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Leveraging organisational agility in B2B ecosystems to mitigate food waste and loss: A stakeholder perspective

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ABSTRACT

Facing global challenges and uncertainty, food wastage and loss (FWL) have become pressing concerns for food industry stakeholders across the supply chain, impacting United Nations Sustainable Development Goals 2 (Zero Hunger) and 12 (Responsible Consumption and Production). This study investigates how organisational agility within business-to-business (B2B) supply chains promotes innovative strategies to reduce FWL. Specifically, through qualitative methods involving interviews and observations with stakeholders in Nigerian food supply chains, this study explores the integration of technological innovations like data-driven decisions, and automation in B2B collaborations to enhance resilience and reduce waste. The findings demonstrate that active and proactive innovative strategies can effectively reduce FWL at the pre-consumption stage. This study contributes to the literature by demonstrating how technological innovation and organisational agility combine to mitigate food waste and loss within pre-consumption stages of B2B supply chains. It also promotes organisational agility within B2B settings, emphasising innovative partnerships and sustainable food supply chain development. These insights address waste in the context of pressing global challenges such as food inequality, economic disparities, environmental degradation, hunger, and malnutrition.

1. Introduction

In recent times, global challenges and crises often require companies to adopt proactive approaches to issues with a potential impact on their financial viability and long-term sustainability (Ludviga & Kalvina, 2024). This necessitates organisational agility and strategies to mitigate adverse developments. Organisational agility is the "ability for businesses to be proactive and respond to change" (Nafei, 2016:3). Those engaged in business-to-business (B2B) operations, in particular, face strategic decisions on proactively addressing turbulent situations that could hinder their financial performance (Li, Malik, Ijaz, & Irfan, 2023; Nejatian, Zarei, Nejati, & Zanjirchi, 2018).

Organisational agility has become crucial for B2B firms to remain competitive in response to changing dynamics and challenges, particularly regarding sustainability (Luu, 2021). According to Frau, Moi, Cabiddu, and Keszey (2022), recent research emphasises that organisations need to consider not only profitability but also their environmental impact, demanding organisational agility on both these fronts. This study investigates how organisational agility within B2B supply chains promotes innovative strategies to reduce food waste and loss (FWL); research that could significantly impact the field of food industry sustainability.

FWL is a major challenge causing turbulence in the food supply chain (FSC), affecting profit, food security, and the environment. With the global population expanding, the need to manage FWL has intensified (FAO, 2023; Kolawole, Mishra, & Hussain, 2021). The United Nations aims to "halve per capita global food waste at the retail and consumer levels by 2030" through Sustainable Development Goal (SDG) 12.3, implicating both production and the supply chain in line with 'Responsible Production and Consumption' (UN, 2016, p. 43). The business objective for companies in the food industry, therefore, is to achieve FWL reduction as required by the UN SDGs while preserving profitability.

Whereas current research predominantly focuses on the post-consumption stage of food waste in developed countries, over 50 % of FWL in developing nations occurs at the pre-consumption stage, driven

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by inefficiencies in harvesting, processing, and distribution (FAO, 2020; Gustavsson, Cederberg, & Sonesson, 2011). For example, in Sub-Saharan Africa (SSA), post-harvest losses account for nearly 30 % of all food produced annually, equivalent to approximately $4 billion in economic losses (Kolawole et al., 2021).

Developing countries face unique challenges that make them different from developed countries. These include but are not limited to unfavourable government policies, market differentiation, and institutional and social factors that negatively impact the food industry. Parfitt, Barthel, and Macnaughton (2010) emphasised the need for more data on food waste in developing countries and socioeconomic contexts, examining both the pre-and consumption stages, while Gustavsson et al. (2011) highlighted the contribution of infrastructure and market inefficiencies in developing countries to high levels of FWL. In addition, Kolawole et al. (2021) mentioned that the supply chain in developing countries might be longer and more fragmented, creating a market structure that leads to higher pre-consumption food waste. For instance, the lack of cold chain logistics at various stages in many SSA countries leads to spoilage during transport, particularly for perishable goods like fruits and vegetables (FAO, 2023). In Nigeria, where over 40 % of the population relies on agriculture for their livelihood, poor infrastructure and inadequate market access result in significant pre-consumption losses (Gustavsson et al., 2011; Kolawole et al., 2021).

Social norms and behaviour, such as cultural practices and religious beliefs, also contribute to FWL at the pre-consumption stage (Higgs, Liu, Collins, & Thomas, 2019). With more than 336 t of waste annually (FAO, 2020), developing countries contribute significantly to global food waste, making research focusing on developing countries an urgent requirement.

Reducing FWL in developing countries, especially in SSA, would contribute to global food security and align with SDGs, particularly SDG 2 (Zero Hunger) and SDG 12 (Responsible Production and Consumption). However, there is a dearth of evidence on how organisations can meet this need. Nigeria provides an ideal context for a case study addressing these challenges due to its substantial agricultural output and central role in the regional economy, accounting for nearly 25 % of SSA's population and GDP (World Bank annual report, 2021). Food waste in Nigeria represents lost revenue and exacerbates food insecurity, with approximately 19.4 million people estimated to be undernourished in 2022 (FAO, 2023). These challenges highlight the critical need for innovative strategies to enhance the efficiency and resilience of food supply chains, and organisational agility will be needed to implement these strategies.

Few studies have investigated pre-consumption losses, such as harvest waste (Mourad, 2016), wholesaler-retailer dynamics (Mena, Terry, Williams & Ellram, 2014), and retail (Dora et al., 2021), and those few mostly relate to developed countries. Consequently, little attention has been given to food processing and distribution waste in developing countries, particularly Sub-Saharan Africa, and how B2Bs utilise organisational agility to address this issue. Moreover, few studies have explored how the sharing of resources like technology and innovation can reduce waste in the pre-consumption and consumption stages of the FSC.

Unlike previous research, which typically focused mostly on the consumption stage, this study explores pre-consumption stages of the FSC. The research question is:

"*How can organisational agility within B2B operations drive innovative strategies to reduce pre-consumption food waste in the FSC*?"

Drawing on Stakeholder theory and organisational agility as a theoretical framework, we interviewed 30 individuals from two B2B firms.

This study offers a significant contribution to literature from the perspective of developing countries. First, there has been limited research into the role of collaboration among B2Bs in reducing pre-consumption FWL in the Global South: This paper offers a comprehensive insight into food waste solutions at the pre-consumption stage of the FSC in Sub-Saharan Africa, taking Nigeria as a key example. Thus, the paper contributes to research on organisational agility, innovation, and relates this to sustainable development goals (United Nations, 2023). It provides a fresh perspective, emphasising the synergy between human and technological innovation to reduce FWL upstream in the supply chain.

Second, by highlighting the importance of UN SDGs 2 and 12, this study demonstrates practical relevance to global sustainability initiatives and efforts to achieve targets for food security and sustainable consumption and production (Lee, Zeng, & Luo, 2023). It also contributes to enhancing organisational agility within the B2B setting by emphasising strategic, innovative partnerships and the development of resilient, sustainable FSCs.

Third, from a stakeholder perspective, the study provides valuable theoretical insights to assist food supply chain managers, consumers, policymakers and food industries in addressing food waste and loss. For example, our research provides actionable strategies that would allow food supply chain managers to optimise operations through collaboration with employees to reduce inefficiencies that can lead to FWL. Our contribution can aid policymakers in formulating and implementing policies that effectively address FWL. The paper contributes to the understanding of the role of food supply chain stakeholders in reducing FWL.

2. Theoretical background and literature review

2.1. Stakeholder theory

Stakeholder theory (Freeman,1984) posits that businesses operate within a complex web of interconnected relationships involving various stakeholders, such as shareholders, employees, communities, and interest groups (Hodgkins, Rundle-Thiele, Knox, & Kim, 2019). Therefore, "Any group or individual who can affect or is affected by the achievement of an organisation's objectives" is referred to as a stakeholder (Freeman, 1984). According to stakeholder theory, businesses create externalities that impact many stakeholders, both inside and outside the company (Ramanathan, Ramanathan, Pelc, & Hermens, 2024). These externalities frequently lead stakeholders to put more pressure on businesses to lessen their negative effects and increase their positive ones (May & Previte, 2016).

Stakeholders have been categorised in several ways: direct or indirect, primary or secondary, or based on urgency, power, or different aspects of legitimacy (Delmas, 2002; Delmas & Terlaak, 2001; Delmas & Toffel, 2004). However, the fundamental idea of stakeholder theory is that both internal and external groups will impact organisational practices in business ecosystems, including B2B operations (Buyucek, Kubacki, Rundle-Thiele, & Pang, 2016). Thus, stakeholder pressures affecting individual or multiple supply chain participants may cause environmental externalities to be internalised (Mesiranta, Närvänen, & Mattila, 2022; Xu, Lin, Gordon, Robinson, & Harder, 2016).

Building on stakeholder theory's emphasis on interconnected relationships, Brown et al. (2024) argue that achieving sustainability starts within organisations by aligning internal marketing strategies with broader sustainability goals, thereby fostering sustainable co-creation of value. This perspective not only underscores the importance of managing internal and external stakeholder dynamics (Buyucek et al., 2016; Hodgkins et al., 2019), but also provides a pathway for organisations to address the sustainability gap in B2B ecosystems (Ramanathan et al., 2024).

In the context of food waste and loss (FWL), this alignment ensures that internal processes, such as the planning of production and demand, are designed to mitigate waste while addressing stakeholder expectations for sustainability (Benyam, Kinnear, & Rolfe, 2018; Govindan, 2018). For example, companies can leverage internal marketing strategies to enhance employee engagement with sustainability practices, thereby improving operational agility (Schaltegger, Lüdeke-Freund, &

Hansen, 2016). This integration of internal and external stakeholder priorities contributes to achieving SDG 12 (Responsible Consumption and Production) by embedding sustainable practices across the supply chain (Lopes de Sousa Jabbour, Frascareli, Santibanez Gonzalez, & Chiappetta Jabbour, 2023; Luu, 2021).

Nonetheless, there are some recurring distinctions, such as the perspectives of organisational stakeholders or supply chain partners. Even more than individual businesses, the supply chain comprises a wide range of stakeholders, and this number grows especially rapidly when sustainability-related concerns are raised (de Brito, Carbone, & Meunier Blanquart, 2008). When issues arise in addressing FWL, stakeholder theory is often presented to explain factors that influence or are contingent upon the adoption of various strategies (Buyucek et al., 2016).

Stakeholder theory is widely recognised and applied in research into social, environmental, and sustainability management (Ramanathan et al., 2024; Montiel & Delgado-Ceballos, 2014; Sarkis, Zhu & Lai, 2011). It promotes mutual interests among stakeholders, rather than a trade-off-focused approach, particularly when organisations develop agility strategies (Gutterman, 2023a, 2023b; Schaltegger et al., 2016) grounded in shared interests, and it strives to create value for all parties involved (Hodgkins et al., 2019). While acknowledging trade-offs, management actively seeks to mitigate them, especially against overriding challenges to sustainability like climate change, responsible production and consumption, including FWL (Lacoste, 2016).

Stakeholder theory aligns with the United Nations Sustainable Development Goals (SDGs), notably SDGs 2 and 12 (Luu, 2021): **Goal 2**: Zero Hunger - Achieve food security and improved nutrition; **Goal 12**: Responsible Consumption and Production - Substantially reduce waste generation through prevention, reduction, recycling, and reuse.

Towards SDG 2, the theory emphasises businesses' contribution to ensuring food security by engaging stakeholders in reducing food waste and enhancing distribution. SDG 12, however, focuses on balancing diverse stakeholder interests, promoting responsible consumption and production, and encouraging organisations to consider social and environmental impacts, for which stakeholder theory provides a valuable framework (Lopes de Sousa Jabbour et al., 2023). Various stakeholders in the food sector have demonstrated unprecedented interest in projects aimed at decreasing FWL in line with the UN's sustainability agenda of halving FWL across the supply chain (Benyam et al., 2018). Collaboration has been viewed by stakeholders throughout the food supply chain as a legitimate and urgent strategy for reducing FWL (Govindan, 2018; Mena, Terry, Williams & Ellram, 2014; Nikolicic, Kilibarda, Maslaric, Mircetic, & Bojic, 2021; Priefer, Jörissen, & Braeutigam, 2016).

This collaborative approach stems from stakeholders' recognition by that waste occurs for various reasons and at different stages in the food supply chain; hence, tackling the intricate issue of FWL requires multi-stakeholder collaboration (Bhattacharya & Fayezi, 2021). A significant portion of previous research on FWL has examined general explanatory theory (Tate, Ellram, & Kirchoff, 2010) or multi-theoretic stakeholder theory to explain phenomena (Sarkis, Gonzalez-Torre, & Adenso-Diaz, 2010). Studies applying stakeholder theory have also sought to examine and identify the roles of different stakeholders within FWL practices (de Brito et al., 2008; Gunther & Scheibe, 2005); specific stakeholder influences on FSC stakeholders in the effective application of Lean Six Sigma (LSS) tools and Double Loop Learning (DLL) to reduce FWL (Kolawole et al., 2021); using stakeholder theory to control food waste in restaurants (Mattila & Mesiranta, 2020); life cycle analysis in the supply chain (Govindan, 2018); environmentally oriented reverse logistics (Sarkis et al., 2010); stakeholder collaboration-related strategies for mitigating FWL in Turkey (Surucu-Balci & Tuna, 2022); and reducing food waste and loss in Indian agri-business (Sagi & Gokarn, 2023).

In this framework, stakeholder theory helps determine the different kinds of stakeholders that are prevalent in the FSC (Freeman et al., 2023; Mitchell, Agle, & Wood, 1997), and ways that collaboration between stakeholders can promote the creation of comprehensive strategies to address FLW (Lipinski et al., 2013; Priefer et al., 2016).

Stakeholder theory promotes an expanded focus, shifting design, planning and implementation efforts beyond downstream participants to other actors who exert influence over complex issues such as FWL (Freudenreich, Lüdeke-Freund, & Schaltegger, 2020; May & Previte, 2016; Wymer, 2011). According to Buyucek et al. (2016), there might be a positive correlation between programme success and the number of stakeholders that are considered during planning and decision-making. Hence, applying a management lens in the form of stakeholder theory might meet the need for efficient management and prioritisation of the stakeholder and partner relationships already involved within FWL programmes (Freeman et al., 2023; Buyucek et al., 2016;).

2.2. B2B ecosystem

Researchers have asserted that collaboration in the B2B ecosystem throughout food supply chains is crucial for sustainable success (Gatto & Chepeliev, 2024). Vachon and Klassen (2007) defined B2B collaborations with an emphasis on environmental sustainability as interactions between supply chain members for common environmental goals, which can be directed upstream or downstream and may be intra- or inter-organisational or both (Nafei, 2016). Therefore, it is vital to recognise the importance of B2B collaboration and the role of organisational agility in achieving sustainability goals.

Viewing B2B ecosystems through an innovation lens, Baldwin, Bogers, Kapoor, and West (2024) highlight how organisations can better understand interdependencies and identify opportunities for collaborative innovation. This perspective is particularly relevant to the study of FWL as it demonstrates how shared technological advancements can foster agility and sustainability in supply chains (Gatto & Chepeliev, 2024; Trischler, Svensson, Williams, & Wikstrom, 2022). Therefore, organisations in B2B ecosystems can develop collaborative platforms for resource sharing, such as integrated transportation systems or shared data analytics tools (Sarkar, Dey, Sarkar, & Kim, 2022; Vachon & Klassen, 2007). These innovations not only enhance operational efficiency but also enable companies to adapt to dynamic market conditions, a critical aspect of addressing FWL (Gonzalez-Perez & Leonard, 2017; Hörisch, Freeman, & Schaltegger, 2014). For instance, adopting predictive analytics tools in a collaborative setting allows multiple stakeholders to optimise inventory management, reducing waste caused by overproduction or supply chain disruptions (Manzoor et al., 2024). This approach aligns with SDGs 2 (Zero Hunger) and 12 (Responsible Consumption and Production), showcasing how innovation-driven collaboration can drive impactful sustainability outcomes (Fonseca & Carvalho, 2019; Huang & Zhang, 2021).

While Supply Chain Value Optimisation and organisational agility have been proposed as effective strategies to reduce FWL in B2B settings to achieve UN sustainability goals, other scholars explore different innovative approaches (Manzoor et al., 2024; Trischler et al., 2022). Collaboration among multiple stakeholders is essential for economically viable and socially acceptable solutions: business sustainability literature emphasises B2B companies' integration of economic, environmental, and social goals while considering stakeholder interests (Bansal, 2002; Dyllick & Hockerts, 2002; Hahn, Pinkse, Preuss, & Figge, 2015; Hörisch et al., 2014). The UN Global Compact (Gonzalez-Perez & Leonard, 2017) defines sustainability as requiring a holistic approach, considering environmental, social, and economic dimensions to achieve lasting prosperity (Huang & Zhang, 2021).

Food waste is increasingly recognised as a major global environmental issue, prompting national and international initiatives (Gatto & Chepeliev, 2024). Mitigation efforts link FWL to related problems like food poverty and a roadmap for solutions is guided by SDG 2 (zero hunger) and SDG 12 (responsible consumption and production). Since the SDGs constitute a clear expression of stakeholder requirements on a global scale and balance social, economic, and environmental growth,

they are a good indicator of the primary objectives of sustainable development (Fonseca & Carvalho, 2019;).

FWL has serious negative effects and is receiving more attention globally because of its connections to food security and its links to issues like uneven access to food, especially the disparity between developed and developing countries (Grosso & Falasconi, 2018). The UN estimates that 1.3 billion tonnes of food are lost annually, leaving 795 million people without access to food and about 1 billion undernourished (Djekic et al., 2021). Food insecurity is a significant problem; it is known that while food production is rising, demand is rising faster (Galli, Cavicchi, & Brunori, 2019). Along with the growth in overall demand, access to money, and changes in lifestyle, there is a tremendous increase in both the production and waste of food (Szulecka & Strøm-Andersen, 2022). With respect to the UN SDGs, these variables exacerbate the pressing issues of climate change and food security, with food security being crucial to achieving SDG 2 (Manzoor et al., 2024).

SDGs 2 and 12 can be achieved more quickly by combining organisational agility with innovative solutions that are focused on reducing FWL and adopting sustainable consumption habits (Mokrane, Buonocore, Capone, & Franzese, 2023). In terms of responsible consumption (SDG 12), the shelf stability of fresh food can be increased by using the latest, ecologically friendly food packaging, which can reduce FWL and its associated costs to the economy and environment (Spada, Conte, & Del Nobile, 2018).

Integrated initiatives to reduce FWL are crucial, as sustainable food systems are vital for resilience during turbulent times and require new technologies, innovative solutions, collaborative work with B2B stakeholders, and alignment with specific UN SDGs. However, there is a lack of research into the utilisation of technology, innovation and FSC sustainability in the Nigerian setting. Such research could help to meet the need for technological innovations, creative thinking and collaborative work with B2B stakeholders in working towards the achievement of the UN SDGs (Akkerman & Cruijssen, 2024).

2.3. Organisational agility and FWL in the B2B ecosystem

Success in building effective connections and achieving organisational agility depends on the clear definition of collaborative project goals and the participants involved, whilst achieving sustainability goals is intrinsically linked to organisational agility, stakeholder management, sustainability performance, and sustainable development (Keszey, 2020; Motwani & Katatria, 2024). Stakeholders' collaboration in B2B organisations takes sustainability as a core value and shared interest (Bansal, 2002; Bansal & DesJardine, 2014), seeing sustainable development as meeting present needs without compromising the ability of future generations to meet their own needs, and addressing economic, environmental, and social dimensions (Bansal, 2002; Dyllick & Hockerts, 2002).

Although organisational agility is recognised as promoting sustainability, there has still been little work on the intersection between organisational agility and environmental sustainability in food production and specifically defining agility in the agri-food context (Ivory & Brooks, 2018; Shams, Alam, & Mahbub, 2021). On the other hand, prior research suggests that agility is critical for improving responsiveness to customer demand and optimizing the whole food system by minimising FWL (Hassoun et al., 2022; Brooks et al., 2021; Sharma, Gahlawat, Rahul, Mor, & Malik, 2021). Prior studies highlight that organisational agility in the food industry shortens production downtime, improving responsiveness to customer demand and, hence, increasing productivity (Ciccullo et al., 2018). More importantly, organisational agility guarantees "reduced food waste through the whole food system because the viable shelf life is optimised" (Brooks et al., 2021, p. 3).

In the face of global uncertainties and challenges, organisational agility becomes increasingly pertinent as organisations adapt to dynamic and unpredictable conditions, while attempting not to jeopardise their long-term ability to serve stakeholders. This adaptability is crucial in a volatile global business environment; hence, it is essential to reinforce stakeholders' interest in sustainability and identify shared goals, such as addressing FWL in B2B ecosystems (Hörisch et al., 2014). Research has primarily focused on measuring sustainability performance at one stage of the supply chain, often the focal company, with a strong emphasis on environmental indicators to address external pressures and constraints (Papargyropoulou, Wright, Lozano, & Steinberger, 2016).

The primary concern that has had a significant impact on all sectors—including the food sector—is sustainability. In the current volatile market, there is greater competition among enterprises, which has forced them to embrace agility to make their operations sustainable. Thus, the food industry has transitioned to sustainable manufacturing methods, in which organisational agility is essential (Geyi, Yusuf, Menhat, Abubakar, & Ogbuke, 2020; Lei, Xu, Liu, Liu, & Sun, 2022). By recognising gaps in the pre-consumption stage, organisational agility is an effective construct that adds value to the activities of organisations and allows them to adjust to the changing environment. It improves businesses' capacity to identify inconsistencies and aids in the planning and production of resources, while resolving any market issues.

Organisational agility allows businesses to adjust to real-time data and develop tools that support decision-making. According to earlier studies, operational agility that incorporates sustainability boosts resilience and adaptability (Cantele, Russo, Kirchoff, & Valcozzena, 2023; Vázquez-Bustelo, Avella, & Fernández, 2007; Wu, Tseng, Chiu, & Lim, 2017), which helps promote sustainable practices and reduces FWL.

For these reasons, organisational agility is receiving increasing attention in academia, while attention has also been given recently to social indicators across various stages of the supply chain. Meanwhile, the literature shows that food production businesses are adopting cutting-edge techniques and innovative tools to address the problem of FWL (Somlai, 2023) and promoting sustainable business practices. Combining these trends, the present study investigates the role of organisational agility through B2B stakeholder engagement to tackle the complex issue of FWL.

2.4. Relationships between FWL, business sustainability and SDGs

Li et al. (2024) and Hassoun et al. (2024) define food waste as the decrease in food available for consumption along the supply chain because of loss, damage, disposal, or diversion to other purposes. Waste occurs everywhere along the food value chain, from production to consumption, and is a serious global problem (Crippa, Solazzo, Guizzardi, et al., 2021; Rosenzweig, Tubiello, Sandalow, Benoit, & Hayek, 2021); it is unethical, unsustainable, and bad for the economy (Li et al., 2024). The Food and Agriculture Organisation's 2015 report (FAO Office of Evaluation, 2015) estimated global food loss to be worth $1 trillion USD. Industrialised countries disposed of 222 million tons of food waste at the consumer level, while low-quality infrastructure for production and distribution in developing nations was also thought to be one of the major causes of high FWL (Luu, 2021), as sub-Saharan Africa alone generated 230 million tons.

Poor coordination between stakeholders along the FSC is a key cause of increased FWL (Govindan, 2018; Somlai, 2023), leading to food being wasted at every stage of the supply chain, from the point of manufacture to the point of consumption. In the early stages, food loss occurs due to ineffective physical infrastructure and post-harvest production and processing practices (Gustavsson et al., 2011). Though there are differences between developed and developing countries, as discussed in the Introduction, the bulk of FWL globally occurs in the final stage of the supply chain, during consumption, retail, and hospitality (Parfitt et al., 2010). This excessive FWL causes one-third of the food intended for human consumption to be lost, with direct effects on society, the economy and the environment (Conrad & Blackstone, 2020; Papargyropoulou et al., 2016). Globalisation, urbanisation, industrialisation, and population growth are all contributing factors to the world's increasing

wastage of food (Galli et al., 2019; Thyberg & Tonjes, 2017).

In B2B food supply chains, sustainability is a paramount concern encompassing a range of issues, such as natural resource usage, emissions, animal welfare, consumer health, food quality, ethical labour conditions, and affordability. The Food and Agriculture Organisation (FAO) projects a need for a 60 % increase in global food production by 2050 to address world hunger, while emphasising the importance of resource capacity and reducing food waste (FAO Office of Evaluation, 2015). This highlights the multifaceted challenges to sustainability in the food industry and the problem is expected to persist for the foreseeable future (Das et al., 2023; Gatto & Chepeliev, 2024).

In the context of global uncertainties and challenges related to food security and sustainable consumption and production (climate change, biodiversity loss, inequitable access to food, economic disparities, global health, conflict and instability, environmental degradation, hunger and malnutrition, food waste) (Brennan, 2024; Das et al., 2023), the food sector interacts with the three pillars of the sustainability triangle (economy, environment and society) (Ciccullo, Fabbri, Abdelkafi, & Pero, 2022). In business terms, sustainability can be defined as "meeting the needs of a firm's direct and indirect stakeholders without compromising the ability to meet the needs of future stakeholders" (Dyllick & Hockerts, 2002, p.131), while Bansal & Song (2017) expand the triangle theme with further underlying principles: pursuing social, environmental, and economic goals simultaneously; prioritising justice across generations, with desirable societal results.

Nafei (2016) states that organisations thrive in dynamic environments when their characteristics are appropriately tailored to the circumstances; they need to change rapidly with the changing environment and must therefore increase internal organisational factors that heighten organisational agility to function under turbulent and unpredictable circumstances. Thus, businesses are viewed as agents of social and economic change in B2B ecosystems because they have the means to instigate such changes (Bansal & DesJardine, 2014). However, to do so they must acknowledge and balance many, sometimes opposing, stakeholders' interests (Hahn et al., 2015).

2.5. Innovation in supply chains

Supply chain innovation plays a vital role in transforming existing processes into optimised states (Rampa & Agogué, 2021). It encompasses various approaches to customer needs and sustainability, as explained by numerous scholars (Hanaysha, 2022). Notably, the concept of circularity has gained prominence in the supply chain discussion; digital business-to-business (B2B) ecosystems are exploring innovative methods to close the loop of product lifecycles, leading to reduced waste, increased reuse, and optimised environmental, social, and economic sustainability indicators (Sarkar et al., 2022).

Innovation is typically defined as the successful implementation of novel concepts or ideas, including revolutionary, ongoing, evolutionary, or disruptive changes (Carayannis & Gonzalez, 2003). However, not all innovation processes create value; they often introduce uncertainty and dissatisfaction among participating businesses and supply chains (Bessant, Lamming, Noke, & Phillips, 2005). Thus, building a capacity for productive innovation is a collaborative endeavour involving varying degrees of intra- and inter-organisational coordination. Organisational agility and innovative supply chain management strategies are pivotal for addressing specific market challenges and realigning market trajectories.

For the purpose of this research, supply chain innovation capacity is the extent to which a supply chain, through its strategic relationships, resulting competencies, and capabilities, proactively develops and implements new practices, processes, systems, and technologies that enhance its competitive advantage and meet end-user needs (adapted from Carayannis and Gonzalez (2003). The complexity of supply chain innovation varies, with some actors in the B2B ecosystem embracing radical and disruptive innovations to proactively reshape market conditions and bolster their market positions, particularly when traditional methods and price competition prove insufficient (Bessant et al., 2005). In the specific B2B ecosystem of the food industry, the factors influencing the adoption of innovative supply chains in remain incompletely understood. Knowledge gaps persist regarding the effects of integrating innovative supply chains, especially concerning the benefits to food businesses and the impact on cooperative behaviours to mitigate food loss (Ben-Daya, Hassini, & Bahroun, 2017).

The following section will examine sustainable, innovative methods, such as technological innovation, to address the complex issue of food waste within B2B ecosystems in selected companies, shedding light on the role of technology in enhancing sustainability and reducing waste.

2.6. Technological innovations in mitigating FWL

Technological innovation is a vital catalyst for transforming food waste management within the supply chain (Antonelli, Basile, Gagliardi, & Isernia, 2022). It involves adopting advanced technologies to create and implement novel goods, services or procedures, bolstering efficiency and sustainability. Yet, harnessing technological innovations for food waste mitigation in B2B settings presents challenges, particularly in terms of costs and risks. Since 2010, a global drive has emerged to develop technologies that can quantify, reduce, and recover food waste more effectively, primarily driven by the quest for sustainability in the food supply (Caldeira, De Laurentiis, Corrado, van Holsteijn, & Sala, 2019). As well as enhancing food security, research highlights that integrating technological innovations in addressing food waste has delivered substantial benefits to diverse organisations in the food sector (Zhang, Wedel, & Bloem, 2022).

Some scholars advocate partnering with third-party technology suppliers, fostering innovative approaches to food waste challenges (Singh, Singh, & Tyagi, 2024). Technology companies and startups have established formal collaborations with hotels and restaurants to implement sustainable waste management strategies (Martin-Rios, Hofmann, & Mackenzie, 2020). Prominent technology solutions for food waste reduction include the Winnow Solution in the UK, LeanPath in the U.S., LightBlue in Singapore, Kitro in Switzerland, and Orbisk in the Netherlands (Nafei, 2016). These technologies facilitate the shift from manual measurements to digital, AI-based solutions (Sharma et al., 2021).

Numerous studies emphasise the significance of technological innovation in reducing FWL for B2B food service outlets (Aramyan et al., 2021), underscoring the potential for businesses to enhance agility across various dimensions. Technological agility empowers companies to plan, organise, and oversee their sustainability objectives across social, economic, and environmental realms. Collaborative efforts, policy resolutions, and appropriate pricing have incentivised stakeholders throughout the food value chain to adopt food waste prevention technology (Martin-Rios et al., 2020). Advanced B2B technologies aim to reduce waste at the consumer end by leveraging enabling environments (Agarwal, Goyal, & Goel, 2020), while manufacturers' innovations in commercial kitchen equipment introduce sustainable practices that minimise waste sent to landfills at the production stage (Bansal and Song 2017).

Furthermore, B2B technological platforms for food waste reduction can mitigate the environmental impact of incineration and landfilling by offering financial incentives to suppliers and customers that mediate food transactions close to their expiry dates (Agarwal et al., 2020). Advanced methods like composting and biological, thermal, and thermochemical processes convert food waste into energy (Pham, Kaushik, Parshetti, Mahmood, & Balasubramanian, 2015), while Industry 4.0 technologies and postharvest procedures extend shelf life, and social interventions establish alternative value chains, offering promising solutions to food waste challenges (Amaral & Orsato, 2023). To encourage consumers to reduce FWL, steps that have proved instrumental include modifications in packaging, increased product shelf life, and

investments in suitable technology, infrastructure, and market reforms (Abatan et al., 2024; Manzoor et al., 2024).

A comprehensive approach to food processing and preservation reduces waste by enhancing product shelf life. Digital food-sharing platforms within B2B settings actively monitor and provide safe, fresh food options, leveraging tracking technologies such as big data, the Internet of Things (IoT), and Robotics Process Automation (RPA) to reduce FWL (Annosi, Brunetta, Bimbo, & Kostoula, 2021). Historical data analysis enables proactive actions to prevent insufficient production and excessive food waste (Martin-Rios et al., 2020). The World Economic Forum in 2023 summed up technological advances that were deemed capable of significantly impacting B2B food ecosystems by 2030 (United Nations, 2023).

Recently developed technologies that are being used to improve food safety and prevent incidents include RFID (Radio Frequency Identification), Internet of Things (IoT), blockchain, Artificial Intelligence (AI) and Machine Learning (ML), and data analytics (Goyal, Kumar, & Verma, 2022; Mavani et al., 2022; Qian, Dai, Wang, Zha, & Song, 2022; Wang, Bouzembrak, Lansink, & van der Fels-Klerx, 2022). These technologies and algorithms can be used to access and analyse raw material procurement, logistics, processing, warehousing, and distribution data to design a traceability system that helps detect and track food safety issues (Lei et al., 2022).

The literature shows great interest in the use of technologies in reducing food waste. For example, Chiaraluce, Bentivoglio, and Finco (2024), Li et al. (2020) and Reichental (2019) have reviewed the literature on the use of blockchain to increase efficiency in FSCs and reduce food waste. Park and Li (2021) and Köhler and Pizzol (2020) in their studies showed the effect of blockchain technology on supply chain sustainability in the food industry. Li et al. (2020) focused on the specific application of IoT sensors for perishable food management. Stefanini and Vignali (2023) further highlighted how new technology can help food organisations accomplish the three pillars of sustainability.

Intrakamhang and Ryckman (2020) in their study showed that data analytics and artificial intelligence facilitate real-time communication between stores and partners in FWL prevention programs in B2B ecosystems. Novel advancements in artificial intelligence and machine learning present promising prospects for augmenting the predictive capacity of B2B firms in decision support systems and developing new tools and methods to mitigate FWL (Frost, 2022). Additionally, integrating data analytics with optical sorting technologies enables more efficient food sorting to reduce waste (Berezina, Ciftci, & Cobanoglu, 2019). Data analytics aids machine calibration, reducing waste and costs (Park & Li, 2021).

2.7. Summary of the literature review: A unified approach to sustainable B2B ecosystems

While diverse, the themes discussed in this review (stakeholder theory, organisational agility, innovation, and technological advancements) converge towards a unified objective of enhancing sustainability in B2B ecosystems, particularly in the food supply chain. Stakeholder theory (Freeman, 1984) is foundational in understanding the myriad interactions within B2B ecosystems, suggesting that businesses operate within a network of relationships involving various stakeholders, including shareholders, employees, communities, and interest groups (Hodgkins et al., 2019). This theory emphasises the importance of addressing stakeholder interests to mitigate negative externalities and enhance positive outcomes (Ramanathan et al., 2024). In the context of sustainable development, stakeholder theory aligns with SDGs, notably SDG 2 (Zero Hunger) and SDG 12 (Responsible Consumption and Production) (Luu, 2021).

Organisational agility, the ability to rapidly adapt to market changes, is critical for achieving sustainability in B2B settings (Keszey, 2020; Motwani & Katatria, 2024). Agility enables businesses to respond swiftly to customer demands and optimise operations to reduce food waste and loss (FWL) (Hassoun et al., 2022). This adaptability is crucial for innovation in volatile global business environments, reinforcing stakeholders' interest in sustainability and shared goals (Hörisch et al., 2014). Innovation within supply chains, particularly in adopting circularity and digital ecosystems, is vital in transforming processes to meet sustainability goals (Rampa & Agogué, 2021). Supply chain innovation involves implementing new practices, processes, systems, and technologies to enhance competitive advantage and meet end-user needs (Carayannis & Gonzalez, 2003). For instance, integrating innovative supply chain management strategies can address market challenges and align market trajectories with sustainability objectives (Ben-Daya et al., 2017).

Technological innovation is a crucial catalyst for addressing food waste within the supply chain. Advanced technologies, such as data analytics and automation, enhance efficiency and sustainability by enabling better waste quantification, reduction, and recovery (Zhang et al., 2022). Collaborative efforts with third-party technology suppliers foster innovative approaches to food waste challenges (Singh et al., 2024). These technologies facilitate proactive measures, such as extending shelf life and optimizing logistics, thereby reducing FWL and its associated economic and environmental impacts (Agarwal et al., 2020; Pham et al., 2015).

3. Methodology

To explore how organisational agility within B2B settings can drive innovative strategies to effectively reduce pre-consumption food waste in the food supply chain (FSC), we adopted a multi-method qualitative research approach, utilising semi-structured interviews and observations as our primary data collection tools (Umeh, Cornelius, & Wallace, 2024). The exploratory nature of our study necessitated the careful selection of methods to capture distinctive contexts and project the voices of the participants insightfully (Yin, 2014).

3.1. Sampling and data collection

Our research employed a stakeholder-centric approach to participant recruitment, collaborating with the Manufacturer Association of Nigeria (MAN), a key organisation in Nigeria's food industry. MAN represents manufacturers' interests, fosters sector growth, provides a platform for collaboration, and influences industrial and economic policies in Nigeria, making it an essential hub for diverse stakeholders (Dzirutwe, 2024; Kolawole et al., 2021). This aligns with stakeholder theory's emphasis on diverse stakeholder involvement, so we utilised MAN's facilitation of letters and emails to approach potential participants.

Our data collection methods aimed to comprehensively understand participants' insights into innovative approaches to mitigate food waste and loss (FWL). In addition to semi-structured interviews, various data sources, including graphs, charts, annual reports, and observations from both case companies, were used to embrace diverse interests (Freeman, 1984). This triangulation approach allowed us to comprehend the multifaceted application of innovative methods. Thirty interviews were conducted across the food processing and distribution chains of two companies, involving staff from various functions as well as other external stakeholders such as policy makers, customers, retailers and distributors (Table 1).

Drawing on stakeholder theory and organisational agility as a theoretical framework, we interviewed 30 individuals from two B2B firms. Our commitment to stakeholder inclusion is further evident in the range of participating respondents (Scotland, 2012). The cohort encompassed four top management members, eight middle management professionals, eight tactical department representatives, six wholesalers or distributors, two policymakers, two retailers and two customers.

The interviews, lasting between 30 and 60 min, were conducted with participants' explicit consent, underscoring the stakeholder theory's

Table 1
Interviewee distribution across Case 1 and Case 2.

Interviewees	Roles	Number of interviewees per case		Total interviews
		Case 1	Case 2	
Internal Stakeholders	Senior Management	4	4	30
	Operational Staff	3	3	
External Stakeholders	Tactical staff	3	3	
	Policy maker	1	1	
	Distributors	2	2	
	Retailers	2	2	

emphasis on collaboration and informed participation. To ensure the triangulation and rigour of the research methods, we employed participant observation techniques alongside interviews. Participant observation was utilised in its own right and as a technique within the interview process. The researcher was introduced to the participants, who were informed that their work would be observed during the interview. However, the timing of the observation was not mentioned to the participants so they would not be conscious that they were being observed.

The interview questions explored various facets of innovative techniques and methods, emphasising stakeholder engagement (Appendix 1). In alignment with stakeholder theory and considerations of sensitivity and ethics, the participating companies were anonymised as Case 1 and Case 2 to ensure confidentiality. Similarly, all participants remained anonymous, given the sensitive nature of FWL in the food sector (Freeman, 1984).

Participant recruitment for this research involved purposive and snowball sampling methods (Bryman, 2016). Purposive sampling employs pre-determined criteria, in this case focusing on individuals with expertise in food waste reduction within the B2B context, including relevant stakeholders in the chosen food industry companies. This targeted approach ensures that the participants' insights are directly relevant to the study's objectives and align with previous qualitative research methodologies (see Umeh, Cornelius, & Wallace, 2023).

Although criticised for the tendency for participants to direct researchers towards recruiting similar others, snowball sampling allows previously interviewed participants to suggest others with valuable insights, contributing to a comprehensive perspective on the pre-consumption stages of the FSC (Kolawole et al., 2021). External stakeholders' viewpoints were also considered by involving additional participants, as recommended by Hodgkins et al., 2019. This comprehensive approach supports our emphasis on addressing food waste challenges using innovative methods and helps in understanding the participants' opinions on innovative strategies that have been adopted.

Further, semi-structured interviews allowed us to engage directly with specific stakeholders (cf. Kurtaliqi, Miltgen, Viglia, & Pantin-Sohier, 2024) and explore their diverse viewpoints regarding the FSC's response to FWL challenges. While interviews are effective for eliciting in-depth participant responses, they also pose certain limitations; participants may provide socially desirable answers, responding in ways they believe the researcher expects. Additionally, Weinreb et al. (2018, p. 95) note the 'Stranger-Interviewer norm,' where participants either refuse to engage or provide limited responses due to perceiving the interviewer as an outsider.

To mitigate these constraints, we also conducted observations, where the researcher observed employees' lived experiences in the workplace during work hours. This approach included informal conversations, which helped to familiarise the participants with the researcher and reduce the 'Stranger-Interviewer norm.' By being seen as an insider by participants, the researcher encouraged more open and robust responses during both observations and interviews (Umeh et al., 2024). Drawing from the stakeholder theory, this method also revealed that considering employees' disposition (acceptance or rejection) towards other stakeholder-initiated policies and practices is crucial for the success of innovation initiatives, such as those targeted at reducing food waste.

However, some ethical considerations were paramount in our use of observations. Observing participants without their awareness is unethical yet informing them could lead to 'acted' responses, with the 'observer effect' compromising data reliability. To address this, we adopted 'semi-participant' observation; participants were informed that their work would be observed at certain points during the interview process, but the specific timing was not disclosed. That is, the researcher was introduced to the participants, who were generally informed about the observation process without specific timing details. This strategy balanced ethical transparency with the need to minimise the observer effect (Bryman, 2012). This allowed the researcher to observe genuine behaviours and interactions within the organisation.

Utilising both interviews and observations provided insights into the subjective meanings and perspectives of stakeholders, influenced by their unique contexts. This comprehensive approach was essential for comprehending how B2B interactions within the FSC respond to the grand challenges of food waste, particularly in the pre-consumption stages. Our methodology provides valuable insights into the dynamics of organisational agility and its role in fostering innovative strategies to mitigate food waste.

3.2. Case study strategy

This study utilised a case study strategy, suitable for exploratory research aimed at understanding complex phenomena, especially "how" and "why" (Yin, 2014). Following similar studies utilising case studies to explore innovative food waste reduction strategies in diverse business settings (see Baldwin et al., 2011; Kolawole et al., 2021), the study adopts an in-depth multiple case study approach by setting boundaries for the case, thereby maintaining research focus (Yin, 2014), while identifying the key determinants relevant to specific organisations and social groups within the case.

3.2.1. Case selection

In the context of global uncertainties and challenges related to food security and sustainable consumption and production, such as climate change, biodiversity loss, inequitable access to food, economic disparities, global health, conflict and instability, environmental degradation, hunger, and malnutrition, addressing food waste becomes imperative (Dora, Biswas, Choudhary, Nayak, & Irani, 2021). Food waste has a significant impact, both in developed and developing countries, where Nigeria serves as a critical context to explore innovative methods. With limited scholarly evidence from developing nations (Dora et al., 2021), such research is indispensable.

Nigeria has experienced a rapid population growth rate and constitutes over 50 % of the population of Sub-Saharan Africa, with a population exceeding 200 million in 2020 and projected to reach over 377 million by 2050. As Africa's most populous country, Nigeria attracts investors in the food industry due to its extensive resources for food production. For example, Dangote Flour Mills, which is a local food processing enterprise, has made huge investments in Nigeria's food industry. This has led to an increase in production and capacity to meet the demand for wheat-based food products; the National Bureau of Statistics (NBS) highlights that the food industry grew by 3.42 % in 2023, reflecting the substantial investment in food production.

To examine these challenges, we focus on two in-depth B2B case studies (Omole, Olajiga, & Olatunde, 2024). These cases involve producing shelf-stable and fresh food products, particularly bread, biscuits, vegetable oil, pasta, and rice. These products are significant for their market share and substantial waste generation, as bread and biscuit production alone contributes over 70 % of total waste in the food sector,

especially in developing countries (Pandey & Mishra, 2024).

3.2.2. Rationale for case selection and methodological robustness

While our study focuses on two in-depth B2B case studies, we acknowledge the potential methodological concern regarding the limited number of cases (Crozier, Lence, & Weijs, 2024). We selected these cases based on their relevance, representativeness, and potential to provide deep insights into the phenomenon of interest and, therefore, further outline the rationale and strengths of our approach:

The two selected cases are prominent examples within Nigeria's food industry, a critical context for exploring food waste due to its unique challenges and opportunities. These companies are among West Africa's largest producers of baked goods, e.g., bread, pastries (e.g., croissants, Danishes, éclairs), cakes (e.g., sponge cakes, layer cakes, cupcakes), muffins, bagels, scones, rolls (e.g., dinner rolls, sandwich rolls), buns and biscuits, making them highly relevant for studying food waste in similar developing and emerging countries.

Furthermore, despite the relatively small number of cases, we employed a rigorous approach to data collection and analysis, including interviews, direct observations, and diverse data, which included annual reports. This triangulation ensures the robustness and validity of our findings (Umeh et al., 2023). Drawing on stakeholder theory, our research involved a wide range of stakeholders, from senior management to operational staff, external stakeholders, including distributors, and policy makers, ensuring that multiple perspectives, interests and experiences were captured (Agarwal et al., 2020. This stakeholder diversity enhanced the reliability of our findings, based on the robustness of the insights derived, and demonstrates how a stakeholder approach can be applied methodologically to understand and address food waste in B2B ecosystems in specific contexts, including in this case, in developing countries.

3.2.2.1. B2B-CASE 1:. Since the 1960s, Case 1 has been producing baked goods and biscuits, which are common food products in Nigeria. These products have a short shelf life, spanning about 5 days for bread and 30 days for biscuits and cookies. Each month, the company, one of the largest producers of biscuits and bread in West Africa, produces about 18,000 tons of products. Through more than 3000 distributors, more than 10,000 retailers sell its products. However, the Case 1 processing unit generates more waste than is created by the companies in its distribution chain.

3.2.2.2. B2B-CASE 2:. Case 2 has been producing biscuits and bread since the 1980s and distributes to several West African countries, representing multiple Sub-Saharan African countries. Each month, the company produces about 15,000 tons of biscuits and bread. This company's distributors exceed 2000, and it sells products through over 10,000 retailers. Like Case 1, the company's processing unit generates more waste than do the companies in its distribution chain.

3.3. Data analysis

NVivo® 11 qualitative analysis software was utilised to transcribe and analyse all interviews, facilitating comparisons between the two distinct cases (Zhou & Creswell, 2012). Thematic data analysis revealed the influence of stakeholders such as producers, consumers, and advocacy groups on organisations' innovation strategies within the B2B ecosystem. The analysis emphasised the interconnectedness of stakeholders and their impact on responsible consumption and production (SDG 12) and the goal of Zero Hunger (SDG 2).

A detailed examination of the companies' innovation in reducing FWL during processing and distribution was conducted, guided by Miles & Huberman (1994) four-step thematic analysis method. Transcripts were imported into NVivo®, and both a priori and emergent codes (Appendix 2) were applied to capture participants' experiences and perspectives within the conceptual frameworks of organisational agility and stakeholder engagement. Interaction analysis, employing abductive logic, was used to classify and organise gestural, spatial, semiotic, and discursive interactions (Umeh et al., 2023), offering a comprehensive lens on stakeholder dynamics and decision-making processes. To ensure methodological rigour, the data analysis combined a priori codes, such as "stakeholder collaboration" and "resource optimisation" (grounded in stakeholder theory (Freeman, 1984) and literature on FWL (FAO, 2023; Kolawole et al., 2021), with emergent themes like "collaborative innovation", "adaptive decision-making", and "data risk management." For example, themes related to "data-driven planning" and "surplus food redistribution" were inductively refined to explore how organisations balance agility with stakeholder expectations and sustainability goals. The iterative coding process, moving between data and theoretical frameworks, revealed challenges such as financial constraints on technology adoption and regulatory compliance, particularly in automation systems and surplus food repurposing. These were further analysed using Miles and Huberman's (1994) thematic analysis framework, ensuring findings were grounded in both participant narratives and broader organisational paradigms.

Muhammad, Dey, Bala, Alwi, and Asaad's (2024) typology for triangulating themes across data sources informed our multi-pronged strategy. For instance, their emphasis on aligning stakeholder insights with strategic frameworks guided our examination of surplus food redistribution programs (e.g., food banks and community partnerships) and data-driven planning processes. NVivo® software facilitated the organisation of codes across interviews, direct observations, and supplementary materials like company reports, while prolonged engagement, peer debriefing, and iterative verification ensured reliability and trustworthiness. This methodological approach highlighted how agility strategies, collaborative innovations, and technological integration can mitigate food waste and align with stakeholder expectations. These themes, as reflected in the findings, illustrate the complex interplay of organisational practices and sustainability goals, particularly in addressing pre-consumption food waste.

4. Findings

The findings indicate that in the face of global challenges related to food security and sustainable consumption and production, the two case firms have effectively implemented B2B agility strategies to combat pre-consumption food waste loss (FWL), directly contributing to SDG 2 (Zero Hunger) and SDG 12 (Responsible Consumption and Production). Data-driven decision-making plays a crucial role in reducing FWL caused by overproduction and underproduction, ensuring a steady food supply and minimising waste. Innovative solutions such as food banks and surplus food distribution not only reduce the environmental impact of FWL but also support vulnerable populations, aligning with Zero Hunger. Repurposing surplus food as animal feed provides both economic and environmental benefits, promoting responsible consumption.

Collaboration through technology, digital solutions, and automation enhances FWL reduction efforts, advancing sustainable production practices. Despite challenges such as data risks, limitations in food bank usage, equitable surplus distribution, and technological reliance, the findings highlight the critical role of agility, data-driven strategies, and collaboration in addressing FWL, thus supporting global food security and sustainability goals. Fig. 1 shows the themes that emerged from the qualitative data analysis.

4.1. Agility strategies in B2B

The study demonstrates that B2B participants develop agility strategies that help their food supply chain to reduce the amount of FWL that occurs at the pre-consumption stage of the FSC. The interviews identified the following as some of the strategies implemented to reduce wastage in the FSC.

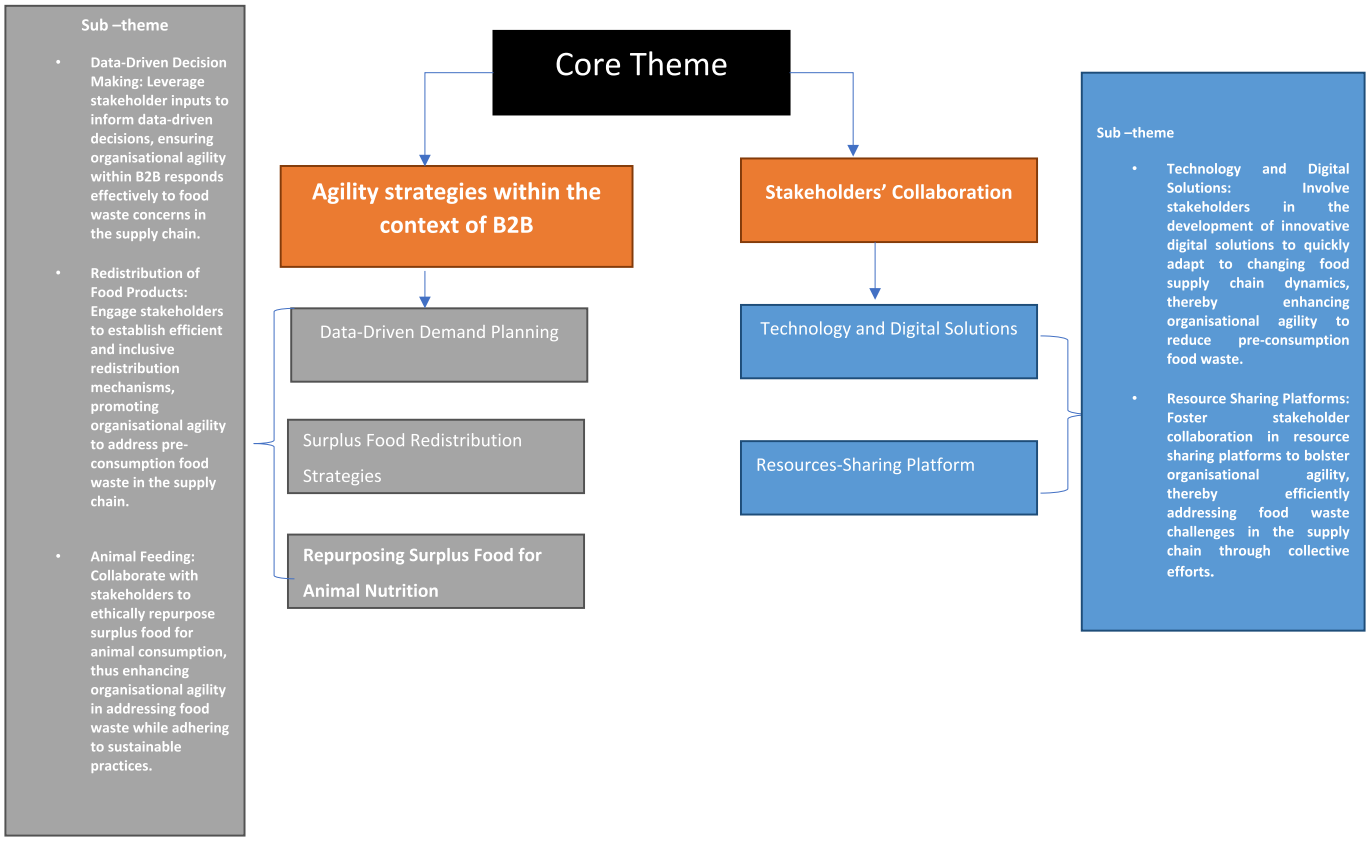

Fig. 1. Emerging themes and sub-themes.

4.1.1. Data-driven demand planning

Both Case 1 and Case 2 have functional data-driven systems that allow them to collect necessary data to improve their agility and respond positively to any change in demand. Both organisations value data-driven decision-making, which aligns with their commitment to reducing pre-consumption FWL within their supply chain. This emphasis on data is instrumental in demand planning and curbing FWL associated with overproduction and underproduction, since successful demand planning relies on understanding marketing patterns. Indeed, many participants recognised that agility would not be possible without technological support for data-driven decisions.

These excerpts from P1 and P12 (see Table 2), from Cases 1 and 2, respectively, confirm this assertion.

We believe for us to be agile, we need the necessary information that will help us to remain an agile company and that is why we do not joke with collecting all these necessary data to plan our production, marketing and operations.

See we collect data that helps us to plan very well for our production. We don't produce bread except we have the demand information: this will help us to reduce waste that comes from overproduction.

Furthermore, interviewees' responses suggested that a data-driven decision has always had a positive impact on demand planning, predicting and managing food demand across the supply chain to reduce wastage caused by overproduction or insufficient demand. The researcher was shown the data room, where he observed staff collating and analysing different customer demands and then transmitting them to the production department. This observation corroborates the evidence from participants P10 and P22, who claimed that understanding marketing patterns helps in planning demand to prevent overproduction and consequent food waste from bread and biscuits. Conversely, without the right information from the customer, underproduction would lead to a market shortage of food products.

P10: *We use data to ensure that products are produced based on the market demand.*

P22 supported the above assertion,

I can confirm to you that production planning in our organisation depends on customer demand information. This has been very helpful to ensure we reduce overproduction or underproduction.

However, while both organisations embraced data for agility, Case 1 appeared to be one step ahead by adopting measures to manage data-related risks, thus demonstrating innovation and effectiveness in tackling the processes and outcomes of FWL. Participants **P4** and **P17** captured this view:

We are more advanced in the way we collect our data and analyse them to make an informed decision. We employ some sophisticated tools to ensure we satisfy the needs of all our stakeholders from the top to bottom.

And

We really cannot do anything except with the help of some of the analytics tools that we are using such as R-coding and others.

Case 1's innovative approach, rooted in stakeholder theory, actively manages data-related risks, demonstrating a commitment to satisfying all stakeholders. Investments in robust data security and privacy protect sensitive information, addressing the concerns of customers, employees, and partners. Implementing advanced data analytics tools aligns with stakeholders' expectations for efficient resource utilisation, while employee training in data-driven decision-making enhances stakeholder engagement and satisfaction. However, while the researcher was taken to the data analytics room in Case one to observe the way the staff were using data for planning, Case 2 did not have such a collaborative space.

Clear data governance and compliance with regulations exemplify transparency and ethical data handling as expected by stakeholders, while boosting agility and minimising food waste throughout the supply chain. Thus, innovation, data risk management, and organisational agility are combined to address challenges. This was confirmed by **P23**, a policy maker, who shared that they monitor and regulate the discharge of waste to the landfill across the FSC to ensure that the environment is

Table 2
Samples of Free Nodes from Nvivo Analysis.

Type	Emerging themes	No of sources	No of reference	Created date and time
Free_N	Technology	35	169	04/07/2023 11:53
Free_N	Digital solutions	33	167	03/07/2023 12:57
Free_N	Data driven	35	160	03/07/2023 12:59
Free_N	Planning	30	150	03/07/2023 13:19
Free_N	Food redistribution	30	144	03/07/2023 12:55
Free_N	Internal collaboration	29	138	03/07/2023 20:35
Free_N	Repurpose surplus	27	137	04/07/2023 23:07
Free_N	Animal Nutrition	26	135	04/07/2023 23:09
Free_N	Information sharing	26	130	03/07/2023 19:37
Free_N	Platform sharing	23	101	04/07/2023 20:30
Free_N	Technical know-how	21	99	03/07/2023 22:52
Free_N	External collaboration	18	90	03/07/2023 13:11
Free_N	Teamwork	18	85	04/07/2023 23:10
Free_N	Charts and graphs	16	80	03/07/2023 19:53
Free_N	Supervision	16	78	07/07/2023 22:34
Free_N	Machine malfunctioning	16	75	03/07/2023 12:30
Free_N	Staff Inadequate knowledge	14	70	04/07/2023 21:29
Free_N	Building relationship with Stakeholders	14	67	03/07/2023 22:45
Free_N	Collaborative learning	15	63	03/07/2023 22:46
Free_N	Learning through experience	11	57	03/07/2023 13:04
Free_N	Quality Control	10	52	03/07/2023 23:35
Free_N	Reporting problems	9	42	03/07/2023 23:50
Free_N	Input and output analysis	9	41	03/07/2023 23:50
Free_N	Awareness of the problem	9	39	03/07/2023 12:46
Free_N	Management inspection	8	30	03/07/2023 23:27
Free_N	Individual Spontaneous ideas	5	23	05/07/2023 19:14
Free_N	Poor monitoring system	7	21	03/07/2023 19:27
Free_N	Learning from experience	6	18	03/07/2023 19:27
Free_N	Improper stacking	5	18	04/07/2023 23:17
Free_N	Sub-standard laminate	10	15	03/07/2023 23:50
Free_N	Leakages	10	13	03/07/2023 19:27
Free_N	Team meetings	7	11	03/07/2023 23:37
Free_N	Automation reduces handling errors	10	10	03/07/2023 23:50
Free_N	Automation increase productivity	9	10	03/07/2023 22:50
Free_N	Packaging issues	7	9	03/07/2023 19:27
Free_N	Lack of provision of standardised working tools	6	9	03/07/2023 18:27
Free_N	Inadequate training of Staff	6	9	03/07/2023 16:28
Free_N	Quarantine approach	7	9	03/07/2023 19:29
Free_N	Semi-finished dislodged	7	9	03/07/2023 19:40
Free_N	Faulty output	7	9	03/07/2023 12:50
Free_N	Involvement in raw materials production	7	9	03/07/2023 19:25

safe.

4.1.2. Surplus food redistribution strategies

An additional innovative practice identified within the case companies, aimed at mitigating pre-consumption FWL in the FSC, involves redistributing surplus food to vulnerable populations. The case companies employ this innovative strategy to divert FWL from landfills and instead utilise it to assist disadvantaged segments of society. The insight provided by **P12** corroborates this innovative approach,

There are times when we might not have the ability to prevent FWL from happening; however, if it does happen, we sometimes do not take some of these products … to landfills but rather give them out to support those with less privilege who might need food on their tables especially if it was the case of oversize or undersize or minor issues that might not allow us to sell the product.

Case 1's approach to reducing FWL involved an external stakeholder strategy, establishing its own food bank system to redistribute surplus food to the public. The food bank operates on Saturdays, offering food to the public from donations by the company's processing and distribution units. While this initiative may have limitations in scale, it contributes to reducing the amount of FWL going to landfills, thereby benefiting the environment. However, its broader impact on reducing FWL rates may be limited, highlighting the need for complementary measures to address this challenge effectively. **P13** stated that:

…the food bank system of the case company is a form of innovation though not to reduce FWL but to ensure the impact of FWL on the environment is reduced. The food bank is our own innovation of reducing the impact of FWL. This has helped us reduce more than 50 % of FWL that would otherwise have gone to landfill.

As this excerpt shows, the organisation is promoting the food bank as a form of innovation that reduces the impact of FWL on the environment. This seems to be an innovative strategy as food banks are not a common feature in developing countries.

Case 1 expanded its food bank system by partnering with other organisations, increasing distribution days, and setting up additional food banks. Their guiding principle was equitable distribution of surplus food, supported by data-driven decision-making. Patterns and trends in food donations and demand were analysed to guide resource allocation and expansion. While participants expressed aspirations for more community engagement and stakeholder awareness through campaigns and collaboration with local businesses and government, these were presented as innovative measures yet to be fully realised. **P6** stated;

Our strengths lie in the ability of our organisation to work in partnership with the community and every stakeholder to ensure we are able to provide the best innovation in our business.

In Case 1, the study reveals an innovative approach where the company adopts an internal-external stakeholder strategy by allowing access by employees and certain external stakeholders, such as retailers and distributors, to surplus food items that might otherwise be wasted due to defects or other issues. This innovative practice helps reduce the environmental impact of discarded food. Both case companies effectively manage food waste through innovative redistribution of edible surplus food items. They also emphasise employee incentive programs and feedback mechanisms, incorporating key performance indicators for

internal food waste reduction programs.

These innovative actions align with UN Sustainable Development Goals (SDGs) 2 and 12. While the primary focus is food waste reduction, rather than specifically hunger alleviation, the companies contribute to SDG 2 (Zero Hunger) by ensuring surplus food reaches vulnerable populations, also supporting responsible consumption and production (SDG 12) through sustainable resource utilisation and waste reduction.

4.1.3. Repurposing surplus food for animal nutrition

Surplus food also finds valuable utility as animal feed rather than ending up in landfills, thus reducing environmental impact and providing economic benefits to the case companies. Case 1 sells around 3000 t of defective food products to farmers at reduced prices, for animal feed. Case 2 sells approximately 4000 t of food products unfit for human consumption to farmers annually. This strategy offers several advantages; it adds economic value to the company, albeit below initial expectations, and efficiently repurposes waste for animal nutrition. Furthermore, it mitigates environmental harm linked to landfill disposal and contributes to land conservation by reducing the demand for landfill space. Interviewees highlighted these benefits, as reported by **P8** and **P10**:

P8: *We have[an] alternative way of preventing waste; that is, we use some of these wastes to feed the animals. In fact, last year, about 3000 t of FWL were sold to our farmers to enable them to feed their animals.*

And **P10** stated:

Our company sold about 4000 t of what could have ended up in landfills to farmers last year. This has helped us to prevent FWL.

These insights illuminate the dual role of repurposing surplus food for animal nutrition as a pragmatic solution that aligns with stakeholder interests and environmental consciousness. However, it appeared that Case 2 company recognises that, while this strategy offers notable benefits, it is not without its challenges:

P20*: We are facing many challenges regarding some of these [programmes] that have been developed to reduce waste in our service.*

Participants' responses suggest that in the quest for organisational agility and sustainability, it is imperative to address potential hurdles such as quality control, regulatory compliance, and ensuring that surplus food meets animal nutrition standards. By critically evaluating these challenges, Case 2 appeared set to continuously and innovatively adapt and refine their approaches, reinforcing the significance of agility in reducing pre-consumption food waste, while engaging stakeholders and minimising environmental impact.

4.2. Collaborative innovations in B2B operations

The study found that for B2B operations to succeed, there is a need for effective collaboration. Collaboration can help organisations to grow and improve their effective ways of delivery. The case companies collaborate in a number of ways, including through technology and resource-sharing platforms. These sub-themes are explained below:

4.2.1. Technology and digital solutions

P7*: The use of automated machines has helped in the reduction of waste that happens as a result of staff handling. It was revealed that automation was prominent in the processing unit while the distribution unit depended on … manual handling to load the products to distribute vehicles.*

The above excerpt shows the implementation of an automated system to reduce the interfacing of staff with the food products during processing. A system of automation was implemented, which sees all manufacturing operations, including packaging, automated from the beginning to the end of the production cycle before staff access the products. This contrasts with the past, when employees moved goods manually from one machine to another. Through automation, staff involvement in production processes has been reduced, helping eliminate human errors leading to FWL. This was confirmed by the following excerpt from P24:

P24: *Automation is used only in processing units, while distributing has not benefited from such automation of machines that can pick the product from the warehouse and load it to the vehicles.*

The responses indicate that the successful implementation of automation in both case companies was facilitated by significant investment by top management in advanced technology, corroborated by the insights of **P6** and **P15**. Automation significantly reduces food waste at the processing unit of the case companies but would not have been possible without these technological investments.

It is worth noting that automation was exclusively implemented in the processing unit; although participants acknowledged its potential benefits in the distribution unit, financial constraints deterred its broader implementation. Participants stressed the strong correlation between technology, automation, and innovation, particularly in the processing unit of the FSC.

This information sheds light on the multifaceted role of technology, aligning with stakeholder interests and environmental concerns, but also representing an innovative approach to food waste reduction. However, challenges arise, such as the financial impact of automation on organisational sustainability, as both companies voiced concerns about its costs:

P14*: One of the biggest challenges is the financial implications of automation.*

This was confirmed by **P30** from Case 2:

P30. *The financial implications of some of this technology are enormous. Too much to bear at times.*

Case 1 also sought to address potential hurdles such as quality control, while Case 2 sought regulatory compliance and to ensure that surplus food met animal nutrition standards. Innovative measures by both companies, therefore, involved critically evaluating these challenges while adapting and refining their approaches, reinforcing the significance of agility in reducing pre-consumption food waste while engaging stakeholders and minimising environmental impact.

4.3. Leveraging transportation platform integration for efficient resource sharing

To reduce food waste through B2B collaboration, the case companies adopted a process that allowed resource-sharing platforms. For example, the two organisations share the same transportation system when distributing food products to their distributors and retailers. It was found that using the same transportation platform to distribute food allowed them not only to share some of the loss that might occur during distribution but also to be more economical. It was found that using a joint resource for transportation allowed both firms to reduce food waste at the distribution stage.

P5: *We share a transportation platform with other organisations and that allows us to share losses together with other businesses that we partner with.*

Nevertheless, participants noted that, although this innovative strategy holds promise, it is not without its challenges. The seamless sharing of transportation resources demands precise coordination, which can be intricate and may, at times, present hurdles in implementation. Additionally, ensuring equitable sharing of losses requires a clear framework and mutual trust between collaborating organisations. Case 2 participants appeared to recognise these challenges:

P19*: Though there are challenges that come with innovation, there are a lot of opportunities innovation can bring to our organisation for us to remain at a high level.*

Case 1 was more forthcoming with specific ways to address these challenges and fortify the foundations of organisational agility:

P7*: We invest so much in training and knowledge development for our employees; by this, we believe we can address some of the challenges of innovation.*

Specifically, participants spoke of the development and utilisation of transparent protocols; effective communication channels and contingency plans for unforeseen disruptions in the transportation system are

all essential components in this endeavour.

5. Discussion

This study addresses critical research gaps in the literature by integrating stakeholder theory (Freeman, 1984; Luu, 2021; Ramanathan et al., 2024), organisational agility (Keszey, 2020; Motwani & Katatria, 2024), and diffusion of innovation (Carayannis & Gonzalez, 2003; Rampa & Agogué, 2021) into a cohesive framework for mitigating food waste in pre-consumption stages of food supply chains (FSCs). Prior research has predominantly focused on post-consumption food waste in developed nations (Gustavsson et al., 2011; Parfitt et al., 2010), leaving a significant gap in understanding pre-consumption inefficiencies in developing regions, where fragmented supply chains and resource constraints exacerbate food loss (FAO, 2020; Kolawole et al., 2021).

This integration, as emphasised in this study, underscores the centrality of stakeholder engagement in fostering value co-creation through sustainable practices (Buyucek et al., 2016), highlights the importance of organisational agility in enabling adaptive responses to dynamic challenges (Ciccullo et al., 2018; Brooks et al., 2021; Hassoun et al., 2022), and emphasises the scalability of innovative solutions through diffusion of innovation (Baldwin et al., 2024; Sarkar et al., 2022), providing understanding of how collaborative and adaptive strategies can address the unique challenges of food supply chains in developing contexts.

In the context of global uncertainties and challenges related to food security and sustainable consumption and production, this study shows that innovative solutions can effectively address food waste within the food supply chain (FSC). The focus is on Sub-Saharan Africa and the business-to-business (B2B) context, investigating various innovative approaches, such as data-driven demand planning and food redistribution, which can significantly mitigate these challenges.

Collaboration with stakeholders, facilitated by advanced technology, digital solutions, and resource-sharing platforms, emerges as a critical enabler for B2B organisations to combat FSC food waste. Stakeholder theory underpins this approach, emphasising the importance of considering and balancing the interests of different stakeholders in developing sustainable solutions (Luu, 2021). While the study primarily discusses food waste reduction, the implications for SDG 2 (Zero Hunger) and SDG 12 (Responsible Consumption and Production) are profound and direct. SDG 2 aims to end hunger, achieve food security, improve nutrition, and promote sustainable agriculture, while SDG 12 focuses on ensuring sustainable consumption and production patterns.

Our findings illustrate how reducing food waste at the pre-consumption stage directly contributes to SDG 2 by increasing food availability and improving food security. For example, surplus food redistribution prevents waste and ensures that food reaches those in need, thereby addressing hunger and malnutrition (Parfitt et al., 2010). Similarly, SDG 12.3 specifically targets halving global per capita food waste by 2030. Through leveraging data analytics for precise demand forecasting and IoT for real-time monitoring, organisations can significantly reduce waste along the supply chain, aligning with SDG 12's framework for responsible production and consumption (Akkerman & Cruijssen, 2024).

Moreover, the study contributes to bridging the sustainability gap outlined by Brown et al. (2024), emphasising that internal organisational strategies such as agile practices (Motwani & Katatria, 2024) and innovative collaborations (Baldwin et al., 2024; Rampa & Agogué, 2021), are foundational to achieving SDGs 2 and 12. Anchoring these practices within stakeholder theory, this research reveals how aligning stakeholder interests can produce systemic changes that extend beyond individual organisations (Buyucek et al., 2016; Hörisch et al., 2014), thereby fostering sustainable ecosystems in Sub-Saharan Africa's B2B settings.

Further, this study engages with various innovative strategies that B2B organisations can adopt to reduce food waste within their supply chains. These include data-driven demand planning, to predict demand accurately and reduce overproduction and underproduction, thereby minimising waste. For instance, data analytics can be utilised to analyse historical data and market trends to forecast demand, enabling producers to adjust their output accordingly (Dora et al., 2013). IoT-enabled monitoring provides real-time data on environmental conditions such as temperature and humidity, ensuring optimal storage conditions and early detection of potential spoilage.

This technology enhances the transparency and traceability of the supply chain, which is crucial for maintaining food quality and reducing waste (Morone, Koutinas, Gathergood, Arshadi, & Matharu, 2019). Automation and robotics can minimise human food processing and packaging errors, significantly contributing to food waste. Robotics can handle repetitive tasks with high precision, ensuring consistent integrity and quality of food products (Mavani et al., 2022). Blockchain technology can be used to track food products from farm to fork, ensuring accountability and reducing inefficiencies in the supply chain. This transparency helps identify and promptly address the root causes of food waste.

Furthermore, our study highlights that agile organisations are more capable of integrating innovative technologies and practices that reduce food waste. Agility enables B2B organisations to reconfigure their operations and supply chains swiftly in response to real-time data and changing market demands. For example, in one of our case studies, implementing a data-driven approach involved setting up dedicated teams and workstations for real-time data analysis, which is relatively uncommon in local African companies. This proactive stance not only reduces food waste but also enhances the overall resilience and efficiency of the supply chain (Gustavsson et al., 2011; Kolawole et al., 2021).

However, to foster an environment conducive to sustainable practices, supportive policy frameworks and institutional backing are essential. Governments can incentivise the adoption of technologies that reduce food waste and implement regulations that promote sustainable production and consumption patterns. Institutional support can facilitate coordination among various stakeholders, ensuring that food waste reduction efforts are holistic and integrated across the supply chain (Frau et al., 2022). To address food waste effectively requires international cooperation and the sharing of best practices. Our research underscores the importance of global collaboration in developing and implementing strategies adaptable to different regional contexts. For instance, knowledge-sharing platforms can help disseminate successful models from developed countries to regions like Sub-Saharan Africa, where there are unique challenges such as infrastructure deficits and market fragmentation (Li et al., 2023; Nejatian et al., 2018).

Our research findings significantly contribute to the existing literature by highlighting the potential for cooperation among producers in the food supply chain to prevent food waste at the pre-consumption stage. This cooperative effort can be made more feasible by utilising innovative methods, including digital/technological innovation. Our research adopts a process-oriented perspective, allowing us to move beyond analysing individual company procedures and encompass producers and retailers to address food waste reduction effectively. The motivations and challenges associated with cooperative practices designed to combat food waste were uncovered, supporting the view that B2Bs are motivated by a common shared goal of solving problems (Karki, Burton, Mackey, & Alston-Knox, 2021). These innovative methods have fundamentally reshaped supply chain operations and design to reduce FWL, contributing to the literature on stakeholder relationship management (Richter & Bokelmann, 2016).

We have ventured into stakeholder theory within the broader framework of organisational agility and the diffusion of innovation, effectively identifying innovative approaches to mitigate food waste. This significantly augments the scholarly understanding of innovation within the unique context of the food supply chain. The study advances the knowledge of food waste reduction at the pre-consumption stage

within the food supply chain, substantially contributing to the broader discourse on cooperation and innovation in the FSC. This study's theoretical integration addresses a critical research gap by offering a holistic framework for reducing food waste at the pre-consumption stage. While prior research has often treated these frameworks in isolation (e.g., Dora et al., 2021; Kolawole et al., 2021; Richter & Bokelmann, 2016), our findings illustrate their synergistic potential in fostering systemic advances. This novel perspective not only strengthens the theoretical underpinnings of food waste mitigation but also aligns with the practical imperatives of achieving SDGs 2 and 12.

6. Implications of the research

Our research findings significantly contribute to the existing literature by highlighting the potential for cooperation among producers in the food supply chain (FSC) to prevent food waste at the pre-consumption stage. This cooperative effort is facilitated by utilising innovative methods, including digital and technological advancements, as identified by Kolawole et al. (2021). The theoretical and practical implications of our research are detailed below:

6.1. Theoretical implications

To provide a comprehensive understanding of stakeholder management in the FSC, we adopted a process-oriented perspective that transcends the analysis of individual company procedures. This approach encompasses both producers and retailers, effectively addressing food waste reduction across the food chain. Our research uncovered various motivations and challenges associated with cooperative practices aimed at combating food waste. For instance, our findings support the view posited by Karki et al. (2021) that a shared goal of problem-solving drives business-to-business (B2B) relationships. Moreover, we reveal how innovative methods have fundamentally reshaped supply chain operations and design to reduce food waste and loss (FWL), contributing significantly to the literature on stakeholder relationship management.

Recent studies have emphasised the critical role of effective communication and cooperation among all stakeholders within the food supply chain to reduce food waste (Richter & Bokelmann, 2016). While most research in this area relies on quantitative analysis (Karki et al., 2021), which inherently falls short of capturing the intricate dynamics of stakeholder cooperation, our qualitative research effectively addresses this critical gap. Our contribution extends beyond the limitations of prior research, which has often focused on operational aspects (Gómez-Talal, González-Serrano, Rojo-Álvarez, & Talón-Ballestero, 2024) or the in-depth examination of individual actors (Karki et al., 2021). By integrating stakeholder theory with the broader framework of organisational agility and the diffusion of innovation, we have effectively identified innovative approaches to mitigate food waste. This significantly enhances the understanding of innovation within the unique context of the food supply chain.

This study contributes to theory by addressing a key research gap through a triadic framework that integrates stakeholder theory, organisational agility, and diffusion of innovation to mitigate food waste within the food supply chain (FSC) (Hodgkins et al., 2019; Buyucek et al., 2016; Hörisch et al., 2014; Ciccullo et al., 2018). Situating these theories within the unique context of Sub-Saharan Africa enhances the theoretical understanding of how regional dynamics intersect with global sustainability efforts (Govindan, 2018; Nikolicic et al., 2021) while addressing organisation-specific but also broader sustainability challenges.

6.2. Managerial/practical implications

Our research advances the understanding of food waste reduction at the pre-consumption stage within the food supply chain and substantially contributes to the broader discourse on cooperation and innovation in the FSC. These findings hold practical implications for food supply chain managers and practitioners in addressing the critical issues of food waste and fostering sustainable practices within the industry. Managers can leverage our findings to enhance the management of relationships between stakeholders and B2B partners. By understanding the motivations towards a shared goal of promoting food security, managers can ensure that this goal is well communicated and that appropriate actions are taken to achieve it. This involves fostering a culture of transparency and collaboration where all parties are aligned towards common objectives.

Additionally, our study provides a roadmap for implementing innovative methods that reshape supply chain operations to reduce food waste. For example, adopting digital tools for better inventory management and predictive analytics can help anticipate demand more accurately and minimise surplus production. Furthermore, by integrating technology into the supply chain, companies can track food products more efficiently, ensuring timely distribution and reducing the likelihood of waste.

Embedding the diffusion-of-innovation framework ensures that managers can better understand how novel practices are adopted and scaled within FSCs. This approach ensures that technologies such as IoT, blockchain, and predictive analytics are not only implemented effectively but also disseminated widely among stakeholders, aligning operational strategies with broader sustainability goals (Baldwin et al., 2024; Chiaraluce et al., 2024; Li et al., 2020; Park & Li, 2021). These technologies enhance supply chain efficiency by improving transparency and traceability, reducing food loss and waste, and aligning practices with the sustainability objectives of SDGs 2 and 12 (Benyam et al., 2018; Luu, 2021).

Policymakers can use our findings to develop frameworks encouraging cooperation and innovation in the food supply chain. Policies could include incentives for collaborative practices, such as tax breaks for companies engaging in partnerships to reduce food waste, or grants for projects incorporating technological innovations. Understanding the challenges and motivations within the supply chain allows policymakers to create supportive regulations that facilitate stakeholder cooperation and the adoption of best practices.

For food industry practitioners, our research highlights the importance of adopting best practices identified in our study, such as improving communication channels and fostering a culture of cooperation. These practices can significantly reduce food waste by ensuring that all stakeholders work towards the same goal and that information flows smoothly across the supply chain. Aligning operational strategies with sustainable development goals (SDGs) ensures that the industry contributes to global efforts towards sustainable food systems.

From a broader stakeholder perspective, including producers and retailers, our insights can enhance collaborative efforts. Understanding the shared benefits of reducing food waste encourages stakeholders to work together more effectively to achieve common goals. Embracing innovation is crucial in this context, as it can lead to more efficient processes and better outcomes for all parties involved.

Our research aligns with United Nations Sustainable Development Goals (SDGs) 2 and 12. SDG 2 aims to end hunger, achieve food security and improved nutrition, and promote sustainable agriculture. We highlight ways to reduce food waste through cooperative and innovative practices, leading to food security and promoting sustainable practices. SDG 12 focuses on ensuring sustainable consumption and production patterns. Our findings support this goal by highlighting methods to reduce food waste, thus encouraging more sustainable consumption and production within the food supply chain. Therefore, our research contributes to global efforts towards sustainable food systems and reduced food waste in the face of global uncertainties and challenges.

7. Conclusions, limitations and scope for future research

The findings in this study provide substantial empirical evidence of

how food waste can be minimised through collaboration between B2B entities to promote innovative ideas that effectively reduce waste.

However, we have identified some limitations. First, the findings are based on qualitative data collection, which cannot be generalised to other cases due to the limited sample size used. Additionally, the research was based on only two case studies, again limiting generalisability, although there was consensus among the participants on many of the aspects investigated. Therefore, future research should consider employing multiple methods of data collection to enhance generalisability.

Finally, the study used only semi-structured interviews and semi-participant observations: future research should consider incorporating a mixed-methods approach using both qualitative and quantitative techniques involving multiple food industry participants to provide more insights into innovative strategies to reduce food waste and loss.

CRediT authorship contribution statement

Kolawole Olushola Adeborode: Writing – review & editing, Writing – original draft, Investigation, Conceptualization. **Manoj Dora:** Writing – review & editing, Conceptualization. **Chidozie Umeh:** Writing – review & editing, Methodology, Conceptualization. **Syeda M. Hina:** Writing – review & editing, Conceptualization. **Tillal Eldabi:** Writing – review & editing.

Declaration of competing interest

None.

Appendix 1. Demographics of the participants

Case Name	Age	Company	Gender	Person	Position	Year of experience
Cases\\People\P1	40–50	A	Male	P1	Executive Director	20
Cases\\People\P2	40–50	A	Male	P2	Director of Distribution	15
Cases\\People\P3	40–50	A	Male	P3	Quality Manager	12
Cases\\People\P4	40–50	A	Male	P4	Shift Manager	12
Cases\\People\P5	30–40	A	Male	P5	Logistics Officer	15
Cases\\People\P6	30–50	A	Male	P6	Supervisor	20
Cases\\People\P7	40–50	A	Male	P7	Production Manager	20
Cases\\People\P8	40–50	A	Male	P8	Sales Distributor officer	15
Cases\\People\P9	30–40	A	Male	P9	Quality Assurance Officer	12
Cases\\People\P10	40–50	A	Male	P10	Shift Manager	12
Cases\\People\P11	30–40	A	Female	P11	Sales officer	15
Cases\\People\P12	30–40	A	Female	P12	Distribution officer	20
Cases\\People\P13	30–40	A	Male	P13	Supervisor	20
Cases\\People\P14	30–40	A	Male	P14	Sales staff	15
Cases\\People\P15	40–50	A	Male	P15	Quality Assurance officer	12
Cases\\People\P16	40–50	A	Male	P16	Retailer	12
Cases\\People\P17	30–40	A	Female	P17	Consumer	15 of using the product
Cases\\People\P18	40–50	B	Female	P18	Factory staff	20
Cases\\People\P19	40–50	B	Female	P19	Wholesaler	20
Cases\\People\P20	30–40	B	Male	P20	Logistics Officer	15
Cases\\People\P21	40–50	B	Male	P21	Executive Director	25
Cases\\People\P22	40–50	B	Male	P22	Director of Distribution	15
Cases\\People\P23	40–50	B	Male	P23	Quality Manager	12
Cases\\People\P24	40–50	B	Female	P24	Quality Supervisor	12
Cases\\People\P25	40–50	B	Male	P25	Production Officer	15
Cases\\People\P26	25–40	B	Male	P26	Supervisor	20
Cases\\People\P27	40–50	B	Male	P27	Production Manager	20
Cases\\People\P28	40–50	B	Male	P28	Sales Distributor officer	15
Cases\\People\P29	30–40	B	Male	P29	Quality Assurance Officer	12
Cases\\People\P34	30–40	B	Male	P30	Consumer	10 of using the product

Appendix 2. Coding from the Nvivo

Type	Emerging themes	No of sources	No of reference	Created date and time
Free_N	Technology	35	169	04/07/2023 11:53
Free_N	Digital solutions	33	167	03/07/2023 12:57
Free_N	Data driven	35	160	03/07/2023 12:59
Free_N	Planning	30	150	03/07/2023 13:19
Free_N	Food redistribution	30	144	03/07/2023 12:55
Free_N	Internal collaboration	29	138	03/07/2023 20:35
Free_N	Repurpose surplus	27	137	04/07/2023 23:07
Free_N	Animal Nutrition	26	135	04/07/2023 23:09
Free_N	Information sharing	26	130	03/07/2023 19:37
Free_N	Platform sharing	23	101	04/07/2023 20:30
Free_N	Technical know-how	21	99	03/07/2023 22:52
Free_N	External collaboration	18	90	03/07/2023 13:11
Free_N	Teamwork	18	85	04/07/2023 23:10
Free_N	Charts and graphs	16	80	03/07/2023 19:53
Free_N	Supervision	16	78	07/07/2023 22:34
Free_N	Machine malfunctioning	16	75	03/07/2023 12:30
Free_N	Staff Inadequate knowledge	14	70	04/07/2023 21:29

(*continued on next page*)

(*continued*)

Type	Emerging themes	No of sources	No of reference	Created date and time
Free_N	Building relationship with Stakeholders	14	67	03/07/2023 22:45
Free_N	Collaborative learning	15	63	03/07/2023 22:46
Free_N	Learning through experience	11	57	03/07/2023 13:04
Free_N	Quality Control	10	52	03/07/2023 23:35
Free_N	Reporting problems	9	42	03/07/2023 23:50
Free_N	Input and output analysis	9	41	03/07/2023 23:50
Free_N	Awareness of the problem	9	39	03/07/2023 12:46
Free_N	Management inspection	8	30	03/07/2023 23:27
Free_N	Individual Spontaneous ideas	5	23	05/07/2023 19:14
Free_N	Poor monitoring system	7	21	03/07/2023 19:27
Free_N	Learning from experience	6	18	03/07/2023 19:27
Free_N	Improper stacking	5	18	04/07/2023 23:17
Free_N	Sub-standard laminate	10	15	03/07/2023 23:50
Free_N	Leakages	10	13	03/07/2023 19:27
Free_N	Team meetings	7	11	03/07/2023 23:37
Free_N	Automation reduces handling errors	10	10	03/07/2023 23:50
Free_N	Automation increase productivity	9	10	03/07/2023 22:50
Free_N	Packaging issues	7	9	03/07/2023 19:27
Free_N	Lack of provision of standardised working tools	6	9	03/07/2023 18:27
Free_N	Inadequate training of Staff	6	9	03/07/2023 16:28
Free_N	Quarantine approach	7	9	03/07/2023 19:29
Free_N	Semi-finished dislodged	7	9	03/07/2023 19:40
Free_N	Faulty output	7	9	03/07/2023 12:50
Free_N	Involvement in raw materials production	7	9	03/07/2023 19:25

Data availability

Data will be made available on request.

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