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Building green innovation networks for people, planet, and profit: A multi-level, multi-value approach

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ABSTRACT

In this conceptual paper we explore the problem of how firms balance profit considerations against their contribution to society and the environmental. We theorize how firms build networks that support green transition, enabling them to reconfigure processes that match sustainability goals and maintain profitable. We explore how building networks for green transition supports firms' transition to more sustainable approaches that support the adoption of, and transition to, green strategies. We extend current theorization of how firms build multi-level B2B networks that support green transition that benefits society and the environment. We suggest three propositions that support the development of a multi-level, multi-value model for building green innovation networks. We identify four critical success factors - embedding technological diversity, developing knowledge sharing mechanisms, embracing open innovation strategies, overcoming resistance to change, – that support this process and help firms overcome value creation frictions and deliver multi-value benefits to society (people) and the environment (planet), whilst enabling firms to make a profit. Our conclusion outlines our contribution and highlights areas for future research.

1. Introduction

Green innovation is having a significant impact on business-to-business (B2B) relationships, transforming how firms interact and collaborate with their partners, suppliers, and customers (Wang, Zhao, & Hou, 2020). Areas that have been particularly influenced include building sustainable supply chains (Koberg & Longoni, 2019), developing inter-firm collaborations for seeking green solutions (Abreu, Ferreira, Proenca, & Ceglia, 2021), supporting circular economy initiatives such as re-use, recycling, and remanufacturing (Calzolari, Genovese, & Brint, 2021), and demonstrating a commitment to sustainability that attracts B2B partners through the adoption of green innovation (Fontoura & Coelho, 2022). Against this background in this conceptual paper, we theorize how firms build multi-level, multi-value networks (Pattinson, Nicholson, & Lindgreen, 2018) that enable them to overcome the value creation friction (Chatain & Zemsky, 2011) of balancing people, planet and profit, to support the green transition that benefits society and the environment, whilst enabling them to make a profit (Devika & Shankar, 2022).

We conceptualize value creation frictions as obstacles, challenges, or inefficiencies within B2B relationships that, despite their negative connotations, can contribute to the creation of value, or positive outcomes (Chatain & Zemsky, 2011; Obloj & Zemsky, 2015) for firms. For example, Bowman and Ambrosini (2000), highlight the challenge of power dynamics between buyers and suppliers. Although frictions might hinder certain processes, somewhat counterintuitively, they can also lead to benefits such as improved quality, innovation, differentiation, or enhanced user experiences. Thus, we theorize that value-creating

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frictions across industries can drive B2B firms to innovate and create value (Pattinson, Cunningham, & Preece, 2023) through the development of new green products, services, or business models that provide unique value to customers or clients.

We explore how building B2B networks for green transition can enable firms to transition to more sustainable approaches to innovation (Brindley & Oxborrow, 2014; Keränen, Lehtimäki, Komulainen, & Ulkuniemi, 2023) and support the implementation of green strategies that contribute positively to society and the environment, and allowing firms to make a profit (Gabler, Richey Jr., & Rapp, 2015). How firms build networks and innovate across multiple levels (including micro, *meso*, and macro) in order to overcome potential value creation frictions (Chatain & Zemsky, 2011) and transition to green strategies that enable them to balance profits as well as the impact on society and the environment requires further consideration (Olsen, Slotegraaf, & Chandukala, 2014). It has further been suggested that greater attention should be given to how multi-level analysis can be used to explore the complex theories and conceptual developments that marketing scholars should be engaged in (Borg & Young, 2014; Gnyawali & Park, 2009; Möller, Nenonen, & Storbacka, 2020; Pattinson et al., 2018). Our multi-level theorization goes some way in addressing this gap.

We define multi-level analysis as a process occurring at different levels within and across organizations, i.e. at network, triadic, dyadic and intra-organizational levels that are distinct from one another and, as we argue in this paper, offer multiple perspectives on how value is created at different levels in different ways (Borg & Young, 2014, p. 544). From this position, we characterise multi-value as a multiplicity that encompasses environmental and social aspects of value creation as well as profit (Šimberová & Kita, 2020). Value friction occurs when there are competing value drivers and or when value is not realized (Cunningham, Menter, & O'Kane, 2018) and or within an industry value chain between buyers and suppliers (see Chatain & Zemsky, 2011). Thus, our multi-level analysis considers how, at the micro-level, individual firms often struggle, or are unwilling, to participate in green network approaches because it is difficult for them to see firm-level benefits (Garcia, Wigger, & Hermann, 2019). At the *meso* level, we argue firms that can develop better networking capabilities are more successful in developing green innovations (Zubeltzu-Jaka, Erauskin-Tolosa, & Heras-Saizarbitoria, 2018). At the macro-level, we argue the emphasis on environmental impact and societal benefits, means firms are less willing to commit resources to activities that they consider offer limited opportunities for profit (Melander & Arvidsson, 2022). For example, the drive to reconfigure value-creating processes that support the circular economy (Ranta, Keränen, & Aarikka-Stenroos, 2020) and match broader sustainability goals of firms requires them to embrace a 'radical value-system transition' (Möller et al., 2020, p. 381) that many firms find challenging. Adopting a multi-level green transition strategy is one way for firms to mitigate value creation frictions present in collaboration (Popa, Blok, & Wesselink, 2020) and build sustainable networks (Lacoste, 2016) that embrace a 'multi-value' approach (Rasmussen, Enevoldsen, & Xydis, 2020, p. 3992) to address the challenge of green transition and innovation.

Green transition is a process of social change to turn existing environmentally unsustainable global economic paradigms into sustainable, multi-value business models (Rasmussen et al., 2020) that support the development of a circular economy (Dragomir & Dumitru, 2022), and provide improved living conditions for all (UN–Habitat, 2019), particularly during the recent COVID-19 pandemic (Cortez & Johnston, 2020; Ritter & Pedersen, 2020). Although there has been much interest in the impact of green transition, little consideration has been given to how it benefits the environment or impacts on firms' ability to make and maintain a profit. Indeed, firms are often reluctant to collaborate in green innovation activities because value is created at the macro-level but the cost of innovation is generated at the micro-level (Melander & Arvidsson, 2022), making it difficult for firms to evaluate where – and how - they can accrue profits. It also can create value-creation friction among buyers and suppliers and can potentially lead to value destruction (Gibbert, Ivens, & Leischnig, 2023).

We adopt a multi-level network approach (Pattinson et al., 2018) to extend current theorization of how firms build multi-level networks that support the green transition that benefits society and the environment without detriment to firms' profit. The specific research question we pose is: *how do B2B firms build multi-level, multi-value networks that deliver societal and environmental benefits, whilst enabling them to make a profit?* While previous studies have focused on the firm or industry level of analysis (Zhang et al., 2020), our contribution lies in the development of a multi-level, multi-value model for building green innovation networks that enable firms to mitigate value creation friction and destruction (Chatain & Zemsky, 2011; Popa et al., 2020) and make profit while contributing to the benefit of society and the environment (Gabler et al., 2015).

The rest of our paper is structured thus. First, we outline the key concepts of green transitioning and green innovation networks that underpin our research. Next, we develop a conceptual model for building multi-level, multi-value green innovation networks. In the discussion, we provide a detailed outline of our model. Our conclusion outlines our contribution and offers implications for managers. Finally, we suggest some fruitful areas for future research.

2. Key concepts

2.1. Supporting green transition, strategy and innovation in a B2B context

Green innovation is widely recognized as the mechanism by which firms can achieve a multi-value approach which can respond to the challenge of environmental sustainability while also realizing opportunities for growth (Bani-Melhem, Al-Hawari, & Mohd. Shamsudin, 2022). Green innovation is defined as innovation (new products, services, processes and markets) that reduces or eliminates environmental impact (Chen, Lai, & Wen, 2006). The multi-value opportunity is, on the one hand, new green products and services (Yu, Chen, Guan, & Zhang, 2021), or new business models that attract consumers and open new markets or create cost reductions through efficiency benefits in resource use, as well as green brand reputation effects and reduced compliance burdens. On the other hand, it is also the broader sustainability value delivered through improved environmental impact via reductions in harmful emissions and better resource use (Chang & Matsumoto, 2022). In essence, green innovation focuses attention on the negative impact of sustainable development while also taking into consideration the positive impact on the economy and wider society (Zhang et al., 2021). Balancing people, planet and profit creates a value creation friction (Chatain & Zemsky, 2011; Popa et al., 2020) for B2B firms attempting to transition to green innovation.

Green innovation has matured as an academic field from an emerging area of research (Díaz-García, González-Moreno, & Sáez-Martínez, 2015; Hojnik & Ruzzier, 2016). It has developed and seen a ten-fold increase in publications per year when comparing the period between 2007 and 2010 with the period between 2016 and 2019 (Takalo & Tooranloo, 2021). There is now an extant body of research that looks at green innovation from multiple aspects and across a broad range of industrial contexts. A substantial stream of research looks at the value of green innovation, investigating the benefits to firms, the environmental impacts, financial costs and benefits as well as implementation issues such as motivation, critical success factors and barriers (Akbari et al., 2022; Takalo & Tooranloo, 2021). Operations and management aspects such as the role of capabilities and competencies, (Dzhengiz & Niesten, 2019), stakeholders, environmental management and green entrepreneurship are another stream of research. Sector-specific research has examined green innovation in a wide variety of industry contexts: service industries like tourism; resource extraction and basic manufacturing such as fishing, forestry, mining, food, pulp and paper; advanced manufacturing such as IT, automotive

industry, electronics and other consumer goods (Takalo & Tooranloo, 2021). Cross-cutting infrastructure such as transportation, logistics, telecommunications and energy have also been researched from a green innovation perspective. However, prior research has not captured the inherent value creation frictions involved in creating green innovations (Orlando, Ballestra, Scuotto, Pironti, & Del Giudice, 2020) that provide multi-value to people, planet and profit. In addition, and to our knowledge, there is no research on green innovation for green transition in the B2B network context.

Avoiding catastrophic climate breakdown requires moving to an economy that is sustainable by operating inside the earth's natural limits by being carbon neutral and resource-efficient (Finke, Gilchrist, & Mouzas, 2016). This represents a fundamental recasting of current economic activity at every point of the value chain, including developing sustainable practices in B2B relationships between buyers and suppliers (Huang, Surface, & Zhang, 2022). Green transition is the process of making this adaptation, by shifting all aspects of economic activity – investment, capital, technology, processes and skills, supply chains, products, business models – to sustainable modes (Deberdt & Le Billon, 2022). The aspiration for a successful green transition is to support economic opportunities and growth while achieving environmental sustainability (UN–Habitat, 2019). However, the challenge of green transition is to overcome value creation frictions (Chatain & Zemsky, 2011; Popa et al., 2020), and lock in existing ways of producing, a transformation that requires change beyond the capabilities and influence of any individual firm (Kemp & Never, 2017).

Value creation frictions on firms to adopt green transition strategies come from both the regulatory landscape and stakeholders' friction (see Kannan, Shankar, & Gholipour, 2022; Martin & Phillips, 2022). The environmental impact of industry means this sector is a significant component of the challenge of addressing climate breakdown and hence the subject of international agreements, and regional/national legislation (Zhang, Yu, & Sun, 2022). Competitive pressures also push firms towards adopting green transition strategies (Law, De Lacy, Lipman, & Jiang, 2016). The environmental impact of manufacturing sectors has resulted in increasing stakeholder friction (Martin & Phillips, 2022) and pressure on the manufacturing industry to embrace green transition activities and activities across global B2B distribution networks (Feng, Chang, Lin, Lee, & Lin, 2022; Hakanen, Helander, & Valkokari, 2017).

Examples of green innovation in B2B context include exploring green market orientation in Taiwan's electronic manufacturing industry (Borazon, Huang, & Liu, 2022), developing green innovation strategies in the Chinese paper-making industry (Han, Wang, & Fan, 2022), switching to the production of green eco-automobiles in Malaysia's automotive industry (Al-Shami & Rashid, 2022), adopting green production across different product categories in Sweden, including wood products, viscose, cardboard and rolled aluminium (Ellström & Carlborg, 2022).

Implementing a green transition requires more than simply switching from fossil fuels to renewable energy sources. The scale and scope of change demanded will affect every aspect of a firm's operations. However, the nature and reach of the green transition changes mean that even innovative firms will face significant challenges in implementing green innovation. Green innovation differs from standard innovation in having a higher degree of technological novelty (Cainelli, De Marchi, & Grandinetti, 2015) and more complexity and uncertainty (De Marchi, 2012; Ketata, Sofka, & Grimpe, 2015). This requires firms to draw on broader and diverse knowledge which lies outside the existing core competencies of firms and the knowledge base of the industry (Aragón-Correa & Sharma, 2003). Because of this, external knowledge sourcing (Ghisetti, Marzucchi, & Montresor, 2015; Ketata et al., 2015), absorptive capacity (Dzhengiz & Niesten, 2019) and collaboration (Cainelli, Mazzanti, & Montresor, 2012; Calvo, Fernández-López, Rodríguez-Gulías, & Rodeiro-Pazos, 2022; De Marchi, 2012) are particularly important for green innovation. Participation in innovation networks offers a way by which firms and sectors can overcome value-creation frictions and access and implement the new knowledge needed for green innovation (Melander & Arvidsson, 2022).

2.2. Green innovation networks and open innovation

There is a significant body of research that suggests networks are a crucial factor for effective innovation systems for B2B firms (Cabanelas, Omil, & Vázquez, 2013; Corsaro, Cantù, & Tunisini, 2012; Möller et al., 2020) and building global connectivity (Mudambi, Mudambi, Mukherjee, & Scalera, 2017) and in supporting open innovation (Chesbrough & Bogers, 2014). It has been acknowledged that networks are essential in developing firms' innovative capabilities (Porter & Ketels, 2003). Networks are critical for promoting social interaction and supporting diversity (Pittaway, Robertson, Munir, Denyer, & Neely, 2004) and successful firms can build networks with a wide range of actors and institutions (Kaufmann & Tödtling, 2001). Green innovation networks are defined as inter-organizational collaborations with multiple actors, with the purpose of developing and implementing green innovation (Melander & Arvidsson, 2022). However, value-creation frictions can temper the flow of knowledge in networks (Ghosh & Rosenkopf, 2015), creating challenges for firms building green innovation networks.

The concept of green innovation network (Liu, Shao, Tang, & Lan, 2021, p. 1) extends the theoretical development of innovation networks that are traditionally related to science and technology environments in specific industries, to include green innovation activities between regions and provinces (Zhang, Tai, et al., 2021), and also at an institutional and societal level (Hofman, Blome, Schleper, & Subramanian, 2020) that we suggest requires consideration across multiple levels of analysis. Additionally, there is evidence that learning through cooperation helps firms understand their green requirements and overcome potential value-creation frictions between the profit imperative and societal benefits (Le, 2022). This encourages a transition to, and adoption of, green innovation (Guo, Yen, Geng, & Azar, 2021) that is multi-value in that it is profit-generating while supporting sustainable environmental goals that benefit society and the environment. For example, new environmental regulations introduced that affected the pharmaceutical manufacturing sector in Ireland, encouraged firms to collaborate with regulators, competitors, suppliers, consultants, trade associations, research institutes and even environmental NGOs, to identify innovative solutions to improve environmental impact and maintain strategic agility and economic performance (Hilliard, 2006).

The technological and managerial innovation required to make a green transition requires firms to deploy environmental capabilities (Aragón-Correa & Sharma, 2003; Hofmann, Theyel, & Wood, 2012) to develop innovative responses to environmental challenges. Acquiring new capabilities happens when firms can recognize the need for change and identify and implement the required changes (Hilliard & Goldstein, 2019). Because green innovations usually lie outside the firm's core competencies, this typically requires accessing and internalizing external knowledge (Dzhengiz and Niesten, 2020). Networks offer an efficient way for firms to build new capabilities as they provide a way to access the diverse knowledge and information needed by the firm but within a relationship of trust that allows learning and knowledge transfer to happen (Cabanelas et al., 2013; Nooteboom, 2000). Benefitting from network relationships is not a given, firms need to be open to change and willing to participate in networks that create mutually beneficial partnerships that enable them to build new 'multi-value' business models that support and help firms catalyze green transition innovations (Rasmussen et al., 2020, p. 3990). Converting network participation into green innovation requires firms to possess dynamic capabilities for collaboration. Developing dynamic capabilities can help firms overcome value-creation frictions (Chatain & Zemsky, 2011) associated with transitioning to green innovation strategies. Dynamic capabilities for managing network relationships (Inigo, Ritala, & Albareda, 2020) as well as absorptive capacity to internalize new knowledge (Dzhengiz & Niesten, 2020) are necessary for the benefits of

networks to be realized as green innovation strategies.

Open innovation offers an approach that helps firms overcome the challenge of collaborative innovation (Chesbrough & Bogers, 2014). Although the utilization of open innovation in the context of the wider circular economy is a recent phenomenon, it emphasizes the need for collaboration between firms, thus aligning green objectives and enabling firms to resolve environmental issues (Jesus & Jugend, 2023, p. 5). Since most circular economy initiatives and projects are collaborative, open innovation practices can help firms integrate new knowledge and technologies (Brown, Bocken, & Balkenende, 2020; Brown, Von Daniels, Bocken, & Balkenende, 2021). Open innovation involves a shift from a closed innovation perspective in which the innovation process takes place within the boundaries of the firm towards 'a distributed innovation process that involves purposively managed knowledge flows across the organizational boundary' (Chesbrough & Bogers, 2014, p. 3). However, collaboration among different stakeholders can be a source of friction for firms (Bertello, Ferraris, De Bernardi, & Bertoldi, 2021).

In an open innovation system, knowledge can more easily flow inwards to the focal firm as it leverages external knowledge from a diverse set of actors such as suppliers, distributors, consumers, universities, and NGOs, through different mechanisms such as collaboration with intermediaries, communities of practice, crowdsourcing, competitions, and tournaments (Chesbrough & Bogers, 2014). Knowledge can also flow outwards from the focal firm as it allows the use of underutilized assets and resources by other actors in their ecosystem (Maarse & Bogers, 2012). Open innovation can also be coupled whereby multiple inward and outward knowledge flows are taking place between firms in the innovation process (West & Bogers, 2014). Adopting an open green innovation process can therefore accelerate the innovation process as it facilitates knowledge sharing, and consequently the development of resources and capabilities to develop green solutions (Chaurasia, Kaul, Yadav, & Shukla, 2020).

Adopting a multi-level, multi-value approach enables us to explore both direct and indirect network interactions (Pattinson et al., 2018) that support a more nuanced understanding of the multifarious aspects of the diverse forces that drive competitive advantage (Cantele & Zardini, 2018; Gürlek & Tuna, 2018; Muñoz & Kimmitt, 2019). In doing so, we also expose the various micro, *meso*, and macro level environmental considerations for green transition in a B2B context in the post-pandemic era.

2.3. A multi-level approach to green innovation networks

Multi-level analysis has been applied to other B2B contexts such as coopetition (seeGnyawali & Park, 2009 ; Pattinson et al., 2018 ; Tidström & Rajala, 2016), and to the theorizing on networks (Möller et al., 2020). However, to our knowledge, multi-level analysis has not been used to explore green innovation networks. We consider a multi-level approach appropriate for supporting our theorization of how firms overcome value creation frictions (Chatain & Zemsky, 2011) related to transitioning to green innovations by building green innovation networks that support collaboration. We identify three levels of interaction; micro-level, meso-level, and macro-level an initial set of critical success factors (Zhang, Sun, Yang, & Wang, 2020) that help firms overcome value creation frictions and deliver multi-value benefits to society (people) and the environment (planet), whilst enabling firms to make a profit.

Our initial conceptualization of multi-level green innovation (Fig. 1) was influenced by the 'nested business environment framework' described by Möller et al., (2020, p. 384). In building on this initial

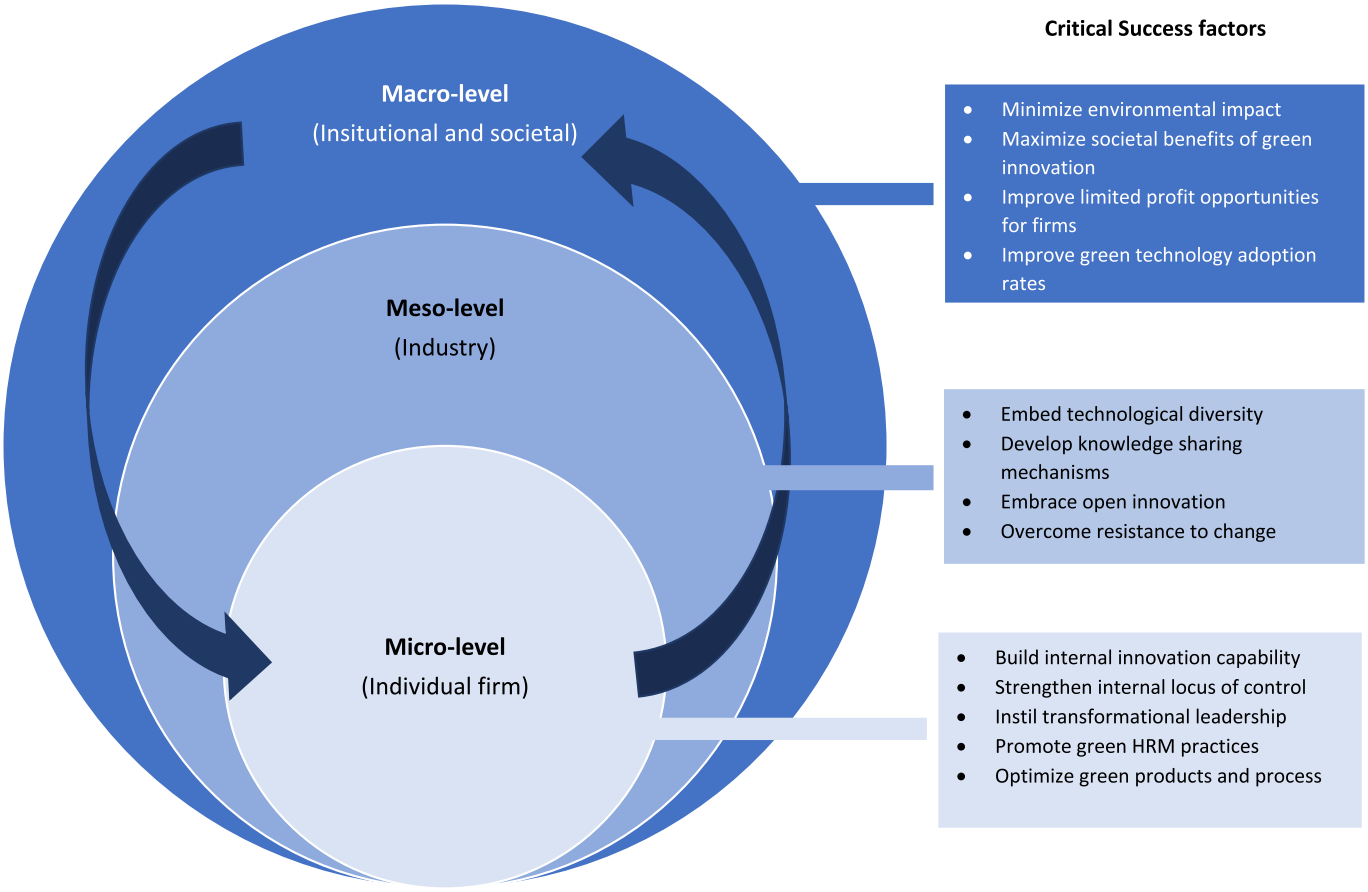

Fig. 1. Critical success factors for multi-level, multi-value green innovation. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

approach, we explored how multi-level analysis has been employed in B2B contexts, especially coopetition (Gnyawali & Park, 2009; Pattinson et al., 2018; Tidström & Rajala, 2016). Prior research also indicates that, in a B2B context, green innovation efforts are evaluated favourably by customers and suppliers, resulting in enhanced relational performance (Wang, Li, Wen and Nie, 2021), therefore a multi-level approach seems appropriate for developing our conceptualization. Companies such as Unilever, Red Bull, Coca-Cola Company and PepsiCo have adapted their business models to enable them to transition to green innovation strategies (Awan, Sroufe, & Kraslawski, 2019).

Given B2B firms rely on successful relationships, our model identifies four critical success factors that help firms leverage value from their connections across multiple levels. Adopting a multi-level approach provides a better understanding of how a phenomenon at one level might impact other levels of analysis (Bengtsson & Kock, 2014). A multi-level approach enables us to better understand how firms might mitigate value creation frictions (Popa et al., 2020) and build sustainable networks (Lacoste, 2016) that embrace a 'multi-value' approach (Rasmussen et al., 2020) to address the challenge of green transition and innovation.

In the next section, we discuss each level identified in Fig. 1 in detail and suggest three research propositions. We developed our propositions in line with the foundational premise that they should identify and define statements that represent the 'core elements' of a theory or concept, and that contain 'novel statements' regarding relationships between theories and concepts (Ulaga, Kleinaltenkamp, Kashyap, & Eggert, 2021, p. 400).

2.3.1. Micro-level

The micro-level focuses on the individual firm. However, firms are often reluctant to collaborate in network activities because the value is created at the macro level, but the cost of innovation is generated at the micro level (Melander & Arvidsson, 2022). Networking enables cooperation and collaboration (Harrison, Prenkert, Hasche, & Carlborg, 2023), but also generates value creation frictions (Chatain & Zemsky, 2011; Popa et al., 2020) due to higher operational costs and carries higher market risks for firms (Ellström & Carlborg, 2022). These costs can be particularly high for firms transitioning to green strategies (Sandberg & Aarikka-Stenroos, 2014) reliant on cross-sector collaboration. Firms often struggle to participate in networks that help them capitalize on the benefits and lessen the cost of green transition (Garcia et al., 2019). Additionally, green innovation is driven by regulatory requirements from the external context, and firms' internal factors, such as organizational culture and available resources (Zhang, Kang, et al., 2020).

However, high levels of risk and uncertainty and low perceived return from green innovation activities, mean that only some firms will achieve their positive green outcomes, more so for those firms less willing to tackle green innovation (Roper & Tapinos, 2016). For example, Tseng, Wang, Chiu, Geng, and Lin (2013) developed a model to improve firms' performance and reduce levels of uncertainty for Taiwanese printed circuit board (PCBs) manufacturers. Therefore, firms need to be prepared to embrace green innovation by *building internal innovation capabilities* (Chen et al., 2006). In fact, firm-level green innovation includes the transition to green management, the creation and optimization of environmentally sustainable products, and the *optimization of green production and processes* (See Tseng, Huang, & Chiu, 2012). Furthermore, firms sometimes find it difficult to overcome the value creation friction between the profit imperative and societal benefits (Le, 2022) and commit the necessary resources to green transition activities, because it is the societal level that reaps the potential benefits (Garcia et al., 2019) from micro-level green activities. The result is little motivation for firms to adopt green strategies where they do not see a clear profit motive (Yousaf, Radulescu, Sinisi, Serbanescu, & Paunescu, 2021).

Internal innovation capability is a prerequisite of green innovation at the micro-level. From the contingency perspective, innovation and technological capability (Peerally, De Fuentes, & Figueiredo, 2019) are more conducive to green innovation when a firm and its employees are motivated (Tsai & Liao, 2017). Additionally, green innovation is expensive, and it involves commitment and investment from both the employer and employees which is sometimes difficult to get (Gürlek & Tuna, 2018; Muduli, Govindan, Barve, Kannan, & Geng, 2013). For instance, research on what drives green innovation has highlighted that firms that are more environmentally aware are also more likely to be innovative (Zubeltzu-Jaka et al., 2018). As a result, environmental concern at a firm level requires employees to fully engage with the green innovation practices of employers (Hojnik & Ruzzier, 2016).

Another factor in supporting green innovation practices is the strengthening of *the internal locus of control*, which is a critical requirement where ownership and operation of firms are often separated (Li, Lin, & Song, 2011). Where the internal locus of control is high, this could help provide a firm with clear strategic direction, supporting knowledge sharing, and building more effective processes for green innovation, while reducing the risk involved in green innovation activities. In particular, a strong internal locus of control can elevate organizational performance (Van den Berghe & Levrau, 2004). This enhances micro-level decision-making related to developing green innovation (Ma, Ock, Wu, & Zhang, 2022). One study, (Afsar et al., 2020, p. 309) found that 'responsible leadership' is a key driver of employees' pro-environmental behaviour. In other words, *transformational leadership* embraces sustainable values positively influencing employees' awareness of green issues and are better equipped to build a shared green vision. At the micro-level, a clear rationale for green innovation requires transformational leaders to balance their firms' interests with those of shareholders who could benefit from green innovation (Bertrand & Mullainathan, 2003). This approach helps firms to make informed and balanced decisions about investing in green innovation projects (Lake, Acquaye, Genovese, Kumar, & Koh, 2015). Accordingly, effective internal control reduces the level of risk associated with investing in green innovation (Ma et al., 2022).

Transformational leaders can also help promote a vision that has a positive impact on employees with green interests, ability, or motivation, helping them realize their green potentialities, and supporting green innovation (Chen & Chang, 2013). Equally important, is how firms incorporate sustainability goals with *green human resource management* (HRM) practices to support and sustain green processes and that optimize green product innovation (Saeed et al., 2019). Green HRM practices guide leaders and managers to formalize micro-level processes and responsibilities to encourage employees towards green practices, such as recycling, green waste management, and improved energy use. Organizational support to help employees understand green issues can help firms enhance and sustain environmental performance (Singh, Del Giudice, Chierici, & Graziano, 2020). The purpose of Green HRM practices is to reduce the negative environmental impact of firms by developing and encouraging employees' green behaviours (Renwick, Redman, & Maguire, 2013), and is pertinent to our micro-level analysis. This gives rise to our first proposition:

P1: At the micro-level, firms that build internal innovation capabilities will be more likely to adopt green strategies that enable them to overcome potential value-creation frictions between the profit imperative and societal benefits.

P1a: Improved internal locus of control will help firms reduce the micro-level risks associated with green investment and develop profitable green strategies.

P1b: Transformational leadership will enable firms to embrace sustainable values at the micro-level, and positively influence employee awareness of green issues and build a shared green vision.

P1c: Firms adopting green micro-level HRM practices encourage employee commitment to green innovation and help optimize green production and processes.

2.3.2. Meso-level

The *meso*-level focuses on the industry, or network level (Keränen et al., 2023). The meso-level is particularly associated with inter-firm collaboration that supports the transition to a circular economy (Aarikka-Stenroos, Chiaroni, Kaipainen, & Urbinati, 2022) in which markets are incentivised to reuse products rather than scrap them (Ranta et al., 2020). In attempting to shed light on the determinants of green innovation, Zubeltzu-Jaka et al. (2018) suggest that firms embedded within networks are better equipped to *develop knowledge-sharing mechanisms* that reduce meso-level value creation frictions (Chatain & Zemsky, 2011; Popa et al., 2020) at the industry level that are likely to generate green innovations. This study showed that firms with strong collaborative networks and/or more concern for green issues, are more likely to adopt green innovation strategies and develop green technologies that offer environmental benefits to society.

Firms that participate in networks with multiple actors are able to transition to green innovations more readily (Fusillo, Quatraro and Usai, 2022). At the meso level, green innovation strategy is often classified under green marketing channels and supply chain management (Abu Seman et al., 2019; Lima, Delgado, Santos and Florentino, 2022). Although firms have generated several benefits from green innovations, such as improved green production, sustainable production, and eco-friendly production, research has also identified barriers to green transition (Rasmussen et al., 2020). Nevertheless, several industries have successfully integrated green innovation into their operations, including food supply chain (Meneghetti & Monti, 2015), green supply chain (Lake et al., 2015; Zhang & Yousaf, 2020), and cleaning products (Gelderman, Schijns, Lambrechts, & Vijgen, 2021).

In the green technology industry, firms need to build green innovation networks that enable them to expand their capabilities and consider diversification that incorporates technologies outside their traditional areas of expertise (Corrocher & Ozman, 2020). In other words, firms that *embed technological diversity* are essential for successful green innovation. This suggests innovation networks are ideally suited to supporting the technological diversity of knowledge across industries (Fusillo et al., 2022). Where technological diversity is challenging, companies must decide whether to rely on their own in-house expertise or go outside the company for answers (Ambos, Brandl, Perri, Scalera, & Van Assche, 2021; Chang & Matsumoto, 2022; de Groote, Schell, Kammerlander, & Hack, 2022; Wang, Chin, & Lin, 2020). At the meso level, recombining and integrating knowledge and learning across diverse disciplines often requires integration of complex concepts and processes (Banerjee & Corredoira, 2013; Pattinson & Dawson, 2023). Here, the formation of technological collaborations or inter-firm networks are essential for effective innovation performances (Frostenson & Prenkert, 2015) and the value of firm-level partnerships supports the development of environmental innovations (Cainelli et al., 2012; Kolk & Lenfant, 2015). The significance of open innovation in the green domain has been referred to as the 'open eco-innovation mode' (Ghisetti et al., 2015, p. 1090). Firms need to *embrace open innovation*, and build meso-level collaborative networks of relationships, that provide access to new information and compensate for a lack of internal knowledge capability (Grant & Baden-Fuller, 2004).

Kannan et al. (2022) identify five key organizational challenges of green transition in manufacturing industries that impact firms understanding of green manufacturing activities. First, a low level of commitment from top management. Second, low levels of research and development. Third, low levels of staff empowerment. Fourth, lack of control and high levels of resistance to change. Fifth, low demand from customers. The first challenge relies on reasons why management avoids green manufacturing, with financial restrictions playing the most significant role (Jin, Ding, & Yang, 2022). The third challenge relates to firms' failure to implement green transition due to a lack of employee support. Ignorance of green manufacturing-related issues is largely responsible for the lack of support among internal stakeholders and creates friction for firms in terms of prioritizing profit against green transition (Martin & Phillips, 2022). The fourth challenge relates to firms' fear of change. Despite being aware of green practices and procedures, firms are often reluctant to implement them. Although it is accepted that firms are resistant to change, they must develop capabilities that enable them to overcome *resistance to change* and enact green transformations and innovations. The fifth challenge is about how firms tackle weak customer demand for green products or series. Here, firms need to develop strategies that encourage customers to switch to environmentally sustainable, green products as a priority.

Understanding the structural features of networks and meso-level characteristics such as quality and sources of knowledge, quality of relationships among network actors (Wang & Zhang, 2021) is crucial for identifying the efficiency of green innovation and how it can serve as a goal that influences the networking strategies of businesses. For example, Zhang, Kang, et al. (2020) demonstrated that the efficiency of green innovation in firms within the Yangtze River Economic Belt improved through participation in green innovation networks. In this regard, technical alliances are an intriguing example of technological collaboration that enables companies to gain access to capabilities that they lack internally and that are outside of their areas of expertise (Gandhi, Thanki, & Thakkar, 2018). On the one hand, technological partnerships are viewed as a mechanism for sharing risk in the innovation process (Pittaway et al., 2004). Conversely, firms gain access to new and complementary technologies, developing markets, and the ability to track the progress of non-core technology (Fusillo et al., 2022; Karuppiah, Sankaranarayanan, Ali, Chowdhury, & Paul, 2020; Sun, Bi, & Yin, 2020; Vonortas & Zirulia, 2015). Hence, this suggests a second proposition:

P2: At the meso-level, the characteristics of the networks in which firms are embedded will shape their propensity to adopt green strategies that deliver multi-value benefits to society and the environment, and enable them to make profit.

P2a: Building green innovation networks will reduce meso-level value creation frictions and improve knowledge-sharing mechanisms and expand firms' capabilities.

P2b: Meso-level B2B networks will enable firms to embrace open innovation, and embed technological diversity to create more innovation opportunities.

2.3.3. Macro-level

The macro-level focuses on the institutional context and societal level and is concerned with *minimizing environmental impact* and *maximizing social benefits* (Melander & Arvidsson, 2022). Here, firms are unwilling to embrace green innovation strategies that benefit society because there are limited profit opportunities compared with the micro/meso-level (Garcia et al., 2019). Although the latter is not directly connected to firms' ability to make profit, it makes a valuable contribution to the overall institutional context, or societal level ecological value (Kemp-Benedict, 2018). Hence, firms are unwilling to develop green innovation strategies that benefit society also due to the limited profit opportunities compared with the micro/meso-level (Garcia et al., 2019; Melander & Arvidsson, 2022). Consequently, such value creation frictions (Chatain & Zemsky, 2011; Popa et al., 2020) increase firms' reluctance to develop green innovation strategies that *improve limited profit opportunities* and positively impact the level of value capture at the societal level and consequently influence the short-term lowering of the costs versus long term profit creation at the institutional level (Huang, Liao, & Li, 2019).

Although green innovation is mainly implemented at the meso-level, through B2B networks, green innovation strategies are also influenced at the macro-level in the country, or societal level by critical components such as innovation strategies, communication channels and social systems (Rogers, Singhal, & Quinlan, 2014). The changes made at the societal level increase the likelihood of successful technology adoption (Hooks, Davis, Agrawal, & Li, 2022), which can support the wider spread of green innovation if/when pursued by the firms. Technology

adoption, particularly digital technology adoption, as a means to support a more integrated societal approach to adopting green innovation, can also provide a way for firms to collaborate in value capture not only for profit but also for society and the environment (Cohen, Lobel, & Perakis, 2016).

Furthermore, *improving green technology adoption rates* at the macro-level will be spread and accepted more widely once, as in the case of Ireland, the firms benefit from a system (regional/national) that promotes inclusive, networked and balanced innovation systems to support technology-innovation-led firms (Ramsey & Ibbotson, 2005). Another example is in the BRIC economies, where 'dirty inputs' have been replaced with cleaner alternatives to reduce pollution intensity (Wong, Lai, Pang, Lee, & Cheng, 2020, p. 435). Decentralized decision-making in governments can result in poor technology adoption, often seen in poorly designed strategies and subsidies meant to improve consumer adoption (Hooks et al., 2022). One example is when Honda overcame low sales of its Fit EV electric vehicle in California by introducing discounts to encourage technological adoption- (Cohen et al., 2016). Nonetheless, the challenges are mostly prevailing, especially in how governments design incentives to encourage green technology adoption by consumers (Diamond, 2009). Weak institutional environments where there is a lack of accountability, out-of-date regulations, and poor enforcement of the law, present potential value-creation frictions (Chatain & Zemsky, 2011; Popa et al., 2020) that hinder the successful adoption of green strategies (Liu & Yan, 2018). These challenges also include the link between the adoption of green innovation and the level of standardization (Fusillo et al., 2022) as well as the disinterest of firms because of the micro-level cost of developing green innovations (Melander & Arvidsson, 2022). At the macro-level, economic incentives offered by governments and other institutions to be 'green' are often limited and benefit distinctive stakeholders at different times, and thus have little impact incentivizing firms to conform to institutional and societal pressure to transition to green innovation strategies (Clemens & Douglas, 2006).

Additionally, because green innovation is often driven by regulatory requirements aimed at reducing environmental impact (Kannan et al., 2022). Some firms will be unresponsive and aim to achieve minimum compliance, illustrating that macro-level pressure to conform with environmental regulations 'can only facilitate reactive green innovation' (Chen, Chang, & Wu, 2012, p. 383). Because B2B relationships play a role in ensuring compliance with environmental regulations and standards, collaborative efforts between businesses, help firms navigate and address complex environmental regulations, ensuring mutual adherence and shared responsibility. However, some research has demonstrated that green incentives do have a positive impact on firms' conformity to institutional and societal pressure to adopt green strategies across diverse industries including examples in energy (Ciarreta, Espinosa, & Pizarro-Irizar, 2014), household waste management (Vorobeva, Scott, Oliveira, & Neto, 2022), and recycling (Yang & Thøgersen, 2022). This gives rise to our third proposition:

P3: At the macro-level, institutional contexts with incentives, regulations and laws that support green practices, will encourage firms to adopt green strategies that deliver multi-value benefits to society and the environment, and enable them to make a profit.

P3a: Firms' responses to institutional factors will be shaped by macro-level incentives to adopt green strategies that enable long-term profit.

P3b: Firms that lack the incentives to adopt green strategies will exhibit minimal conformity with macro-level institutional and societal pressures.

P3c: Firms aiming for minimum regulatory compliance can distribute the burden of compliance by engaging in existing networks.

P3d: Firms with adequate incentivization will go beyond conformity and will play a role in shaping partnerships that will contribute towards building green networks.

3. Conceptual model: A multi-level and multi-value approach

Our theorization highlights the current structural challenges of balancing the duality for firms adopting a multi-level, multi-value approach, and the potential for value frictions (Chatain & Zemsky, 2011; Popa et al., 2020) in relation to making profits and effectively addressing environmental and societal considerations. Building on our initial conceptual of the critical success factors for multi-level green innovation (Fig. 1) and the propositions developed in the previous section, we propose a multi-level, multi-value model (Fig. 2) for supporting green transition and green innovation that enables B2B firms to contribute to society and the environment, whilst enabling them to make a profit. The micro-level focus is on the cost of transition to green innovation strategies for individual firms. Here firms often find it difficult to see a benefit in network participation because the value capture is perceived to occur at the macro level. We proposed that participation in green networks, where knowledge and resources can be shared, reduce the cost of green innovation. The macro-level focus, on green innovation, captures value that offers societal-level benefits. Firms are, therefore, less willing to consider value capture opportunities generated through green transition. Again, we suggest that green network participation helps support activities that enable the transition to green innovation strategies. The *meso*-level is significant to our theorization because this is the level at which firms need to focus the relationship-building activities and build their green innovation networks. Firms who do this, are more successful in transitioning to green innovation strategies. In the model, we identify four critical success factors (embedding technological diversity, developing knowledge-sharing mechanisms, embracing open innovation strategies, and overcoming resistance to change), that help firms overcome value creation frictions, and that support green transition and enable them to make a profit while delivering multi-value benefits to society and the environment. In the next section, we discuss our conceptual model in greater detail.

4. Discussion

Our model captures the importance of meso-level industry relationships that help B2B firms to build multi-level, multi-value networks that support green transition and deliver societal and environmental benefits, whilst enabling them to make a profit. The four critical success factors we identify, that help firms overcome value creation frictions and deliver multi-value benefits to society (people) and the environment (planet), whilst enabling firms to make a profit.

4.1. Embedding technological diversity

Successful innovation requires a diversity of knowledge and skills, and firms' ability to integrate complex processes and competencies (Befort, 2020; Brunetta, Marchegiani, & Peruffo, 2020) that support circular economy initiatives (Calzolari et al., 2021), and demonstrate a commitment to sustainability that attracts B2B partners. Technological diversity brings together these different sets of knowledge, skills and experiences in support of complex innovation processes. Developing such processes is challenging and often requires close interaction between multiple actors and across diverse contexts (Pattinson, Preece, & Dawson, 2016). For example, in science-based, and high-technology contexts, positive innovative performance has been linked to employee diversity (Østergaard, Timmermans, & Kristinsson, 2011), disciplinary, as well as to firm diversity (Nepelski & Piroli, 2018). Networks help to promote social interaction that supports technological diversity (Pittaway et al., 2004). Additionally, the value of diverse innovation partners is recognized as a significant factor in supporting innovation (Kaufmann & Tödtling, 2001).

Harnessing green innovation relies on firms developing diverse and new knowledge and skills (Ardito, Messeni Petruzzelli, Pascucci, & Peruffo, 2019). Diversity has been shown to support innovation in

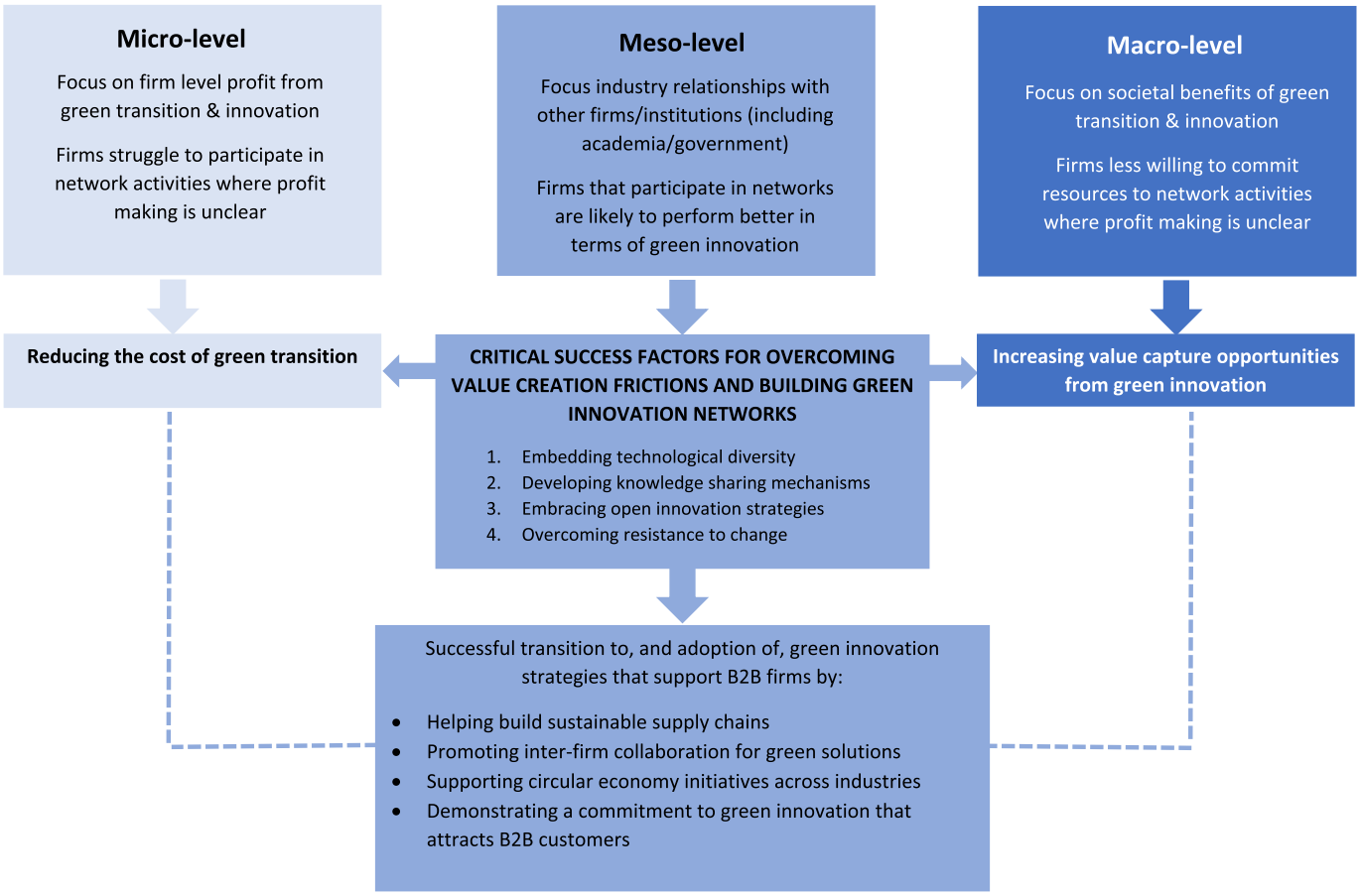

Fig. 2. A multi-level, multi-value model for supporting green transition and innovation.

green-technology firms, enabling them to mobilize competencies and resources for green innovation (Meyskens & Carsrud, 2013). However, individual firms do not always have the necessary resources internally (Horbach, Oltra, & Belin, 2013), and therefore need to put greater emphasis on their networks to build new knowledge and capabilities (Hojnik & Ruzzier, 2016). Our model suggests that by participating in green innovation networks, firms can embed technological diversity and overcome deficiencies in knowledge, skills, and resources that benefits to society and the environment, whilst maximizing profit opportunities (Meyskens & Carsrud, 2013).

4.2. *Developing knowledge sharing mechanisms*

Knowledge sharing is about 'identifying existing and accessible knowledge, in order to transfer and apply this knowledge to solve specific tasks better, faster and cheaper than they would otherwise have been solved' (Christensen, 2007, p.37). Knowledge sharing is crucial for firms' success because it fosters creativity and accelerates innovation (Lin, 2006). Notably, knowledge resources facilitate the development of new opportunities (Lawson, Petersen, Cousins, & Handfield, 2009), and operational performance (Rungsithong & Meyer, 2020). Knowledge sharing is crucial in enhancing firms' ability to manage knowledge resources (Estrada, Faems and de Faria, 2016). Knowledge sharing is firm-specific, socially complicated, and path-dependent, and can be viewed as an innovation input (Chiang & Hung, 2010; Gächter, von Krogh, & Haefliger, 2010). When firms are willing to share knowledge, they manage knowledge efficiently (Lundvall & Nielsen, 2007). To do innovative activities more effectively, employees must often rely on their skills or experience (tacit knowledge), or search for institutionalized techniques or practices (explicit knowledge) (Arnett, Wittmann, & Hansen, 2021; Heffner & Sharif, 2008). Therefore, a company that promotes knowledge sharing practices between firms is better equipped to generate innovations. Furthermore, knowledge sharing is about integrating and implementing multi-stage processes that contribute to firm performance (Azeem, Ahmed, Haider, & Sajjad, 2021).

Knowledge sharing can be core-point in building green innovation projects and process (Arfi, Hikkerova, & Sahut, 2018). Sharing green knowledge has been referred to as the 'process of sharing or transferring green marketing and technological knowledge between a manufacturer and its supply chain members, with the aim of developing new techniques and new opportunities for effectively diminishing negative environmental impacts' (Song, Yang, Zeng, & Feng, 2020. p. 3). Effective supply chain collaborations support circularity in B2B relationships, especially at the meso and macro levels (Aarikka-Stenroos et al., 2022; Calzolari et al., 2021).

According to Wu (2013), the success of green innovations is contingent on firms' obtaining and sharing knowledge related to green issues with partners. Other research has suggested that sharing knowledge merely offers the potential to enhance green innovation (Chen, Lin, Lin, & Chang, 2015; Gebauer, Worch, & Truffer, 2012), because new green information is not necessarily compatible with firms' current expertise (Wong, 2013). Knowledge sharing in green innovation processes also enhances the quality of knowledge being shared (Chavez, Yu, Gimenez, Fynes, & Wiengarten, 2015), and mitigates turbulence in uncertain environments (Song, Wang, Wang, & Chen, 2023), thus reducing pressure at institutional level (Liao & Tsai, 2019).

4.3. *Embracing open innovation strategies*

As pressure by various stakeholders mounts on firms to address

sustainability challenges (Wolf, 2014) and support the development of a circular economy (Dragomir & Dumitru, 2022), there is a need for firms to rethink their processes and products in a way that meet the twin challenge of profitability and transition to green processes, where environmental sustainability that supports the wider circular economy becomes more pressing (Geissdoerfer, Savaget, Bocken, & Hultink, 2017). The simultaneous pursuit of firm profitability and environmental sustainability is a challenging task as it requires firms to go beyond mere compliance with environmental standards towards a strategic and active approach to developing green and sustainability-oriented processes and products that support the circular economy (Bocken, Short, Rana, & Evans, 2014). Indeed, it has been argued that a broader sustainability-oriented approach to innovation is the driving force towards green transition (Song & Oh, 2015) as it would enable firms to make 'changes to their products, processes or practices to serve the specific purpose of creating and realizing social and environmental value in addition to economic returns' (Adams, Jeanrenaud, Bessant, Denyer, & Overy, 2016, p. 180). Open innovation helps firms integrate new knowledge and technologies that support circular economy initiatives (Brown et al., 2020; Brown et al., 2021).

But engaging in green innovation is a risky and uncertain endeavour for firms (Hall & Wagner, 2012) as it requires them to develop dynamic capabilities to enable reconfiguration of their knowledge base (Teece, 2007). Furthermore, the speed of technological and societal change in the sustainability context, means the reconfiguration of firms' knowledge needs to be a continuous process (Ghassim & Foss, 2021). As such, it has been recognized that developing green innovation is a collaborative affair between diverse stakeholders as it requires knowledge that is beyond the capacity of individual firms (Goodman, Korsunova, & Halme, 2017). Accordingly, several researchers have explored the relevance of open innovation in facilitating green innovation and wider processes of green transition (Chaurasia et al., 2020). Continuous interaction in the open innovation process can also create pressures on participating firms to adopt green innovation (Lopes, Scavarda, Hofmeister, Thomé, & Vaccaro, 2017) which can lead to the emergence of a shared purpose and value (Porter & Kramer, 2011) thus leading to a virtuous cycle of innovating for sustainability (Chaurasia et al., 2020).

4.4. Overcoming resistance to change

Despite the macro-level desire to pursue green transition at societal level, environmental regulation can often face resistance from individuals and industry due to regulators lack of legitimacy and suspicion of governmental motives, together with concerns that regulation will restrict economic growth (Francesch-Huidobro, Lo, & Tang, 2012; Herbert, 2014). The suspicion surrounding regulatory processes, and whether (or how) government should regulate (Eden, 1999) means green innovation activities carry a high level of risk for firms wishing to transition to greener processes (Sun et al., 2020). The consequentialist position on the green issues, for example, considers how interventions have had a positive environmental outcome, and plays an essential role in legitimizing the regulation of environmental issues (Eckersley, 2007). Therefore, an effective strategy should not only minimize the green innovation risk in the manufacturing sector for instance, but also ensure successful transition to green innovation strategies for firms (Sun et al., 2020), enabling firms to adopt 'true circular economy thinking' (Keränen et al., 2023, p. 117).

In particular, Ball, Burt, De Vries, and MacEachern (2018) propose Voluntary Reciprocal Legitimacy (VRL) as a new way to legitimize green issues. VRL identifies some mechanisms for policy makers and environmental regulators to use to encourage voluntary participation. These include using environmental or green award schemes as well as encouraging firms to sign up to voluntary agreements to move firms beyond often obligatory regulatory compliance and embrace green transition. However, while regulators' activities support market change and transition to green innovation, policy instruments such as the EU Circular Economy Action Plan create uncertainty for firms regarding how to enact policy (Keränen et al., 2023). For individuals, resistance to green transition is often about fears of how it might compromise job security (Kannan et al., 2022). Successful transition to green innovation requires firms to overcome the challenge present by resistance to change.

5. Conclusion and contribution

5.1. Theoretical contribution

In this paper we offer a theoretical contribution to green transitioning in a B2B context that supports circular economy initiatives (Calzolari et al., 2021) and encourages firms commitment to sustainability through the adoption of green innovation (Fontoura & Coelho, 2022). Previous studies have concentrated on one level of analysis - the firm (micro), or industry (macro) level of analysis (Zhang, Kang, et al., 2020), whereas our model shows that the cost and benefits of green innovation are derived from multiple levels. Our contribution, therefore, lies in the development of a multi-level, multi-value model for building green innovation networks. Moreover, other models do not fully acknowledge the potential for value friction and destruction. Our model demonstrates that firms can mitigate value creation friction and destruction (Chatain & Zemsky, 2011; Popa et al., 2020) and make profit while contributing to the benefit of society and the environment (Gabler et al., 2015).

Because the value of innovation is often captured at the macro-level and the costs occur mostly at the micro-level (Melander & Arvidsson, 2022), it is often difficult for firms to overcome the value creation frictions (Chatain & Zemsky, 2011) associated with balancing green transition that benefits society and the environment, and invest time and resources in green innovation activities. Our theorization and model suggest that reducing the costs of green transition and increasing the benefits from macro-level value capture by building multi-level networks enables firms to create 'multi-value' processes that benefits society and the environment, whilst enabling them to make a profit. We identify four critical success factors (embedding technological diversity, developing knowledge sharing mechanisms, embracing open innovation strategies, overcoming resistance to change), that help firms mitigate value creation frictions and deliver multi-value benefits to society and the environment, while maintaining profit.

5.2. Managerial implications

Our theorization has significant implications for managers in B2B firms. First, managers need to develop a better understanding of the mechanisms firms can use to build green innovation networks to enable them to capture value occurring at the macro-level but that is generated from micro and *meso*-level activities (Melander & Arvidsson, 2022). This can be achieved through building networking capabilities that help firms develop green innovations that capture multi-level value (Zubeltzu-Jaka et al., 2018). B2B network capabilities differ from B2C firms, focusing more on value co-creation (Lacoste, 2016), where businesses collaborate to create new products and services. Second, managers should be aware of the impact of potential value destruction and value friction (Cunningham et al., 2018), particularly at the micro-level. Our conceptualization provides managers with a deeper understanding of how to overcome potential value destruction and value friction issues. Third, in being open to collaboration across multiple levels and willing to participate in networks, managers must recognize the need to build new multi-value business models (Rasmussen et al., 2020) that support and help firms catalyze green innovations. Our conceptual model offers a way forward in all of these respects by highlighting critical success factors that enable managers to support firms' engagement in green innovation networks and develop new circular business models (Dragomir & Dumitru, 2022) that support green transition. Existing literature

on B2B have identified challenges that need to be addressed for effective B2B arrangements. Our research implications highlight the unique requirements and elements of B2B firms in building green innovation networks. Our model focuses specifically on B2B green innovation networks that primarily target other businesses and supply chain partners. Uniquely we emphasize value friction complexities occurring at multiple levels and involving multiple stakeholders involved in building green network. This is against requirements for large-scale circular economy initiatives driven by the need to reduce costs, meet the demands of regulatory compliance, and enhance reputation of firms across industries. We suggest that future studies should examine the value creation dynamics in building B2C green networks that uses our multi-layered and level approach.

5.3. Limitations and future research

There are a number of limitations to our study. First, our theorization focuses on building green innovation networks. It does not consider the impact of other external mechanisms such as sustainability reporting on green innovation practices and strategies. Second, our conceptualization does not consider how pressures to conform and transition to green innovation strategies impacts the wider stakeholder perspective. Third, we do not consider how firms build innovative capabilities, or what types of capabilities are required for successful transition to green innovation. Fourth, our model needs to be empirically tested to see how it might support value-creating processes that support the circular economy. Nevertheless, we suggest that our theoretical development offers a rigorous exposition of how firms build multi-level networks that support the green transition that offers to benefit society and the environment, while maintaining a profit.

At the micro-level, further research might explore how firms build innovation capacity to enable the transition to green technologies. Additionally, the motivations and value drivers of network participants for collaborating in green innovation networks are worthy of further investigation. Further empirical research is required to explore how networks support green transition in a B2B context. Additionally, new studies should examine how individual firms maximize the (macro-level) societal benefits of green transition while maintaining, or even improving (micro-level) profit opportunities and the mechanisms that they use to resolve value creation frictions. Here, new research examining the role of transformational leadership in supporting green HR practices is also likely to offer a fruitful area of future research. Future empirical research should also explore the microfoundations of green innovation networks.

At the meso level, future empirical research is required that uses multi-level, multi-value analysis to examine how to embed green transition strategies in a B2B context. Further consideration of the implications of green transitioning in the B2C context is also a priority for future research (Zhang, Sun, et al., 2020). Although our theorization is more readily applicable to science and technology-based firms and industries, future research should explore green transition and green innovation at a B2B level across specific industries, or sectors outside of this domain. Related to this, research might also explore how technological diversity can be embedded across industries.

At the macro level, future research could explore green transition and innovation in an ecosystem context (Möller et al., 2020), that explore, inter alia, different geographies and cultures, or that employ different theoretical lenses that can validate green, sustainability-led innovation in a multi-level, multi-value context (Pattinson, Nicholson, Ehret, Velu, & Ryan, 2022). We suggest another interesting area for new research is to identify factors to improve green technology adoption rates at the macro-level. Another related area ripe for exploration is research that considers how the transition to green technologies and adoption of green innovation can be incentivised to maximize societal benefits and minimize environmental impact while allowing firms to still make profits.

Declaration of Competing Interest

None.

Data availability

No data was used for the research described in the article.

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