; Sundqvist-Andberg & Åkerman, 2021). It is also considered as one of the largest databases including books, conference proceedings, and scientific journals, hence suggested by several scholars (e.g., Farrukh et al., 2022b; Parmar & Desai, 2020; Seuring & Müller, 2008). In addition, it covers more than 30,000 titles compared to the Web of Science (WOS) with about 12,000 indexed journals, thereby covering 20% more journals than the WOS (Aksnes & Sivertsen, 2019; Falagas et al., 2008; Gebre et al., 2021). While using the SCOPUS, we only focused on peer-reviewed journal articles to ensure research rigor excluding conference proceedings, books, editorials, and book chapters. In addition, we included articles published in the English language; however, the time duration was not specified to obtain a maximum number of articles (Moraes et al., 2021). The search was carried out in January 2023 using distinct combinations (such as packaging (OR flexible packaging OR plastic packaging OR plastic food packaging) AND tension (OR trade-offs OR paradox) AND plastic AND food) of the keywords including "packaging," "paradox," "tensions," "plastic, food," "plastic food packaging," "trade-offs," "plastic packaging," and "flexible packaging." The keywords were searched in the title, abstract, as well as keywords list of the articles.

As a result, 71 records were identified which reduced to 43 journal articles after applying the inclusion criteria. Out of these articles, 10 were not accessible which limited the list to 33 articles. After removing the duplicates, the titles and abstracts of the articles were read through to ensure their relevance to the research objectives, which further reduced the list to seven journal articles. The content analysis technique was used to analyze the selected articles and extract pertinent information. Moreover, a snowballing approach was used to find additional articles from the references of the selected articles. Following this, a further six articles were identified resulting in the final list of 13 articles. In the final phase, the results were reported including the sustainability tensions and resolution strategies which are discussed below. Figure 1 presents the PRISMA (preferred reporting items for systematic reviews and meta-analysis) diagram for reporting systematic reviews.

The following sections present a review of the literature, research gaps, and theoretical underpinnings.

2.1 | Plastic food packaging and sustainability challenges

The food packaging industry is one of the significant industries in the synthetic plastic packaging area (Attaran et al., 2017; Gopal & Muthu, 2022; Venter et al., 2022). Among the different packaging materials (such as plastics, paper, and glass), a wide variety of plastic is used for food packaging due to their benefits of convenience and food protection which have led to their increasing demand (Otto et al., 2021; Truong, 2019). To this end, it is estimated that plastic production will reach the level of 155–265 megatons (Mt) by 2060 at the current growth rates (Lebreton & Andrady, 2019; Sundqvist-Andberg & Åkerman, 2021). The increased consumption of the PFP has resulted in negative environmental impacts which have raised serious concerns for manufacturers, recyclers, customers, consumers,

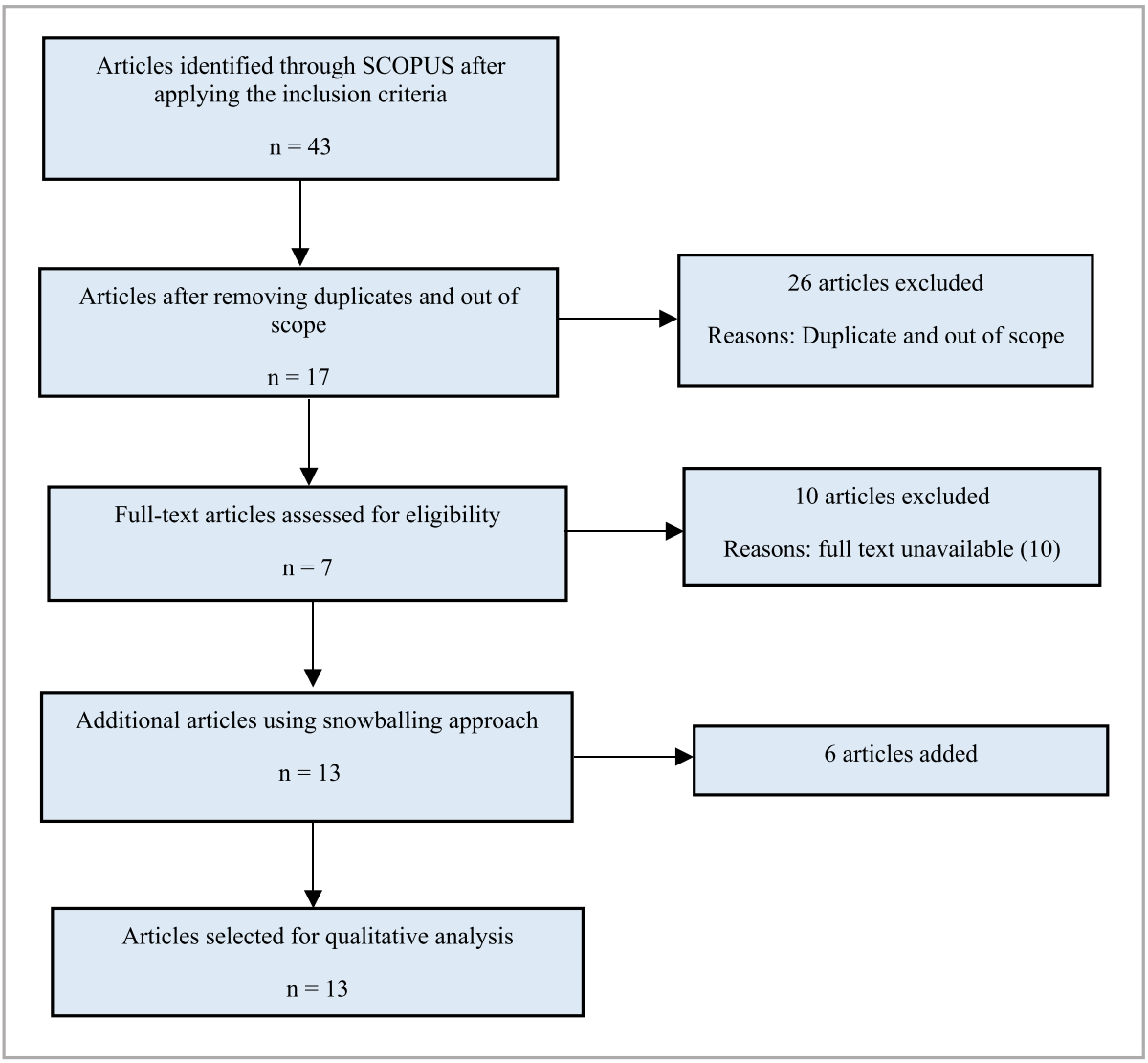

FIGURE 1 PRISMA diagram.

and policymakers (European Commission, 2018; Sundqvist-Andberg & Åkerman, 2021). The environmental issues associated with PFP manufacturing and consumption include marine pollution, solid waste generation, soil pollution, air pollution, and natural resource depletion (Ahamed et al., 2021; Farrukh et al., 2023b; Kramm et al., 2022; Pathak et al., 2023). In addition, PFP waste leads to other environmental problems such as ingestion by animals, blockage in the drainage systems, and soil depletion (Farrukh et al., 2022b). It is worthwhile to note that due to mismanaged plastic waste practices, around 4.7–12.8 Mt of waste enters the world's oceans every year which has become a global environmental issue (Jambeck et al., 2015; Sundqvist-Andberg & Åkerman, 2021). One of the major reasons for marine plastic pollution is found to be associated with the food packaging industry (Miller et al., 2018; Sundqvist-Andberg & Åkerman, 2021). From this perspective, a study conducted in Germany highlighted that riverine litter mainly consisted of 30.5% plastic, of which 44% was associated with food packaging (Kiessling et al., 2019). Similarly, a longitudinal study conducted on the mainland beaches of California revealed that a large quantity of debris is composed of small plastic fragments and single-use plastic associated with food packaging (Miller et al., 2018).

2.2 | Paradox theory

The paradox theory focuses on the contradictory yet interrelated elements that appear to be logical in isolation but irrational and incoherent when placed against each other (Poole & Van de Ven, 1989; Schad et al., 2016; Waldman et al., 2019). According to Ketchen and Hult (2007), paradox theory provides a suitable lens to comprehend organizational complexities concerning achieving multiple performance objectives and addressing desirable yet competing stakeholders' interests. Paradox theory enables researchers and practitioners to examine an organization's incompatibilities holistically

(Pålsson & Sandberg, 2021). Further, Van der Byl and Slawinski (2015, p. 73) posited that "paradox theory holds promise for finding creative solutions to some of our most vexing sustainability challenges."

The literature distinguishes tensions into those that can be settled (non-paradoxical) and those that are recurring in nature involving a persistent contradiction between interdependent elements that cannot be resolved (Lewis & Smith, 2014; Schad et al., 2016). The latter are referred to as the paradoxical tensions that persist over time, and their underlying factors remain impervious to resolution, even in highly vibrant environments (Pålsson & Sandberg, 2022; Schad et al., 2016). Smith and Lewis (2011, p. 383) further classified organizational tensions into four categories—learning, belonging, organizing, and performing paradoxes. Performing paradoxes focus on the tensions originating from the inherent complexity of different organizational units, as well as contradictory goals while responding to varied stakeholder concerns (Jarzabkowski et al., 2013; Pålsson & Sandberg, 2020). Organizing paradoxes arise due to competing organizational processes to achieve the desired results (Lewis, 2000; Schad et al., 2016). By and large, organizations comprise different subunits working independently and interdependently (Jarzabkowski et al., 2013; Pålsson & Sandberg, 2020) which leads to creating paradoxes due to conflicts between trust, commitment, and innovation on one side and discipline, productivity, and authority on the other side (Pålsson & Sandberg, 2020). Belonging paradoxes occur as a result of tensions regarding values and roles within and between organizations (Pålsson & Sandberg, 2020). These include the tensions between individual and collective affiliations such as supply chain managers are representative of their companies and also have their values which create tensions (Smith & Lewis, 2011). Finally, the learning paradoxes originate when new knowledge is established to renew and change an organization's existing operational activities, thus creating tensions between replacing old experiences with new practices (Smith & Lewis, 2011).

Furthermore, scholars have suggested resolution strategies to transform organizational tensions into manageable solutions (Dieste et al., 2022; Schad et al., 2016). First, an acceptance strategy suggests that managers need to consider contradictory aspects together while favoring one side over another (Hahn et al., 2015). Such an understanding means that favoring one demand over the other would create new problems at other places or points in time (Lewis, 2000; Poole & Van de Ven, 1989). The acceptance approach emphasizes that the organizations recognize the paradoxes and "live with it" (Poole & Van de Ven, 1989, p. 566) by creating awareness and gaining acceptance of these tensions by different stakeholders which leads to creating a balance between the stakeholder objectives. Second, spatial separation focuses on managing the paradoxes by separating the objectives of organizational units and stakeholders. It also emphasizes that paradoxes can be managed by prioritizing organizational and individual objectives separately or addressing the paradoxes at different plants, locations, or offices located in different regions or countries (Joseph et al., 2018). Third, a temporal separation strategy emphasizes that an organization can favor one side of the paradox at a point in time followed by favoring the other side of the paradox at another point in time (Pålsson & Sandberg, 2021). Fourth, a synthesis strategy considers applying new perspectives to remove paradoxical tensions by meeting multiple demands simultaneously (Hahn et al., 2015).

2.3 | Sustainability tensions in the PFP industry and resolution strategies

The PFP industry is facing complex sustainability tensions due to the differing requirements, interests, and values of multi-stakeholders (Sundqvist-Andberg & Åkerman, 2021). The SLR results revealed paradoxes emerge due to the PFP characteristics, operational requirements, and stakeholders' concerns (Pålsson & Sandberg, 2021; Sasaki et al., 2021). Pålsson and Sandberg (2021) examined tensions in the food supply chain of Swedish companies which included packaging feature X versus packaging feature Y, standardized range of packaging versus customized packaging, resources for formal training versus informal training with minimal resources, and packaging value in subunit A versus packaging value in subunit B. Similarly, Sundqvist-Andberg and Åkerman (2021) investigated PFP industry tensions through an integrative and SLR methodology. These tensions include increasing use of bio-based materials versus the negative environmental impact on land and freshwater use, food safety versus human health issues due to nanomaterials, food protection versus overpackaging, food safety and delivery versus unsustainable consumption culture, and increase in recycling and recovery versus energy consumption and exposure to bioaerosols (such as bacteria, fungi, and endotoxins).

An experimental study performed in Japan implemented the life cycle assessment (LCA) methodology to determine the trade-offs between reducing food loss during the transportation of peaches and increasing energy consumption and material consumption related to surplus packaging (Sasaki et al., 2021). The study results emphasized that there should not be an excessive reduction in packaging to decrease the environmental impact as it could rather increase the environmental impact in the form of food loss. The SLR results also demonstrated that a few studies examined the tensions related to consumer behavior. For example, a research study conducted in Australia determined the consumers' perception regarding the role of packaging, packaging design, packaging label, food waste, and packaging waste (Langley et al., 2021). The study investigated the trade-offs between food waste and packaging waste. Similarly, a longitudinal study conducted in Thailand investigated the consumers' perceptions of packaging attributes versus increased cost (Jinkarn & Suwannaporn, 2015). The study results revealed that consumers prefer the additional attributes of the packaging such as opening and structure features over the increased price of the product.

Our SLR findings showed that only a few studies have suggested solutions to manage the underlying tensions through strategies such as acceptance, spatial separation, temporal separation, and synthesis approach. For example, one study emphasized the awareness and understanding of the trade-offs between food loss and the environmental burden associated with the peach life cycle (Sasaki

et al., 2021). Another study highlighted the awareness among consumers as an acceptance strategy, reducing, reusing, recycling, and recovery of plastic packaging as a spatial strategy, and the extended producer responsibility and stakeholder collaboration as a synthesis strategy (Sundqvist-Andberg & Åkerman, 2021). Similarly, Pålsson and Sandberg (2021) suggested strategies to manage the tensions in the food supply chain including the acknowledgment of the contradictory sustainability goals as an acceptance approach and management of the packaged products with various characteristics as spatial and temporal strategies. In addition, the study also suggested the synthesis approach by using the combination of operational practices such as leagile to simultaneously manage the economic and environmental sustainability issues where lean strategy focuses on reducing waste and cost and agile strategy emphasizes increasing responsiveness.

2.4 | Research gaps

Overall, the SLR results revealed that limited studies have investigated sustainability tensions in the PFP industry (e.g., Pålsson & Sandberg, 2021; Sasaki et al., 2021; Sundqvist-Andberg & Åkerman, 2021). However, among the sustainability tensions, the majority of the studies emphasized the trade-offs related to food waste and managing the environmental burden of overpackaging, while ignoring the other paradoxical and non-paradoxical tensions faced by the PFP industry (Sasaki et al., 2021; Sundqvist-Andberg & Åkerman, 2021; White & Lockyer, 2020).

The results highlighted that out of the limited studies, only two studies have addressed all the paradoxes including performing, belonging, organizing, and learning (Pålsson & Sandberg, 2021) while other studies have addressed only one dimension of the paradox theory such as performing paradoxes (Jinkarn & Suwannaporn, 2015; White & Lockyer, 2020).

The SLR results further demonstrated that some studies predominantly focused on the acceptance approach to recognize and understand the sustainability tensions (Langley et al., 2021; White & Lockyer, 2020). Accordingly, there is a dearth of studies that consider the solutions to manage the sustainability tensions in an integrated way utilizing acceptance, temporal, spatial, and synthesis strategies (e.g., Pålsson & Sandberg, 2021).

3 | RESEARCH METHODOLOGY

To fill the above research gaps, we adopted an exploratory qualitative research design to examine sustainability tensions and determine resolution strategies in the PFP industry. We employed a purposive sampling technique that fosters adequate participant selection and enables an improved understanding of the research phenomenon (Saunders et al., 2015). Accordingly, we recruited senior corporate managers and consultants who hold extensive knowledge of the sustainability challenges faced by companies operating in the PFP industry. Further, consultants' opinions were used to complement and corroborate the managers' viewpoints (Johnstone, 2020). The criteria for selecting the participants include (a) must have experience in the PFP industry of NZ and (b) must have implemented operational, environmental, and circular economy practices, with more than 2 years of experience. The consultants were contacted after reviewing their profiles on LinkedIn and were requested to participate in this research study. In addition, the human resource department of the PFP companies was contacted to suggest the participants from operational departments in these companies. The information regarding the research study, objectives of the study, interview type, length of interviews, and interview questions were shared with the participants as per the ethical considerations. In addition, the participants' consent was obtained prior to the interviews. The following Table 1 provides the details of the research participants.

3.1 | Data collection and analysis

For the data collection, semi-structured interviews were conducted via Zoom and Skype, and the average duration of the interviews was about 1.5 h. An interview guide was developed based on the extensive literature review which included questions related to investigating the sustainability paradoxes in the PFP industry such as: "What types of tensions your company faces while ensuring product safety along with environmental sustainability aspects? How do you address the trade-offs (or tensions) amongst the environmental, economic, and social sustainability aspects?" In addition, probing questions were asked to obtain relevant information and interesting insights into the research phenomenon.

We utilized a thematic analysis approach to develop the themes which is a "method for identifying, analyzing, and reporting patterns (themes) within data" (Braun & Clarke, 2006, p. 79). One of the characteristics of the thematic analysis is that it supports in analyzing the qualitative data analysis following the abductive approach which is a combination of both inductive and deductive coding processes (Graebner et al., 2012). This approach enables the researcher to logically explore the research phenomenon and helps in theory building (Kovács & Spens, 2005). The data collected from the senior corporate managers and experts were treated collectively (Johnstone, 2020). For data analysis, the interview data were first transcribed using the software Otter.ai, which provides speech-to-text transcriptions (Paulus, 2023). Transcriptions were reviewed several times to understand the meanings, ideas, and patterns emanating from the data which facilitated identification and building understanding of sustainability tensions and resolution strategies (Braun & Clarke, 2006; King, 2004). The transcripts were also sent to the participants for validating and highlighting any missing information which further ensured the reliability and validity of the information (Yin, 2018).

Transcribed data were transferred into Microsoft Excel sheets to organize the information which also aided in the systematic manual coding of the data comprising the priori and emergent codes resulting from the thematic analysis process (Castleberry & Nolen, 2018;

TABLE 1 Details of the research participants.

Participants' codes	Position	Type of expertise	Years of experience
PN-A	Production manager	Operational and environmental	17
PN-B	Packaging consultant	Food packaging	4
PN-C	Supply chain manager	Supply chain operational and environmental	5
PN-D	Senior environmental consultant	Environmental sustainability	15
PN-E	Quality assurance manager	Food packaging quality and safety	13
PN-F	Chief executive officer	Operational, environmental, and circular economy	3
PN-G	Health safety and environmental manager	Operational, occupational safety, and environmental conservation	25
PN-H	Operations manager	Operational and environmental	26
PN-I	Packaging consultant	Sustainable packaging	28
PN-J	Quality assurance manager	Food packaging quality and safety	7
PN-K	Research and development manager	Innovation and research	6
PN-L	Supply chain manager	Operational and environmental practices	4
PN-M	Senior packaging consultant	Operational, environmental, and circular economy	4
PN-N	Health safety manager	Operational, occupational health, and environmental safety	3.5
PN-O	Principal consultant	Operational and environmental	20

Ose, 2016). Different color schemes and sorting features of Microsoft Excel were used to recognize and group similar data (Bree & Gallagher, 2016; Ose, 2016). The codes were arranged into first-order codes which are grouped under the second-order themes, and then the second-order themes were synthesized into the main dimension of sustainability tensions and resolution strategies (Braun & Clarke, 2006; Farrukh et al., 2023b; Reay et al., 2017). For example, various first-order codes such as waste disposal, material loss, natural resource depletion, lack of technology, and food safety are combined under the second-order theme of recycling-related tensions leading to the main dimension of sustainability tensions. Figure 2 provides an overview of the thematic analysis process.

4 | FINDINGS

4.1 | Sustainability tensions in the PFP industry

The analysis of the findings revealed diverse sustainability tensions related to operations and supply chain, recycling, and external stakeholders, both paradoxical and non-paradoxical.

4.1.1 | Operations and supply chain-related tensions

The findings disclosed various operations and supply chain-related tensions linked to operational costs and efficiencies, product shelf-life, as well as inventory optimization, and logistics concerns. The participants revealed that while recycling plastic waste can help mitigate negative environmental impacts, it incurs additional costs which present challenges in terms of achieving economic sustainability. According to PN-C, "plastic waste is costly to recycle." PN-G asserted that "our company tries to offer sustainable options for those products which are difficult to substitute. However, it is challenging to get customers to uptake on what the options are, because they often cost a lot more." Similarly, the packaging expert PN-I pointed out that some PFP manufacturers are more concerned with reducing their manufacturing costs prioritizing unsustainable materials such as petroleum-based raisins since sustainable (e.g., vegetable-based inks) or biodegradable materials are expensive.

The findings further indicated that while packaging is imperative to enhance product shelf-life, ensure product quality, and reduce or eliminate food waste, inadequate packaging characteristics and materials can lead to shelf-life issues, thus creating paradoxical tensions. For example, the shelf-life of fresh vegetables is limited and if these are not properly packed, then they can end up in landfill which can increase carbon emissions. According to PN-N, "we always keep safety and hygiene paramount. However, after reducing the amount of plastic packaging, we say, "hey, before, you might have had 120 days of shelf-life, now it is 80 days or 70 days." While the use of sustainable packaging materials reduces plastic waste, it also reduces the shelf-life of the products causing unintended environmental risks of food waste. PN-K pointed out, "when sustainable materials are used, the shelf-life is reduced from 120 days to 60 days." In addition, there are paradoxical tensions related to the use of compostable packaging since it can only be used for dry products and cannot hold much weight compared to plastics. PN-N explained that although customers are switching to paper from plastic, the shelf-life is affected since "paper is more brittle than plastic." For example, if chocolate or lettuce is packed in a paper bag, it is not going to last very long as compared to plastic packaging.

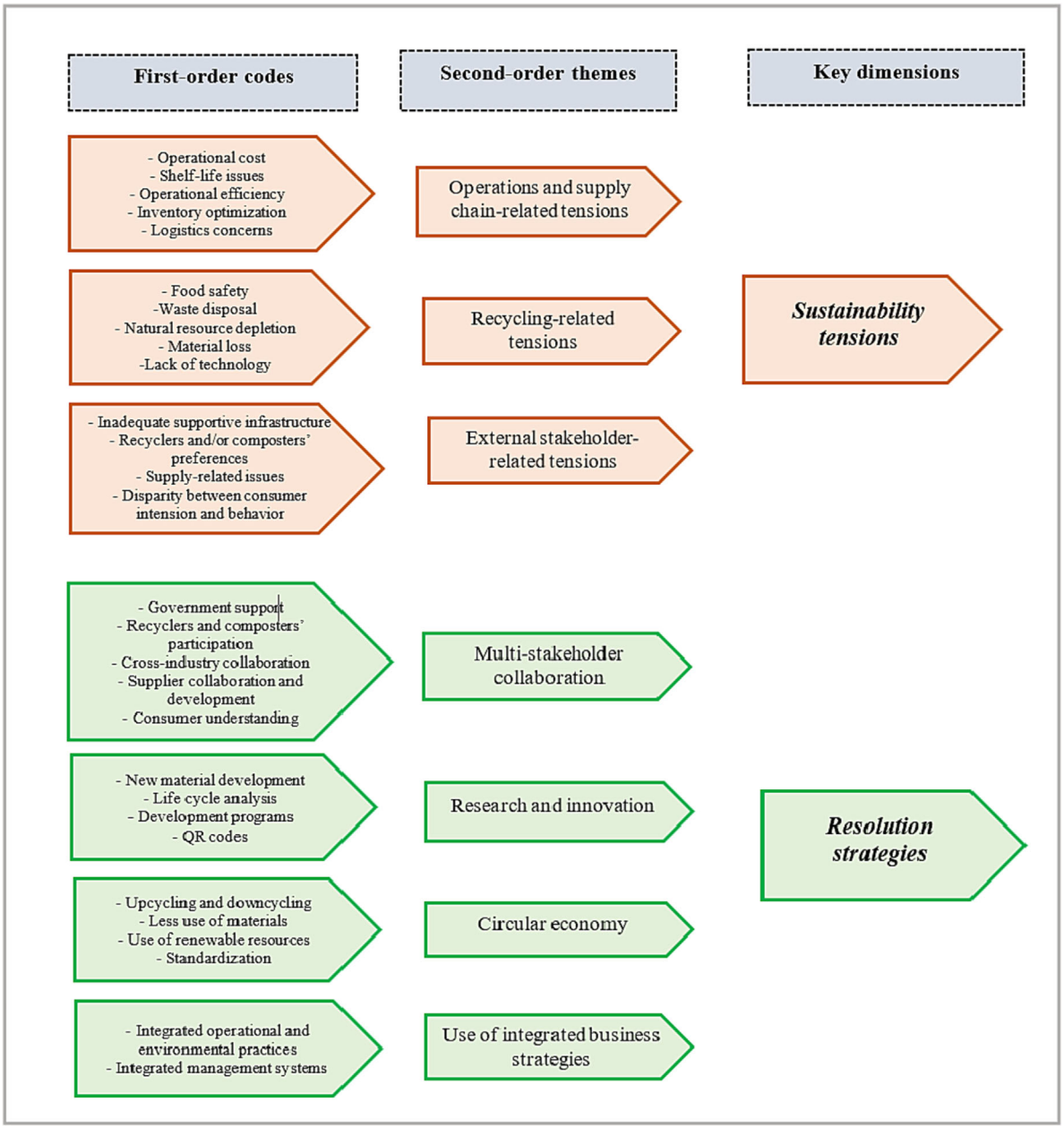

FIGURE 2 Thematic analysis process.

On the other hand, the participants highlighted the non-paradoxical tensions related to production efficiencies while managing the sustainability aspects. While unsustainable materials such as solvent-based inks are not expensive compared to sustainable materials (e.g., vegetable and water-based inks), these inks release volatile organic compounds (VOCs) and air pollutants which pose significant risks to the environment and workers' safety. To address this issue, companies could use water-based inks; nevertheless, the brightness of the image on the package is reduced leading to a quality issue as customers also prefer the appearance of the packaging. PN-K indicated that "when you use sustainable materials for tea packaging, it is not attractive like a traditional polyethylene (PE) tea packaging. So, in terms of [maintaining] aesthetics, it creates a paradox." Further, PN-F emphasized that the PFP companies are also using vegetable-based inks in their printing process; however, these are not quite so shiny. Likewise, the water-based inks need to be dried by using hot air which slowdowns the printing process. In addition, productivity declines when compostable packaging is utilized. According to PN-N, "it takes longer to produce [sustainable packaging] compared to a non-compostable product."

Since the PFP companies offer a range of different packaging solutions to fulfill the customers' requirements for different grades of products, they need to maintain the inventory of these products which often leads to conflicting economic and environmental issues. PN-C emphasized, "economically, it does not make sense to buy narrow where the work is very spontaneous. Therefore, it is quite hard to

figure out to handle a variety of products." PN-J noted that "from the flexibility side of things, more inventory sitting in the rack increases cost. We have to pay for those things to sit on the rack for a few months before we use them." At the same time, excessive inventory requires warehousing that, in turn, results in increased energy consumption, as well as poses extra risks associated with material perishability and obsolescence causing environmental concerns.

The participants also affirmed paradoxical tensions related to the logistics side of the supply chain such as companies' logistics department focusing on economic buying and wanting to order limited products that can be used for every single customer. However, in the case of fulfilling customers' requirements of different grades and shades, the companies need to order at least "12 different solutions coming from different places around the world which create tensions from the shipping perspectives," PN-N noted. Similarly, in the case of using sustainable materials, the PFP companies need to do frequent replenishments due to their short shelf-life as compared to oil-based raisins which increase the transportation requirements, hence adding to the air emissions and fuel consumption. In this regard, PN-K argued that "more deliveries, more couriers, more trucks, more diesel, more fumes, and more road usage" when sustainable materials are preferred.

4.1.2 | Recycling-related tensions

The participants highlighted different recycling-related tensions associated with food safety, material loss, waste disposal, natural resource depletion, and lack of technology. The findings revealed that the PFP companies are primarily concerned with food safety issues due to local and international regulatory requirements. However, using recycled packaging for food-grade products includes a risk of contamination—a paradoxical tension, which in turn, leads to serious health implications for consumers. PN-E noted that "we are constrained a little bit as we manufacture for the food industry. So, once it gets past the point of introducing raisins back into the blending mix and applying ink on it, then our ability to reuse that material is reduced somewhat." Further, the participants emphasized that heterogeneous materials cannot be recycled such as polyester and aluminum foil due to their varying characteristics and temperature requirements, hence resulting in material losses. PN-N explained that their company faced difficulties during the recycling of a multi-layer structure comprising polyester and PE since the melting points of both materials are dissimilar such as 260 C for polyester and 110 C for PE, "we had the recycling project, where we did the three test that that was a blend of polyester and PE, and we came to know that melting points are very dissimilar. Therefore, it was difficult for the recycler to recycle it due to the risks of material [either one] loss."

The findings also demonstrated that PFP companies are facing paradoxical tensions in managing the waste generated from the recycling of the materials. For example, after extracting the plastics during the chemical recycling process the resulting ash—titanium dioxide—a blend of burnt adhesive and printing ink is left that needs to be discarded. Similarly, in the case of mechanical recycling, wastewater is generated. PN-B noted, "when the water is used to separate the different types of plastics (floating), it results in the generation of gray water (wastewater), then the companies find it difficult to manage this waste as they need to treat and discard it." Additionally, recycling processes present a risk of natural resource depletion. PN-G argued, "let us say you have got a packaging for something like meat or some product which is recyclable. In the case of recycling the package, it needed to be washed. However, the issue is that we could have a water shortage, so I think that people, certainly in Auckland are somewhat reluctant to wash items and plastic packaging of that nature."

Although the manufacturers want to use recyclable material in packaging, there are limited recycling options available in NZ. According to PN-B, mainly mechanical recycling is done in NZ and the resulting product is generally a low-grade product. PN-N emphasized that chemical recycling helps in improving the recycled product which can be used in food grade products; however, there are few chemical recycling plants in NZ compared to mechanical recycling. PN-N further noted, "only 5% of the volume of plastics can be recycled into food-grade products using chemical recycling and almost 40-50% of the plastics are recycled through mechanical recycling." In addition, there are volumes of plastic waste to be recycled and recyclers are willing to recycle; however, "their machines are not capable of recycling due to the lack of technology," PN-N highlighted. Moreover, it requires an investment in equipment, plants, and factories to make recyclable packaging.

4.1.3 | External stakeholder-related tensions

The findings manifested sustainability tensions arise due to the inadequate supportive infrastructure, recyclers and/or composters' preferences, supply-related issues, and the disparity between consumer intension and behavior. While companies are providing sustainable packaging solutions, there is a lack of infrastructure to manage plastic packaging waste resulting in a non-paradoxical tension. According to PN-B, "a company might make a compostable chocolate wrapper. However, the consumer will complain over Facebook to the corporate customers and say, "I love what you are doing since you are not using oil. I have got a compostable wrapper; however, I live in an apartment. Now, where do I put my wrapper?" This is another side of the equation where they would send it somewhere to be composted if only that place exists."

The findings indicated that PFP companies are shifting towards the use of sustainable and bio-based materials in PFP; nevertheless, these materials are not readily available due to the limited number of suppliers leading to paradoxical tensions. According to PN-K, "the global supply of some of these materials is quite limited. So, if everybody decides to go sustainable tomorrow, I think there would not be enough product to go around." Similarly, the participants recalled that one of the sustainability tensions for the PFP industry is that there are few green options available in terms of sustainable raw materials and bio-based materials such as sugarcane. In addition, PN-N

highlighted that due to the Ukraine-Russia war, their company is facing the issues from supplier side since the war has affected the supply of these materials. Following this, there was an increase in the freight charges and raw materials costs. Similarly, PN-B cited, "in case of pyrolysis oil, where plastic waste could be turned back into oil, and then turned back into plastic, there is only limited global supply – around 5% of all the current plastics."

The PFP industry is facing another sustainability tension because of the recycler's ability to provide desired solutions and composters' preferences. Since the PFP companies are manufacturing a variety of packaging structures that are laminated; however, the majority of the recyclers only accept those packaging materials which they can easily recycle. As an example, due to the contamination issues in multi-layer structures, the recyclers do not want to collect and process the waste, which poses an environmental sustainability challenge. PN-N further emphasized that their company works with recyclers in NZ; however, they are very "picky about what they will accept and what they would not." In addition, there is another paradox that exists with compostable packaging materials due to the requirements of composting companies. For example, PN-B suggested that although the plastics have already been certified to compostable packaging standards, a lot of composting companies require testing of the packaging due to the different temperatures in their facilities, "within NZ, not all composters compost the same way, they get different temperatures and different time timeframes."

Most of the participants referred to a disparity between consumer intention and behavior as a sustainability tension in the PFP industry. PN-B noted, "customers want to see us doing something green or environmentally friendly. However, they do not want to pay more. Essentially, all our sustainable options are more expensive, 200%, more expensive." Similarly, PN-J posited that a lot of the buyers generally require such options that would pack their food in a way with the same shelf-life and same price. The PFP industry is providing sustainable solutions to their customers and recycling schemes such as soft recycling also promote multi-layer recycling; however, consumer behavior is a barrier and a non-paradoxical tension in managing plastic waste. PN-K noted, "the consumer says, "It is convenient for me to take my packaging, open up, use it, and dispose of the bag straightaway in my kitchen rubbish bin because it takes more effort and energy to wash it out, clean and dry it, and then put it in the recycle bin in the garage". Table 2 presents illustrative quotes on sustainability tensions aligning with the paradox theory.

4.2 | Resolution strategies to manage the sustainability tensions

Our analysis revealed that several resolution strategies can be considered to address sustainability tensions in the PFP industry including multi-stakeholder collaboration, circular economy, innovation and research, and the use of integrated business strategies as the acceptance, spatial, temporal, and synthesis approaches. The following sections explain these strategies.

4.2.1 | Multi-stakeholder collaboration

The participants emphasized acceptance and synthesis approaches as the resolution strategies including the understanding and awareness of the sustainability issues and multi-stakeholder collaboration which is vital to addressing sustainability paradoxes. The participants stressed that managing sustainability tensions is not only the manufacturers' responsibility rather all concerned stakeholders need to be aware and understand these issues and actively collaborate to develop workable solutions. The participants asserted the multi-stakeholder involvement (synthesis approach) including supplier collaboration and development, recycler/composter participation, government support, cross-industry collaboration, and consumer understanding and education to navigate sustainability concerns residing in the PFP industry. PN-K suggested that "what I see over my years on the packaging is whenever such things come, these just get forced upon one person or one company. Then, we just push it back to our supplier to say, 'well, we are using your raw material to make this pack, so you deal with it.' I do not think it should be pushed back to just one stakeholder. It should be everybody to look at it to solve the paradox."

PN-B emphasized that the government needs to provide an adequate waste recycling infrastructure, "we need more places that accept plastics to be recycled rather than just the supermarkets and the warehouse." The government can also increase the landfill levy which would drive the collectors and recyclers to segregate and recycle the waste. PN-B further noted, "if the landfill levy can triple over the next 10 years, it is going to make it more worthwhile for people to go to a landfill to get up, pull out all the plastic, wash it, and recycle it." Similarly, the government needs to provide the infrastructure such as providing bins to consumers for disposing of plastics from number one to number seven. In addition, the government should promote the use of recycled materials in packaging such as "by forcing manufacturers to use 30% recycled content in the packaging by 2025," PN-N noted.

To address the sustainability tensions of the PFP industry, more recyclers and collectors are needed. The recyclers also need to collaborate with the manufacturers to develop workable solutions to address sustainability tensions in the PFP industry. PN-N recalled that in a specific recycling project of a material, the recycler was not ready to collaborate; however, the company convinced the recycler after running several tests of the material, "we agree, it is hard to do. But let us work together. We did a test and had some good learnings … we proceeded to a second test in which we altered some of the parameters and we got some success. Then, we did a third test as scaling up and we said, "now let us make one ton of product to prove that it will work through your equipment with your people and operators." Finally, that was the product they are now making for us, and we can consume it as a recyclable waste."

In addition, collaboration with suppliers is instrumental in addressing sustainability tensions. PN-E emphasized, "it depends on communicating with suppliers to see how they are investing their time, effort, and energy into developing sustainable options." The

TABLE 2 Illustrative quotes on sustainability tensions aligning with the paradox theory.

Sustainability tensions	Sub-categories	Illustrative quotes	Paradox theory
Operations and supply chain-related tensions	Shelf-life issues	"There must be a trade-off if you are getting thin layer and then, obviously the product characteristics in terms of shelf-life are affected." (PN-N) "If you go to a mono-material, generally you are compromising your shelf-life or compromising your barrier, so the performance is not there." (PN-B)	Performing and organizing paradoxes
	Operational costs	"A few years ago, when the company tried to develop environmentally sustainable materials and products, the customers were not ready to pay for that due to their high cost." (PN-C) "I think the use of sustainable materials will increase; however, it is not going to be that fast because it costs more to switch." (PN-N)	
	Operational efficiency	"The reason we do not use water-based inks at the moment is they are slower, and we have to heat them hotter to dry off the water. But we can run faster with solvent-based products. It is something which looms us to an efficiency-environmental paradox." (PN-N)	
	Logistics concerns	"By using sustainable materials, the shelf-life reduces lets us 60 days of a particular product, but the ordering cycle increases." (PN-K)	
	Inventory optimization	"With every extra option, you are going to hold more things. It complicates the situation as you need more safety stock." (PN-C).	
Recycling-related tensions	Food safety issues	"We are struggling to make our laminated food products' packaging sustainable or recyclable which are mostly dairy products such as powdered milk products that require a high barrier. However, in case of using recycled materials in such food products poses high risks of contamination and oxidization." (PN-G)	Performing, organizing, and learning paradoxes
	Lack of technology	"Another issue with the equipment or the technology side is that the recyclers do not have such technology that can make it into recyclable." (PN-B)	
	Risk of material losses	"It is not like if you had 100 kilos of wrappers of muesli bar and you think that you will get 100 kilos of recycled plastic. It is not 100% efficient." (PN-K)	

TABLE 2 (Continued)

Sustainability tensions	Sub-categories	Illustrative quotes	Paradox theory
External stake-holder-related tensions	Inadequate supportive infrastructure	"Though there are companies in NZ who are involved in composting operations around NZ. Some take food waste, and some take green waste, like trees, leaves, and twigs, and turn those into soil or compost and sell it. However, there is a very small number that accepts packaging into that compost." (PN-B)	Organizing, learning, and belonging paradoxes
	Disparity between consumer intention and behavior	"A lot of consumers just look for the lowest cost option." (PN-I) "The customers insist packaging companies use the volatile organic solvent which has a negative environmental outcome; however, it is the client who is asking for it." (PN-F)	
	Recyclers/composters' preferences	"We are working with two recyclers in NZ, one of them does the majority of our recycling So, whilst we make a lot of varieties of plastic materials which are glued and laminated together, they only take one or two types." (PN-K)	
	Supply-related issues	"Big multinational companies such as Nestle say [to us]: "We want to change all of our plastic to be food grade through pyrolysis oil … they are happy to pay more for it but there is only a handful of sites [and suppliers] around the world that does pyrolysis oil production." (PN-B) "Some products' supply is limited. There are supply constraints as there is only one big supplier that supplies the cellulose film to us." (PN-N)	

participants stressed supplier development is a key driver for developing packaging solutions. Owing to the increasing environmental burden of plastic packaging, the PFP companies need to collaborate with other industrial sectors such as the paper and pulp industry from a future perspective. PN-N stated, "we manufacture plastic products; however, we are now printing on paper and coating papers. There is a whole lot of learning and understanding from another industry. We need to take them on board because we see a future of plastic and paper together."

The participants suggested that consumer awareness, education, and participation as a synthesis strategy to resolve the sustainability tensions. PN-K noted, "small customers want to be market leaders and they want to differentiate themselves from the big multinationals by promoting the sustainable packaging materials." Further, consumer habits and expectations need to be changed to manage the sustainability tensions through promoting education on sustainable consumption aspects. PN-B noted, "it is like a human social education thing. I think we get tagged with a pretty big brush, is that plastics are the enemy, but I certainly feel, it is just human nature and habits that need to be changed."

4.2.2 | Research and innovation

The participants underlined the importance of enhancing research and innovation prospects related to new materials development, LCA, development programs, and quick response (QR) codes as temporal and synthesis strategies. PN-I suggested that there is an urgent need to focus on innovation and technological development in packaging materials since the life cycle of PFP products is quite long. Similarly, other participants highlighted that right now the PFP industry is using multi-layer structures; however, the research and development (R&D)

is focusing on using mono-layer structures in the future (temporal) which will make it easier for recyclers to recycle plastic waste. The participants suggested that more focus on LCA (spatial) is needed to analyze the current sustainability aspects of the packaging materials as lots of the customers just want those materials that can pack their food that would last longer and can be delivered at a similar or lower price.

Due to the low recyclability of multi-layer products, PFP companies are working on some development programs with recycling companies as a synthesis approach. PN-K highlighted that their company developed an alternative material after 2 years, similar to the paper which is heat sealable, "customers could take a coffee bag and put it into a paper recycling stream. Whereas today, that paper, polyester, and PE laminate, just go into the landfill. We are just trying to fill those gaps." Likewise, PN-N emphasized that their company collaborates with a research partner as a synthesis approach to generate some compound for film-making or bag-making that could run smoothly on the equipment to achieve both effectiveness and efficiency. The participants suggested that from a long-term perspective, the QR codes for recycling information and labels on the package can help the consumers to adequately dispose of the packaging waste and waste collectors to identify, differentiate, and collect the packaging materials as a temporal strategy. PN-I posited, "Australia has got the ARL (Australian recycling label) label and in NZ, we see some of the customers are adopting that and signing up to be able to print that on their packaging." PN-N emphasized that their company also printed such logos with QR codes on a potato chip package exported to Australia.

4.2.3 | Circular economy

The participants asserted circular economy practices such as upcycling and downcycling (spatial and temporal), standardization (temporal), less use of materials (spatial), and use of renewable resources (temporal) to manage the sustainability tensions. For example, the multi-layer products that cannot be recycled for use in the food grade products can be used in other products such as baby diapers and rubbish bags which can help the PFP industry in managing their plastic waste as a downcycling practice considered as a spatial strategy. Further, the extrusion waste can be dealt with separately and reused in the packaging products as an upcycling practice (spatial approach). Similarly, the resulting ash produced during the mechanical recycling process can be used in road construction which works as a binding agent/filler, PN-B suggested. The participants revealed that machinal recycling is mainly performed in NZ to handle plastic waste; however, in the future, the PFP industry needs to be focused on chemical recycling for transforming the plastic waste into liquid oil through the pyrolysis process and reusing it in food-grade products as a temporal approach. From a long-term perspective, the companies are planning to shift towards chemical recycling and using pyrolysis oil. PN-B emphasized, "company ABC got a small plant in Australia and bigger plants offshore where the plastics go through the pyrolysis which turned these back into liquid oil. Then, the company trade or export that liquid oil back to the petroleum plants that will then crack it or distill it into virgin polyethylene. It is a good way to close the loop for products that are not currently able to go through mechanical recycling."

Using renewable resources and efficient use of resources are also highlighted by the participants as a circular economy practice. PN-H stressed that since the recycling process consumes energy, the energy should be produced through renewable resources such as wind or hydropower (temporal approach). The findings indicated that the PFP industry can also manage sustainability tensions through short-term planning (spatial approach). For example, the companies are currently manufacturing plastic packaging using less plastic to manage the environmental burden while ensuring conformance to the required performance criteria, PN-K highlighted.

Along with managing the flexibility aspects regarding the customer requirements to achieve economic sustainability, the PFP industry can handle the environmental sustainability issues through standardization of the packaging materials as a spatial approach. According to PN-C, "the more standardized the work is, the less time you have to spend." PN-C further stressed the best thing the PFP industry can do from a future perspective to continuously improve is to standardize as much they can, "try not to use a million different grades. Standardization goes a long way which helps in reducing inventory, safety stocks, and waste from the storage, warehousing, and obsolescence." Similarly, PN-B elaborated that NZ is exporting its beef and lamb to the UK which is packaged in a standardized vacuum meat packaging that lasts for 6 months, hence reducing the inventory and environmental burden.

4.2.4 | Use of integrated business strategies

The PFP industry needs to execute the integrated operational and environmental business strategies as a synthesis approach to simultaneously manage the sustainability paradoxes such as through implementing green-lean, lean-six sigma, leagile, and green-lean-six sigma. For example, through a leagile strategy, companies can efficiently handle the flexibility aspects while reducing operational and environmental waste, thus achieving both economic and environmental sustainability, PN-O argued. Similarly, organizations can implement a green-lean-six sigma strategy to achieve the economic, environmental, and social sustainability challenges. As an example, the PFP manufacturers can implement the environmental-LCA and social-LCA to address the future environmental and social aspects of sustainable materials as a green strategy, PN-D noted. On the other hand, by using lean tools such as kaizen, organizations can take small steps to achieve sustainable objectives by gradually reducing the quantity of plastic in the packaging while maintaining operational efficiencies and confirming the performance requirements, PN-B emphasized. In addition, lean can help in improving quality and reducing waste. Further, using lean techniques such as just-in-time can help in reducing the environmental impact (by minimizing the raw material inventory and energy requirements in the warehouse). Similarly, six sigma helps in

innovating sustainable packaging solutions by using statistical tools such as the design of experiment. PN-C cited, "six sigma helps us in producing quality products and offering more technically advanced options." Further, the business strategies comprising the integrated management systems and certifications such as ISO 9001, ISO 22000, ISO 45001, and ISO 14001 can simultaneously address the packaging quality (ISO 9001), environmental sustainability (ISO 14001), food safety (ISO 22000), and workplace safety (ISO 45001) aspects, PN-L noted. Table 3 provides illustrative quotes on resolution strategies aligning with the paradox theory.

5 | DISCUSSION

This study investigates sustainability tensions (paradoxical and non-paradoxical) in the PFP industry which is currently facing critical economic, environmental, and social sustainability issues. Building on the paradox theory, the study demonstrated sustainability tensions related to operations and supply chain, recycling, and external stakeholders linked with the performing, organizing, learning, and belonging paradoxes. In answering the first research question, the findings revealed operations and supply chain-related paradoxes including shelf-life issues and operational efficiency which are aligned with the performing paradoxes, inventory optimizations and operational costs are related to the organizing paradoxes, and logistics concerns are aligned with the belonging and learning paradoxes which are identified as key tensions in the PFP industry. On the one hand, the PFP industry is striving to address the environmental safety aspects by using environmentally friendly materials and increasing the recycling of plastic materials. On the other hand, the industry is facing cost-related issues as sustainable materials are expensive and recycling also requires capital investment which is related to the organizing paradoxes (Bening et al., 2021; Farrukh et al., 2022b). However, limited studies have discussed the cost-related trade-offs and tensions between traditional and sustainable packaging (Pålsson & Sandberg, 2021). The PFP sector is attempting to fulfill the customer requirements of customization by providing a variety of packaging solutions; nonetheless, struggling to manage the inventory of these materials leads to an increasing environmental burden. These tensions are also linked with the organizing paradoxes as the organizations are trying to manage both environmental and economic performance. This finding is also aligned with the study results of Pålsson and Sandberg (2021).

In addition, the competing values of different departments such as production emphasize customer satisfaction and logistics focuses on economic purchasing which creates belonging paradoxes associated with inventory optimization issues (Hahn et al., 2018; Xiao et al., 2019). Similarly, replacing the use of sustainable and innovative materials with traditional materials creates learning paradoxes between the subunits/functional units of the PFP industry due to the change in operational activities of production, logistics, and marketing (Pålsson & Sandberg, 2021). Similarly, the PFP industry is struggling to reduce the environmental footprint of plastic packaging by minimizing the use of plastic and increasing the use of sustainable materials; however, facing the shelf-life and food waste issues related to the performing paradoxes due to the characteristics and attributes of the packaging materials (White & Lockyer, 2020). The findings also revealed the operational efficiency and quality-related trade-offs between traditional and sustainable packaging linking with the performing paradoxes; however, prior studies did not address this aspect. Based on the empirical evidence of the operations and supply chain-related tensions, we propose that:

> **Proposition 1.** The PFP industry faces various performing, organizing, learning, and belonging paradoxes due to the packaging characteristic, use of sustainable materials, recycling requirements, and customer satisfaction while managing the economic, environmental, and social sustainability tensions.

In terms of recycling-related tensions such as food safety, material loss, and natural resource depletion, these are aligned with the performing paradoxes and waste disposal and lack of technology with the organizing paradoxes. For example, the PFP companies encounter performing paradoxes in the process of managing environmental issues related to plastic packaging by using recyclable materials; however, they face difficulties in addressing the food safety requirements and the risks of material losses due to the use of unsustainable materials such as multi-layer structures. Similarly, the PFP companies are facing paradoxical tensions in the form of natural resource depletion during the recycling process of plastic packaging. This finding resonates with the evidence from previous studies exploring packaging-related performing paradoxes arising from simultaneously responding and often competing and interdependent economic, social, and environmental concerns (e.g., Pålsson & Sandberg, 2020, 2022).

Further, the PFP companies are facing paradoxical tensions in handling the resulting waste produced from the recycling processes which is aligned with the organizing paradoxes. Among the above aspects, paradoxical tensions related to food safety issues while handling the environmental sustainability aspects during the recycling process are consistent with the study results of Sundqvist-Andberg and Åkerman (2021). However, the paradoxical tensions related to waste disposal issues, natural resource depletion, and material losses are not highlighted in prior studies due to a lack of research in this area (Sundqvist-Andberg & Åkerman, 2021). The above discussion leads us to propose the following.

> **Proposition 2.** The PFP industry confronts various performing and organizing paradoxes due to the inadequate recycling process, lack of recycling techniques, and use of unsustainable and recycled materials while managing sustainability issues.

The analysis has also revealed external stakeholder-related tensions including the inadequate supportive infrastructure and

TABLE 3 Illustrative quotes on resolution strategies aligning with the paradox theory.

Resolution strategies	Sub-categories	Illustrative quotes	Paradox theory
Multi-stakeholder collaboration	Consumer understanding	"We need people putting it in the right bin and then it is not a burden" (PN-B). "From the household perspective, I think there is a need to create more awareness of the person at home." (PN-E) "I think we have just forgotten about what we do with it at the end?." (PN-N)	Acceptance and synthesis strategy
	Recyclers/composters' participation	"We might need more recyclers and we might need better collection." (PN-B) "We had the recycler who was saying, we can't recycle it. Then, after three attempts, we got them recycling and they were happy with it. It is just that partnership and having relationships." (PN-K)	
	Government support	"The government needs to increase the landfill levy which will help drive the collection and segregation of the waste. Then, recyclers will have more money to play with." (PN-B) "We need more avenues for recyclable waste." (PN-N)	
Innovation and research	Development programs	"If we did not find a solution, we might have to conduct some research with a research partner … to generate a compound that would work for our company on our equipment during the film or bag manufacturing process." (PN-N)	Spatial separation, temporal separation, and synthesis strategy
	New material development	"We have a budget for new product development. We have a review process where we go through and say, 'this new customer wants this new type of packaging, is there a future or a good sales volume that can be achieved if we go and develop that product?' If the answer is yes, and the customer is happy to pay for some of that development cost, we add that to our list and start to produce it." (PN-K)	
Circular economy	Upcycling and downcycling	"We should do more recycling and that will sort of drive down the production of new plastic and try to keep plastic being used rather than just burying it in the landfills." (PN-K) "I think, we need to study the variation in recycling. We need to prove that it still can do its job with the same performance characteristics." (PN-B) "After five years, we want to be using pyrolysis oil." (PN-K)	Spatial separation, temporal separation, and synthesis strategy
	Use of sustainable and renewable resources	"There are certain product types which are easy to substitute." (PN-G)	

TABLE 3 (Continued)

Resolution strategies	Sub-categories	Illustrative quotes	Paradox theory
		"I think if we move towards mono materials which is one type of plastic, it will make it easier for the recyclers to recycle different plastics on different machines rather than have them all blended in together." (PN-B)	
	Standardization	"With a standardized material, you only have to process it and pack it once in the factory, rather than having a factory run 12 months of the year and pack up smaller proportions." (PN-N) "Instead of buying two products, we could buy just one product and that will make the process efficient." (PN-H)	
Use of integrated business strategies	Integrated operational and environmental practices	"We always talk about little steps [kaizen] every day. One small step towards being more sustainable or more renewable like making the plastic thinner and checking that it still fits the performance requirements. It is something we can do today and start our journey. Then, we can say that we are now 10% or 15% thinner, and we are using less plastic." (PN-B) "An integrated strategy sounds to me like that will be beneficial and a better way of doing it. Whereas we have kind of done a few piecemeal, bits, and pieces here and there, and if you get a more integrated approach, you could get better results." (PN-A)	Synthesis strategy

supply-related issues are aligned with the performing and organizing paradoxes, recyclers/composters' preferences are related to the organizing and belonging paradoxes, and the disparity between consumer intention and behavior linked with the belonging and learning paradoxes due to their contrasting requirements and demands. Although the PFP industry is trying to reduce environmental issues by using compostable materials, there is a lack of composting standards, infrastructure, and research and innovation which creates issues related to managing and organizing compostable waste (Ministry for the Environment, 2022). Similarly, the PFP industry initiated the use of sustainable packaging materials; nevertheless, the lack of supply of bio-based and biodegradable materials and a limited number of suppliers are creating tensions that are related to the organizing paradoxes. However, limited studies have addressed the supply trade-offs between traditional and sustainable packaging materials (Pålsson & Sandberg, 2021). Moreover, manufacturers desire to use recycled materials in manufacturing packaging solutions; however, the preferences of recyclers regarding recyclable materials create tensions linked with the belonging paradoxes as they value only those materials for which there is some market available (such as pipe manufacturing, furniture manufacturing, and construction). On the other hand, while handling the compostable materials, the composters are facing performing paradoxes due to a lack of composting infrastructure which is also aligned with the findings of the report presented by the Ministry for the Environment (2022).

Similarly, the consumer preference for choosing economic packaging over sustainable packaging is another paradoxical tension related to the belonging paradox as they value the economic dimension of sustainability such as the cost aspect of traditional packaging over sustainable packaging and individual versus family-sized packaging while ignoring the environmental and social impact (Bayus et al., 2016; Jinkarn & Suwannaporn, 2015). Despite the availability of sustainable and compostable materials and recycling schemes, consumer habits regarding inadequate disposal and handling create

learning paradoxes due to the lack of awareness of sustainability issues of PFP materials (Bening et al., 2021). The above discussion leads us to propose the following:

> **Proposition 3.** The PFP industry faces performing, learning, organizing, and belonging paradoxes due to the limitations, preferences, behavior, and intentions of the external stakeholders while managing sustainability issues.

In answering the second research question, the findings revealed different resolution strategies comprising multi-stakeholder collaboration research and innovation, circular economy, and the use of integrated business strategies aligned with the acceptance, spatial separation, temporal separation, and synthesis approaches of the paradox theory. The findings revealed that multi-stakeholder understanding and awareness of the existence of paradoxical tensions are linked with the acceptance approach. For example, the government, manufacturers, and recyclers need to recognize and understand that a few sustainability tensions such as natural resource depletion, material loss, logistic concerns, and shelf-life issues are paradoxical in nature as these cannot be settled. However, through multi-stakeholder collaboration, including government support, recyclers and composters' participation, cross-industry collaboration, supplier collaboration and development, and consumer understanding as the synthesis and temporal strategies, the non-paradoxical sustainability tensions in the PFP industry can be resolved. In this perspective, the policymakers need to design adequate recycling policies, provide waste management infrastructure and funding opportunities, and collaborate with the recyclers, PFP industry, composters, and development organizations to address the sustainability tensions including waste disposal, lack of technology, inadequate supportive infrastructure, and operational cost (Farrukh et al., 2022b; Ministry for the Environment, 2022). Similarly, through consumer understanding, awareness, participation, and education and synthesis approaches, the sustainability tensions associated with the operations and supply chain and external stakeholders such as the variety of packaging products and the consumer behavioral issues can be addressed (Fadeeva & Van Berkel, 2021; Rhein & Schmid, 2020). In addition, recyclers and composters also need to collaborate with the PFP industry as a synthesis strategy, understand the requirements of the manufacturers regarding the use of recycled materials in food products, and increase their recycling capabilities to handle the multi-layer PFP materials (Bening et al., 2021). Based on the empirical evidence of the above discussion, we propose the following.

> **Proposition 4.** Multi-stakeholder collaboration can play a significant role in managing operations and supply chain, recycling, and external stakeholder-related tensions as the acceptance and synthesis strategy.

The findings highlighted that innovation and research regarding new material development, LCA, development programs, and QR codes can also resolve various sustainability tensions in the PFP industry linked with the temporal, spatial, and synthesis approaches of the paradox theory. Among these practices, material development is also emphasized by prior studies conducted by Bayus et al. (2016) and He et al. (2021) as the temporal strategy since material development is a long-term process and requires investment and time. In this perspective, the PFP industry can work on the development programs with the research organizations and recyclers as the synthesis approach to develop sustainable and biodegradable materials. Meanwhile, the PFP industry can conduct LCA studies as a spatial strategy to examine and address the sustainability issues of plastic packaging products during different phases of the supply chain. The findings revealed the use of QR codes as a temporal approach to tracking plastic packaging products in the long run which can help in sorting and collecting food packaging waste; nevertheless, limited studies have addressed the use of QR codes in the PFP sector (e.g., Sandhiya & Ramakrishna, 2020). The above discussion leads us to propose the following.

> **Proposition 5.** Innovation and research practices can address various sustainability tensions related to operations and supply chain, recycling, and external stakeholders as the temporal, spatial, and synthesis strategies.

The findings highlighted various practices under the circular economy domain including upcycling and downcycling, less use of materials, use of renewable resources, and standardization which can facilitate managing the sustainability tensions in the PFP industry. Among these practices, upcycling and downcycling practice is regarded as the spatial strategy to simultaneously address the recycling-related sustainability tensions such as food safety concerns minimizing the environmental burden of plastic packaging by using recycled material in other non-food grade applications such as baby diapers, plastic lumber, trash bags, and pipes (Farrukh et al., 2022b, 2023b; Horodytska et al., 2018). On the other hand, upcycling is also suggested as a practice to recycle the plastic waste from the extrusion process to be used in food-grade packaging (Farrukh et al., 2022b). In this way, these practices (upcycling and downcycling) can also address external stakeholder-related sustainability tensions associated with the recyclers' preferences for recyclable materials. The tensions related to flexibility concerns in the operations and supply chain-related tensions can be managed through a spatial approach by standardizing the packaging product design for multiple grades of products which can help to conserve resources and facilitate efficient recycling. This finding is also aligned with the "designing for a circular economy (D4ACE)" guidelines of CEFLEX, which is key to achieving circularity in the PFP industry (Soares et al., 2022). Similarly, the use of renewable energy resources including wind, solar, and hydropower in the near future is also highlighted as the temporal approach to address the recycling-related sustainability tensions such as energy consumption issues in the mechanical and chemical recycling process (Horodytska et al., 2020; Siracusa et al., 2014).

Based on the empirical evidence of the circular economy practices, we propose that:

> **Proposition 6.** Circular economy practices can resolve the operations and supply chain, recycling, and external stakeholder-related tensions as the temporal, spatial, and synthesis strategies.

Finally, the findings highlighted that firms could implement integrated business strategies comprising the operations and environmental practices and management systems as a synthesis approach to address the sustainability paradoxes. Prior studies have emphasized using a combination of green-lean, leagile, lean-six sigma, total quality environmental management, green-lean-six sigma, and sustainable lean-six sigma to simultaneously address the economic, environmental, and social sustainability objectives of waste reduction, cost reduction, responsiveness, resource conservation, and emission reduction in manufacturing organizations (Farrukh et al., 2023a; Garza-Reyes, 2015; Garza-Reyes et al., 2018). For example, using a combination of tools from the green-lean-six sigma such as design for

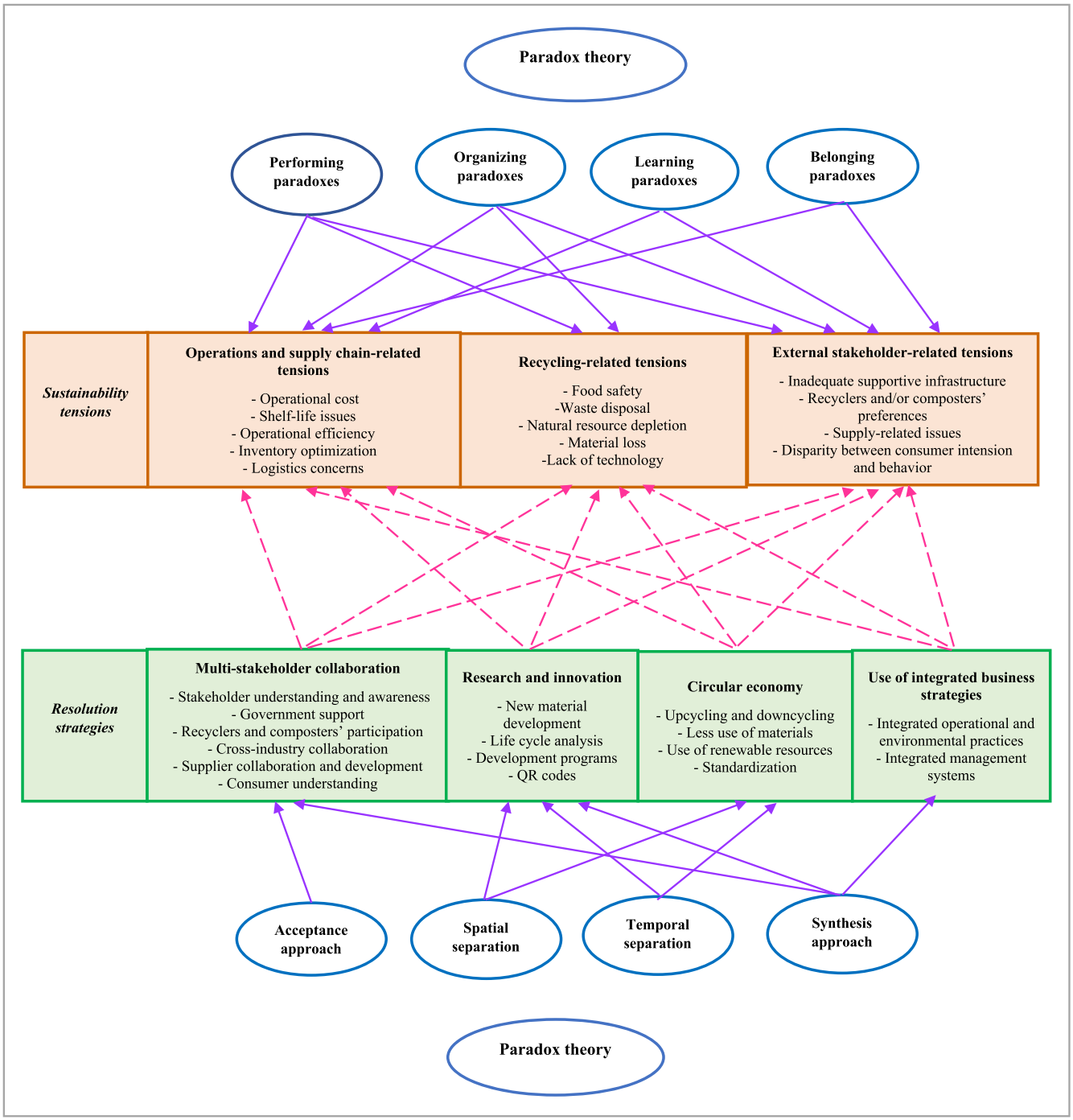

FIGURE 3 A holistic model of the sustainability tensions and resolution strategies.

recycling (DFR), 5S, kaizen, design for six sigma (DFSS), and define-measure-analyze-improve-control (DMAIC) can help manufacturers, recyclers, and composters to address the recycling, resource recovery, and operational inefficiencies (Farrukh et al., 2023b; Marrucci et al., 2020). Similarly, the integrated management systems comprising the quality management system, environmental management system, energy management system, occupational health, and safety management system, and food safety system can address the sustainability tensions associated with the recycling, operations, supply chain, and external stakeholders in the PFP sector by simultaneously focusing on the objectives of quality, environment, food safety, and employee's health and safety (Santos et al., 2021; Weyandt et al., 2011). These systems and certifications are generally based on the plan-do-check-act cycle, which can help manufacturers continuously improve their economic, environmental, and social sustainability while focusing on the internal and external stakeholders' aspects including employees, suppliers, customers, and regulators (Boiral et al., 2018; Santos et al., 2021). The above discussion leads us to propose the following.

> **Proposition 7.** Integrated business strategies and management systems can resolve the operations and supply chain, recycling, and external stakeholder-related tensions as a synthesis approach.

Based on the above discussion, Figure 3 presents a holistic view of the sustainability tensions and their management strategies aligning with the constructs of the paradox theory.

6 | CONCLUSION, IMPLICATIONS, AND FUTURE RESEARCH DIRECTIONS

This study has investigated the sustainability tensions and resolution strategies in the NZ PFP industry. Drawing on the paradox theory, the findings revealed 14 sustainability tensions that are categorized under the operations and supply chain, recycling, and external stakeholder-related aspects linked with the performing, organizing, learning, and belonging paradoxes. Further, this study proposed 16 resolution strategies classified into a circular economy, research and innovation, multi-stakeholder collaboration, and use of integrated business strategies linked with the acceptance, spatial, temporal, and synthesis strategies of the paradox theory which can potentially address the sustainability tensions. Based on the insights obtained from the corporate managers and consultants, the study concluded with the development of a holistic model (Figure 3) demonstrating the underlying sustainability tensions and potential resolution strategies to simultaneously respond to economic, social, and environmental issues in the PFP industry.

This study offers several theoretical, practical, and policy implications. First, the findings of this study provide in-depth insights into identifying and explicating the nature of sustainability tensions experienced by companies operating in the PFP industry. Building on paradox theory, we identified, analyzed, and mapped various sustainability tensions into the performing, organizing, belonging, and learning paradoxes classification. Second, we also examined the strategies to manage the sustainability tensions based on the empirical data aligned with the resolution strategies of spatial, temporal, and synthesis approaches, which is also lacking in the current literature. Third, the study findings are based on the diverse opinions and expertise of the corporate managers and consultants to examine the economic, environmental, and social sustainability issues, thus adding useful insights into the existing knowledge domain. Finally, drawing on a paradox theory, we developed a model of sustainability tensions and management strategies that provides a holistic understanding of the paradoxical tensions and pathways through which such paradoxes can be resolved.

This study also offers several implications for managerial practice. First, the study findings can facilitate the corporate practitioners and consultants to better understand and analyze the key sustainability tensions while managing the divergent goals of different departments within their organizations and the requirements of the external stakeholders. Second, the study results can guide them in managing these tensions through various strategies such as multi-stakeholder collaboration, innovation and research, circular economy, and the use of integrated business strategies. Third, using the study findings, the consultants can guide the manufacturers in the effective execution of the integrated business strategies since they are experts in implementing circular economy, operational and environmental practices, and integrated management systems and certifications in various industrial sectors. Fourth, the findings can facilitate corporate managers in decision-making regarding the investment needed for research and innovation activities to address the sustainability issues in their organizations.

This study can also help policymakers in designing effective policy responses and providing adequate infrastructure for the PFP industry which can facilitate the manufacturers in dealing with the operations and supply chain, recycling, and external stakeholder-related paradoxical tensions. First, policymakers can assist the PFP industry by promoting research and innovation activities and providing adequate funding. Second, the government can support the industry in using renewable energy sources by providing subsidies and investing in this area. Third, the study can guide the policymakers and decision-makers in initiating consumer awareness programs and campaigns regarding the sustainable consumption of PFP products which can help in minimizing the environmental burden of food and packaging waste.

While the findings of the present study enrich the literature, it has some limitations. Though the research has been conducted in the PFP industry, the sustainability tensions and resolution strategies can be explored in other manufacturing organizations in the continuous process industry facing serious sustainability issues such as the textile, chemical, leather, and pharmaceutical industries to generalize the study findings. While our findings provide rich insights into the PFP industry in the NZ context, investigating the research phenomenon in other developed and developing economies could help in unpacking differences in the institutional, socioeconomic, and cultural aspects.

Finally, to achieve statistical generalization, the propositions need to be ascertained using quantitative research methodology.

ACKNOWLEDGEMENTS

Open access publishing facilitated by Massey University, as part of the Wiley - Massey University agreement via the Council of Australian University Librarians.

ORCID

Amna Farrukh https://orcid.org/0000-0002-2350-7184

Aymen Sajjad https://orcid.org/0000-0002-2768-8277

REFERENCES

Ahamed, A., Veksha, A., Giannis, A., & Lisak, G. (2021). Flexible packaging plastic waste—Environmental implications, management solutions, and the way forward. *Current Opinion in Chemical Engineering*, *32*, 100684. https://doi.org/10.1016/j.coche.2021.100684

Aksnes, D. W., & Sivertsen, G. (2019). A criteria-based assessment of the coverage of Scopus and Web of Science. *4*, 1–21. https://doi.org/10.2478/jdis-2019-0001

Ardra, S., & Barua, M. K. (2022). Halving food waste generation by 2030: The challenges and strategies of monitoring UN sustainable development goal target 12.3. *Journal of Cleaner Production*, *380*, 135042. https://doi.org/10.1016/j.jclepro.2022.135042

Attaran, S. A., Hassan, A., & Wahit, M. U. (2017). Materials for food packaging applications based on bio-based polymer nanocomposites: A review. *Journal of Thermoplastic Composite Materials*, *30*(2), 143–173. https://doi.org/10.1177/0892705715588801

Bayus, J., Ge, C., & Thorn, B. (2016). A preliminary environmental assessment of foil and metallized film centered laminates. *Resources, Conservation and Recycling*, *115*, 31–41. https://doi.org/10.1016/j.resconrec.2016.08.024

Bening, C. R., Pruess, J. T., & Blum, N. U. (2021). Towards a circular plastics economy: Interacting barriers and contested solutions for flexible packaging recycling. *Journal of Cleaner Production*, *302*, 126966. https://doi.org/10.1016/j.jclepro.2021.126966

Boiral, O., Guillaumie, L., Heras-Saizarbitoria, I., & Tayo Tene, C. V. (2018). Adoption and outcomes of ISO 14001: A systematic review. *International Journal of Management Reviews*, *20*(2), 411–432. https://doi.org/10.1111/ijmr.12139

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Bree, R. T., & Gallagher, G. (2016). Using Microsoft Excel to code and thematically analyse qualitative data: A simple, cost-effective approach. *All Ireland Journal of Higher Education*, *8*(2), 2811.

Büsser, S., & Jungbluth, N. (2009). The role of flexible packaging in the life cycle of coffee and butter. *The International Journal of Life Cycle Assessment*, *14*(S1), 80–91. https://doi.org/10.1007/s11367-008-0056-2

Castleberry, A., & Nolen, A. (2018). Thematic analysis of qualitative research data: Is it as easy as it sounds. *Currents in Pharmacy Teaching & Learning*, *10*(6), 807–815. https://doi.org/10.1016/j.cptl.2018.03.019

Chen, M. S., Eweje, G., & Kennedy, J. C. (2021). Managerial sensemaking of tensions in sustainability: Empirical evidence from Chinese and New Zealand business partnerships. *Journal of Cleaner Production*, *319*, 128699. https://doi.org/10.1016/j.jclepro.2021.128699

Daddi, T., Ceglia, D., Bianchi, G., & de Barcellos, M. D. (2019). Paradoxical tensions and corporate sustainability: A focus on circular economy business cases. *Corporate Social Responsibility and Environmental Management*, *26*(4), 770–780. https://doi.org/10.1002/csr.1719

De Bhowmick, G., Sarmah, A. K., & Dubey, B. (2021). Microplastics in the NZ environment: Current status and future directions. *Case Studies in Chemical and Environmental Engineering*, *3*, 100076. https://doi.org/10.1016/j.cscee.2020.100076

De Koeijer, B., De Lange, J., & Wever, R. (2017). Desired, perceived, and achieved sustainability: Trade-offs in strategic and operational packaging development. *Sustainability*, *9*(10), 1923.

Dhir, A., Talwar, S., Kaur, P., & Malibari, A. (2020). Food waste in hospitality and food services: A systematic literature review and framework development approach. *Journal of Cleaner Production*, *270*, 122861. https://doi.org/10.1016/j.jclepro.2020.122861

Dieste, M., Sauer, P. C., & Orzes, G. (2022). Organizational tensions in industry 4.0 implementation: A paradox theory approach. *International Journal of Production Economics*, *251*, 108532. https://doi.org/10.1016/j.ijpe.2022.108532

Diprose, G., Dombroski, K., Sharp, E., Yates, A., Peryman, B., & Barnes, M. (2023). Emerging transitions in organic waste infrastructure in Aotearoa New Zealand. *New Zealand Geographer*, *79*, 15–26. https://doi.org/10.1111/nzg.12348

Erthal, A., Frangeskou, M., & Marques, L. (2021). Cultural tensions in lean healthcare implementation: A paradox theory lens. *International Journal of Production Economics*, *233*, 107968. https://doi.org/10.1016/j.ijpe.2020.107968

European Commission, 2018. *Communication from the commission to the European Parliament, the Council, the European economic and social committee and the committee of the regions. A European strategy for plastics in a circular economy COM/2018/028 Final*.

Evans, D. M., Parsons, R., Jackson, P., Greenwood, S., & Ryan, A. (2020). Understanding plastic packaging: The co-evolution of materials and society. *Global Environmental Change*, *65*, 102166. https://doi.org/10.1016/j.gloenvcha.2020.102166

Fadeeva, Z., & Van Berkel, R. (2021). Unlocking circular economy for prevention of marine plastic pollution: An exploration of G20 policy and initiatives. *Journal of Environmental Management*, *277*, 111457. https://doi.org/10.1016/j.jenvman.2020.111457

Falagas, M. E., Pitsouni, E. I., Malietzis, G. A., & Pappas, G. (2008). Comparison of PubMed, Scopus, Web of Science, and Google Scholar: Strengths and weaknesses. *The FASEB Journal*, *22*(2), 338–342. https://doi.org/10.1096/fj.07-9492LSF

Farrukh, A., Mathrani, S., & Sajjad, A. (2022a). A natural resource and institutional theory-based view of green-lean-six sigma drivers for environmental management. *Business Strategy and the Environment*, *31*(3), 1074–1090. https://doi.org/10.1002/bse.2936

Farrukh, A., Mathrani, S., & Sajjad, A. (2022b). A systematic literature review on environmental sustainability issues of flexible packaging: Potential pathways for academic research and managerial practice. *Sustainability*, *14*(8), 4737. https://doi.org/10.3390/su14084737

Farrukh, A., Mathrani, S., & Sajjad, A. (2023a). Green-lean-six sigma practices and supporting factors for transitioning towards circular economy: A natural resource and intellectual capital-based view. *Resources Policy*, *84*, 1-17.

Farrukh, A., Mathrani, S., & Sajjad, A. (2023b). An exploratory study of green-lean-six sigma motivators for environmental sustainability: Managerial insights from a developed and developing economy. *Business Strategy and the Environment*, 1-24. https://doi.org/10.1002/bse.3412

Garza-Reyes, J. A. (2015). Green lean and the need for six sigma. *International Journal of Lean Six Sigma*, *6*(3), 226–248. https://doi.org/10.1108/ijlss-04-2014-0010

Garza-Reyes, J. A., Yu, M., Kumar, V., & Upadhyay, A. (2018). Total quality environmental management: Adoption status in the Chinese manufacturing sector. *The TQM Journal*, *30*(1), 2–19. https://doi.org/10.1108/tqm-05-2017-0052

Gebre, S. L., Cattrysse, D., Alemayehu, E., & Van Orshoven, J. (2021). Multi-criteria decision making methods to address rural land allocation problems: A systematic review. *International Soil and Water Conservation Research*, *9*(4), 490–501. https://doi.org/10.1016/j.iswcr.2021.04.005

Gopal, J., & Muthu, M. (2022). The COVID-19 pandemic redefining the mundane food packaging material industry. *Science of the Total Environment*, *861*, 160463. https://doi.org/10.1016/j.scitotenv.2022.160463

Graebner, M. E., Martin, J. A., & Roundy, P. T. (2012). Qualitative data: Cooking without a recipe. *Strategic Organization*, *10*(3), 276–284. https://doi.org/10.1177/1476127012452821

Hahn, T., Figge, F., Pinkse, J., & Preuss, L. (2018). A paradox perspective on corporate sustainability: Descriptive, instrumental, and normative aspects. *Journal of Business Ethics*, *148*, 235-248.

Hahn, T., Pinkse, J., Preuss, L., & Figge, F. (2015). Tensions in corporate sustainability: Towards an integrative framework. *Journal of Business Ethics*, *127*, 297–316. https://doi.org/10.1007/s10551-014-2047-5

Harper, S. (2022). Paradoxical tensions impacting small-series production implementation in high-cost contexts: Insights from the EU apparel industry. *International Journal of Operations & Production Management*, *42*(8), 1200–1228. https://doi.org/10.1108/ijopm-11-2021-0729

He, H., Fu, Y., Zhao, Y., Liu, S., Zuo, G., Guo, P., & Xu, W. (2021). Applied properties and life cycle assessment of flexible packaging lamination processes: A comparative study. *The International Journal of Life Cycle Assessment*, *26*(3), 561–574. https://doi.org/10.1007/s11367-021-01883-4

Horodytska, O., Kiritsis, D., & Fullana, A. (2020). Upcycling of printed plastic films: LCA analysis and effects on the circular economy. *Journal of Cleaner Production*, *268*, 122138. https://doi.org/10.1016/j.jclepro.2020.122138

Horodytska, O., Valdes, F. J., & Fullana, A. (2018). Plastic flexible films waste management—A state of art review. *Waste Management*, *77*, 413–425. https://doi.org/10.1016/j.wasman.2018.04.023

Jambeck, J. R., Geyer, R., Wilcox, C., Siegler, T. R., Perryman, M., Andrady, A., Narayan, R., & Law, K. L. (2015). Marine pollution. Plastic waste inputs from land into the ocean. *Science*, *347*, 768–771. https://doi.org/10.1126/science.1260352

Jarzabkowski, P., Lê, J. K., & Van de Ven, A. H. (2013). Responding to competing strategic demands: How organizing, belonging, and performing paradoxes coevolve. *Strategic Organization*, *11*(3), 245–280. https://doi.org/10.1177/1476127013481016

Jinkarn, T., & Suwannaporn, P. (2015). Trade-off analysis of packaging attributes for foods and drinks. *British Food Journal*, *117*(1), 139–156. https://doi.org/10.1108/bfj-08-2013-0231

Johnstone, L. (2020). The construction of environmental performance in ISO 14001-certified SMEs. *Journal of Cleaner Production*, *263*, 121559. https://doi.org/10.1016/j.jclepro.2020.121559

Joseph, J., Borland, H., Orlitzky, M., & Lindgreen, A. (2018). Seeing versus doing: How businesses manage tensions in pursuit of sustainability. *Journal of Business Ethics*, *164*(2), 349–370. https://doi.org/10.1007/s10551-018-4065-1

Katic, M., & Agarwal, R. (2018). The flexibility paradox: Achieving ambidexterity in high-variety, low-volume manufacturing. *Global Journal of Flexible Systems Management*, *19*(S1), 69–86. https://doi.org/10.1007/s40171-018-0184-x

Ketchen, D. J. Jr., & Hult, G. T. M. (2007). Toward greater integration of insights from organization theory and supply chain management. *Journal of Operations Management*, *25*(2), 455–458. https://doi.org/10.1016/j.jom.2006.05.001

Kiessling, T., Knickmeier, K., Kruse, K., Brennecke, D., Nauendorf, A., & Thiel, M. (2019). Plastic Pirates sample litter at rivers in Germany–Riverside litter and litter sources estimated by schoolchildren. *Environmental Pollution*, *245*, 545–557. https://doi.org/10.1016/j.envpol.2018.11.025

King, N. (2004). Using templates in the thematic analysis of text. In *Essential guide to qualitative methods in organizational research* (pp. 256–270). SAGE Publications Ltd. https://doi.org/10.4135/9781446280119

Kovács, G., & Spens, K. M. (2005). Abductive reasoning in logistics research. *International Journal of Physical Distribution and Logistics Management*, *35*, 132–144. https://doi.org/10.1108/09600030510590318

Kramm, J., Steinhoff, S., Werschmöller, S., Völker, B., & Völker, C. (2022). Explaining risk perception of microplastics: Results from a representative survey in Germany. *Global Environmental Change*, *73*, 102485. https://doi.org/10.1016/j.gloenvcha.2022.102485

Langley, S., Phan-Le, N. T., Brennan, L., Parker, L., Jackson, M., Francis, C., Lockrey, S., Verghese, K., & Alessi, N. (2021). The good, the bad, and the ugly: Food packaging and consumers. *Sustainability*, *13*(22), 12409. https://doi.org/10.3390/su132212409

Lebreton, L., & Andrady, A. (2019). Future scenarios of global plastic waste generation and disposal. *Palgrave Communications*, *5*(1), 6. https://doi.org/10.1057/s41599-018-0212-7

Lewis, M. W. (2000). Exploring paradox: Toward a more comprehensive guide. *Academy of Management Review*, *25*(4), 760–776. https://doi.org/10.5465/amr.2000.3707712

Lewis, M. W., & Smith, W. K. (2014). Paradox as a metatheoretical perspective: Sharpening the focus and widening the scope. *The Journal of Applied Behavioral Science*, *50*(2), 127-149. https://doi.org/10.1177/0021886314522322

Marrucci, L., Marchi, M., & Daddi, T. (2020). Improving the carbon footprint of food and packaging waste management in a supermarket of the Italian retail sector. *Waste Management*, *105*, 594–603. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/32199583. https://doi.org/10.1016/j.wasman.2020.03.002

Miller, M., Steele, C., Horn, D., & Hanna, C. (2018). Marine debris trends: 30 years of change on Ventura County and Channel Island beaches. *Western North American Naturalist*, *78*(3), 328–340. https://doi.org/10.3398/064.078.0308

Ministry for the Environment. (2022). Te hau marohi ki anamata Towards a productive, sustainable and inclusive economy: Aotearoa New Zealand's first emissions reduction plan. https://environment.govt.nz/assets/publications/Aotearoa-New-Zealandsfirst-emissions-reduction-plan.pdf

Ministry for the Environment. (2023). https://environment.govt.nz/what-government-is-doing/areas-of-work/waste/reducing-food-waste/

Moraes, N. V., Lermen, F. H., & Echeveste, M. E. S. (2021). A systematic literature review on food waste/loss prevention and minimization methods. *Journal of Environmental Management*, *286*, 112268. https://doi.org/10.1016/j.jenvman.2021.112268

Ose, S. O. (2016). Using Excel and Word to structure qualitative data. *Journal of Applied Social Science*, *10*(2), 147–162. https://doi.org/10.1177/1936724416664948

Otto, S., Strenger, M., Maier-Nöth, A., & Schmid, M. (2021). Food packaging and sustainability—Consumer perception vs. correlated scientific facts: A review. *Journal of Cleaner Production*, *298*, 126733. https://doi.org/10.1016/j.jclepro.2021.126733

Pålsson, H., & Sandberg, E. (2020). Paradoxes in supply chains: A conceptual framework for packed products. *The International Journal of Logistics Management*, *31*(3), 423–442. https://doi.org/10.1108/ijlm-12-2019-0338

Pålsson, H., & Sandberg, E. (2021). Packaging paradoxes in food supply chains: Exploring characteristics, underlying reasons and management strategies. *International Journal of Physical Distribution and Logistics Management*, *52*(11), 25–52. https://doi.org/10.1108/ijpdlm-09-2019-0270

Pålsson, H., & Sandberg, E. (2022). Adoption barriers for sustainable packaging practices: A comparative study of food supply chains in South Africa and Sweden. *Journal of Cleaner Production*, *374*, 133811. https://doi.org/10.1016/j.jclepro.2022.133811

Parmar, P. S., & Desai, T. N. (2020). A systematic literature review on Sustainable Lean Six Sigma: Current status and future research directions.

International Journal of Lean Six Sigma, *11*(3), 429–461. https://doi.org/10.1108/ijlss-08-2018-0092

Pathak, G., Nichter, M., Hardon, A., Moyer, E., Latkar, A., Simbaya, J., Pakasi, D., Taqueban, E., & Love, J. (2023). Plastic pollution and the open burning of plastic wastes. *Global Environmental Change*, *80*, 102648. https://doi.org/10.1016/j.gloenvcha.2023.102648

Pauer, E., Wohner, B., Heinrich, V., & Tacker, M. (2019). Assessing the environmental sustainability of food packaging: An extended life cycle assessment including packaging-related food losses and waste and circularity assessment. *Sustainability*, *11*(3), 925. https://doi.org/10.3390/su11030925

Paulus, T. M. (2023). Using qualitative data analysis software to support digital research workflows. *Human Resource Development Review*, *22*(1), 139–148. https://doi.org/10.1177/15344843221138381

Perrot, J.-F., & Subiantoro, A. (2018). Municipal waste management strategy review and waste-to-energy potentials in New Zealand. *Sustainability*, *10*(9), 3114. https://doi.org/10.3390/su10093114

Petticrew, M., & Roberts, H. (2006). *Systematic reviews in the social sciences: A practical guide 2006* (Vol. 6, pp. 304–305). Blackwell Publishing CrossRef Google Scholar. https://doi.org/10.1002/9780470754887

Poole, M. S., & Van de Ven, A. H. (1989). Using paradox to build management and organization theories. *Academy of Management Review*, *14*(4), 562–578. https://doi.org/10.2307/258559

Reay, T., Goodrick, E., Waldorff, S. B., & Casebeer, A. (2017). Getting leopards to change their spots: Co-creating a new professional role identity. *Academy of Management Journal*, *60*(3), 1043–1070. https://doi.org/10.5465/amj.2014.0802

Rhein, S., & Schmid, M. (2020). Consumers' awareness of plastic packaging: More than just environmental concerns. *Resources, Conservation and Recycling*, *162*, 105063. https://doi.org/10.1016/j.resconrec.2020.105063

Sandhiya, R., & Ramakrishna, S. (2020). Investigating the applicability of blockchain technology and ontology in plastics recycling by the adoption of ZERO plastic model. *Materials Circular Economy*, *2*, 13. https://doi.org/10.1007/s42824-020-00013-z

Santos, Â. R. S., De Melo, R. M., Clemente, T. R. N., & Machado Santos, S. (2021). Integrated management system: Methodology for maturity assessment in food industries. *Benchmarking: an International Journal*, *29*(6), 1757–1780. https://doi.org/10.1108/bij-05-2021-0280

Sasaki, Y., Orikasa, T., Nakamura, N., Hayashi, K., Yasaka, Y., Makino, N., Shobatake, K., Koide, S., & Shiina, T. (2021). Life cycle assessment of peach transportation considering trade-off between food loss and environmental impact. *The International Journal of Life Cycle Assessment*, *26*(4), 822–837. https://doi.org/10.1007/s11367-020-01832-7

Saunders, M., Lewis, P., & Thornhill, A. (2015). *Research methods for business students* (7th ed., Vol. 124). Pearson.

Schad, J., Lewis, M. W., Raisch, S., & Smith, W. K. (2016). Paradox research in management science: Looking back to move forward. *Academy of Management Annals*, *10*(1), 5–64. https://doi.org/10.1080/19416520.2016.1162422

Seuring, S., & Müller, M. (2008). From a literature review to a conceptual framework for sustainable supply chain management. *Journal of Cleaner Production*, *16*(15), 1699–1710. https://doi.org/10.1016/j.jclepro.2008.04.020

Sharp, E. L., Haszard, J., Egli, V., Roy, R., Te Morenga, L., Teunissen, L., Decorte, P., Cuykx, I., De Backer, C., & Gerritsen, S. (2021). Less food wasted? Changes to New Zealanders' household food waste and related behaviours due to the 2020 COVID-19 lockdown. *Sustainability*, *13*(18), 10006. https://doi.org/10.3390/su131810006

Siracusa, V., Ingrao, C., Lo Giudice, A., Mbohwa, C., & Dalla Rosa, M. (2014). Environmental assessment of a multilayer polymer bag for food packaging and preservation: An LCA approach. *Food Research International*, *62*, 151–161. https://doi.org/10.1016/j.foodres.2014.02.010

Smith, W. K., & Lewis, M. W. (2011). Toward a theory of paradox: A dynamic equilibrium model of organizing. *Academy of Management Review*, *36*(2), 381–403. https://doi.org/10.5465/amr.2009.0223

Soares, C. T. D. M., Ek, M., Östmark, E., Gällstedt, M., & Karlsson, S. (2022). Recycling of multi-material multilayer plastic packaging: Current trends and future scenarios. *Resources, Conservation and Recycling*, *176*, 105905. https://doi.org/10.1016/j.resconrec.2021.105905

Sundqvist-Andberg, H., & Åkerman, M. (2021). Sustainability governance and contested plastic food packaging—An integrative review. *Journal of Cleaner Production*, *306*, 127111. https://doi.org/10.1016/j.jclepro.2021.127111

Sustainable Business Network. (2021). Going full circle. https://sustainable.org.nz/

Talwar, S., Kaur, P., Yadav, R., Sharma, R., & Dhir, A. (2023). Food waste and out-of-home-dining: Antecedents and consequents of the decision to take away leftovers after dining at restaurants. *Journal of Sustainable Tourism*, *31*(1), 47–72. https://doi.org/10.1080/09669582.2021.1953512

Truong, Q. (2019). *Food packaging process material's effect on environment and their control measures*. Metropolia University of Applied Sciences.

Van der Byl, C. A., & Slawinski, N. (2015). Embracing tensions in corporate sustainability: A review of research from win-wins and trade-offs to paradoxes and beyond. *Organization & Environment*, *28*(1), 54–79. https://doi.org/10.1177/1086026615575047

Venter, Z. S., Shackleton, C., Faull, A., Lancaster, L., Breetzke, G., & Edelstein, I. (2022). Is green space associated with reduced crime? A national-scale study from the Global South. *Science of the Total Environment*, *825*, 154005. https://doi.org/10.1016/j.scitotenv.2022.154005

Waldman, D. A., Putnam, L. L., Miron-Spektor, E., & Siegel, D. (2019). The role of paradox theory in decision making and management research. *Organizational Behavior and Human Decision Processes*, *155*, 1–6. https://doi.org/10.1016/j.obhdp.2019.04.006

Weyandt, A. J., Da Costa, S. R. R., Nunes, M. L., & Gaspar, A. (2011). Environmental & food safety management systems, according to ISO 14001 & ISO 22000 in fish processing plants: Experiences, critical factors & possible future strategies. *Procedia Food Science*, *1*, 1901–1906. https://doi.org/10.1016/j.profoo.2011.09.279

White, A., & Lockyer, S. (2020). Removing plastic packaging from fresh produce—What's the impact. *Nutrition Bulletin*, *45*(1), 35–50. https://doi.org/10.1111/nbu.12420

Xiao, C., Wilhelm, M., van der Vaart, T., & van Donk, D. P. (2019). Inside the buying firm: Exploring responses to paradoxical tensions in sustainable supply chain management. *Journal of Supply Chain Management*, *55*(1), 3-20.

Yin, R. (2018). *Case study research and applications: Design and methods*. Sage Publications.

How to cite this article: Farrukh, A., & Sajjad, A. (2024). Investigating sustainability tensions and resolution strategies in the plastic food packaging industry—A paradox theory approach. *Business Strategy and the Environment*, *33*(4), 2868–2889. https://doi.org/10.1002/bse.3637