

Carbon neutrality drivers and implications for firm performance and supply chain management

Abraham Zhang¹  | Huay Ling Tay²  | Muhammad Faizan Alvi¹ |
Jason X. Wang³  | Yu Gong⁴ 

¹Essex Business School, University of Essex, Essex, UK

²School of Business, Singapore University of Social Science, Singapore, Singapore

³Huddersfield Business School, University of Huddersfield, Huddersfield, UK

⁴Southampton Business School, University of Southampton, Southampton, SO17 1BJ, UK

Correspondence

Yu Gong, Southampton Business School, University of Southampton, Southampton, SO17 1BJ, UK.

Email: y.gong@soton.ac.uk

Abstract

Many nations have committed to achieving carbon neutrality to combat climate change, but little is known about its drivers at the micro level and implications for firm performance and supply chain management. To address the knowledge gap, this research conducts case studies of seven early movers in the initiative by exploring the key drivers, influential stakeholders and effects of institutional pressures. We find four major drivers: ‘customer enforcement’, ‘sustainable business value’, ‘environmental legitimacy’ and ‘competitive pressures’. Customers and competitors were the most influential external stakeholders. Shareholders and top management with intrinsic environmental values, being internal stakeholders, played pivotal roles in a proactive move to carbon neutrality when there was limited regulatory pressure. The early movers believed in the long-term economic benefits of transitioning to carbon neutrality. We also identify the implications of carbon neutrality initiatives for supply chain management. Based on the research findings, we develop a decision support framework to guide firms in transitioning towards carbon neutrality in a multi-tier supply chain context.

KEYWORDS

carbon neutrality, case study, drivers, multi-tier supply chain, supply chain decarbonisation

1 | INTRODUCTION

Climate change caused by anthropogenic greenhouse gas (GHG) emissions has become one of the most significant challenges for the world in contemporary times. Since 1850, our global average atmospheric concentration of CO₂ has increased from 285 to 415 ppm, resulting in an average surface temperature increase of 1.2°Celsius (Chen, 2021). Due to the severity and urgency of the climate issue, the United Nations considers committing to carbon neutrality by 2050 as the world's most urgent mission (Guterres, 2020).

Businesses have a major and urgent role in the world's mission to achieve decarbonisation (de Sousa Jabbour et al., 2019). The 26th Climate Conference of the Parties (COP26), which concluded in late 2021, reignited the urgency and called upon organisations and supply chains to make joint efforts to mitigate the global climate threats by reducing carbon emissions. To ensure accountability in decarbonisation, COP26 has called for strengthening the ‘integrity of the private sector net-zero plan’ (COP26, 2021, p. 21). These, in effect, highlight the criticality of the firm's commitment to carbon neutrality, which is much more concrete than a commitment to low carbon. The former is

This is an open access article under the terms of the [Creative Commons Attribution](https://creativecommons.org/licenses/by/4.0/) License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited.

© 2022 The Authors. Business Strategy and The Environment published by ERP Environment and John Wiley & Sons Ltd.

clear-cut and concrete, while the latter can be subjective and vague in the definition and measurement of *low-carbon*.

A commitment to carbon neutrality accords organisations with accountability and legitimacy in a sustainable business setting involving relationships with the environment and society. Hence, many leading global organisations have started to plan for carbon neutrality in their operations and supply chains. As of September 2021, 201 leading companies across 26 industries and 21 countries have joined the Climate Pledge (Edmund Bell, 2021). These companies are committed to transitioning towards net-zero carbon in their worldwide businesses and meeting the Paris Agreement 10 years early.

However, organisations that have attempted to minimise GHG emissions often discover that their direct emissions are overshadowed by those generated by their supply chain networks (Plambeck, 2012). On average, supply chain emissions are 5.5 times higher than operational emissions (CDP, 2019). Hence, it has become apparent that firms must take a supply chain approach to engage their suppliers and customers across multiple tiers if carbon neutrality targets are to be met (Gong et al., 2018).

The recent review of de Sousa Jabbour et al. (2019) shows that ample studies have investigated low-carbon production and operations. However, research on the emergent carbon neutrality concept is still nascent. The limited extant research on carbon neutrality mainly employs a macro perspective, discussing and elaborating global, regional and national initiatives, focusing on policy and technological aspects (Chen et al., 2022; Zhang et al., 2021). Moreover, while some scholars have considered what drives firms to adopt proactive environmental strategies (e.g. Jansson et al., 2017; Roy et al., 2001), there is little knowledge in the academic literature on what drives a firm's commitment to carbon neutrality and the implications of such a commitment for firm performance and supply chain management (SCM).

Our research attempts to fill this knowledge gap by addressing the following research questions using empirical data collected from practising managers:

1. What drives a firm's commitment to carbon neutrality among the first movers?
2. How does a commitment to carbon neutrality impact firm performance?
3. What are the implications for SCM when firms transition towards carbon neutrality?

This paper draws upon empirical data from multiple case studies of different geographic regions and economic conditions. We examine seven case companies that are early adopters of the carbon neutrality concept using an integrative theoretical lens that combines stakeholders and institutional theories. Our case analysis consists of in-depth within-case and cross-case analyses to understand the drivers for carbon centrality commitment and implications for firm performance and SCM.

Our study contributes to the literature in several ways. First, we add to the growing literature on corporate responses to climate change (Cadez et al., 2019; Dhanda et al., 2022; Lee, 2012). Second,

to the best of our knowledge, this pioneering work uses multiple case studies to examine the drivers of carbon neutrality commitment integratively with the implications of such a commitment for firm performance and SCM. The research results suggest positive economic performance among the early movers who have embarked on a journey to carbon neutrality. Third, we extend the literature on the link between stakeholder influences and institutional pressures on carbon neutrality commitment, offering insights on how to engender a commitment to carbon neutrality in a multi-tier supply chain.

The remainder of this paper is organised as follows. Section 2 reviews the relevant literature. Section 3 describes the research framework and methodology. Section 4 presents our findings on drivers for a firm's commitment to carbon neutrality and the implications for firm performance and SCM. Section 5 synthesises the findings to develop a decision support framework for engendering carbon neutrality and discusses managerial implications. Section 6 concludes.

2 | LITERATURE REVIEW

As stakeholder influences and institutional pressures play significant roles in sustainability initiatives (Hong et al., 2021; Koh et al., 2013), we integrate two theoretical lenses—*stakeholder theory* (Freeman & Reed, 1983) and *institutional theory* (DiMaggio & Powell, 1983) to guide our research.

2.1 | Stakeholder theory and carbon emissions

Stakeholder theory refers to the reciprocal relationships between firms and their various stakeholders. It posits that firms can achieve business success by considering stakeholders' interests (Donaldson & Preston, 1995). Freeman (1984) defines a stakeholder as any group or individual who can affect or is affected by achieving the organisation's objectives. Primary stakeholders include organisations, employees, customers/consumers, suppliers, competitors, governments, communities, activist groups and trade associations (Donaldson & Preston, 1995; Jawahar & McLaughlin, 2001).

Stakeholder theory has been used in numerous environmental and sustainability studies (Ching & Gerab, 2017; Hörisch et al., 2014; Miles, 2019). It has been widely acknowledged that stakeholder pressures instigate a sense of urgency for firms to go beyond increasing carbon transparency to adopting more substantive carbon abatement measures (Pinkse & Busch, 2013). Pålsson and Kovács (2014) find out that stakeholder pressures set expectations on the minimum emissions reductions in freight transport in an industry or a country. Cadez et al. (2019) suggest that stakeholder pressures, including those from the market and the regulatory bodies, influence the emissions reduction strategies of GHG-intensive firms, which in turn affect their GHG-related performance. Dhanda et al. (2022) confirm that firms employ carbon mitigation strategies to address climate change-related risks and opportunities in response to various stakeholder pressures.

Several studies differentiate sources of stakeholder pressures and their varying effects. For example, Sprengel and Busch (2011) conduct a global survey across eight GHG emission-intensive industries. They establish four corporate response strategies ranging from passive (minimalists) to total environmental quality (emission avoiders). They find that managers respond to stakeholders' GHG reduction pressures but do not differentiate sources of stakeholder pressures when it comes to their strategic response to carbon management. Yunus et al. (2020) examines whether the perceived pressures from stakeholders with a high potential to cooperate and/or threaten the firm's survival affect the decision to adopt carbon management strategies. Therefore, firms are likely to commit to carbon neutrality when the pressures from stakeholders are perceived to be influential. However, whether firms respond to stakeholders' pressures by making concrete moves to carbon neutrality and what specific stakeholders are more influential in such regard is little understood. We attempt to fill this knowledge gap by identifying stakeholders with high potential to influence firms towards carbon neutrality commitment.

2.2 | Institutional theory and carbon emissions

The institutional theory explains how various institutional pressures exerted by different stakeholders could drive a firm's behaviour (DiMaggio & Powell, 1983). Delmas and Toffel (2004) state that stakeholders such as governments, regulators, customers, competitors and industry associations impose different pressures on firms. These pressures can be perceived as coercive, normative and mimetic, collectively known as isomorphic forces. These pressures were found to positively influence sustainability strategies and carbon abatement measures (Chithambo et al., 2020; Haque & Ntim, 2020). In the context of climate-related risks, firms respond to institutional pressures to reduce emissions due to legitimacy (symbolic)- and efficiency (economic)-oriented motives (DiMaggio & Powell, 1983; Haque & Ntim, 2022).

2.2.1 | Coercive pressure

External stakeholders, such as government authorities and big clients, exert coercive pressure on businesses, forcing them to comply with various environmental rules and principles (Roxas & Coetzer, 2012). For example, regulatory bodies and big brands may exert coercive pressure on suppliers to abide by green measures (Berrone et al., 2013). In fighting climate change, growing regulatory pressure has contributed to firms' emissions reduction initiatives (Lewandowski, 2017). Dhanda et al. (2022) suggest coercive pressure is usually more effective than other institutional pressures for adopting mitigation strategies to reduce carbon emissions.

A proactive approach to dealing with coercive pressure may allow businesses to develop competitive advantages. In a coercive context, proactive firms are more likely to explore new business opportunities by rapidly reconciling the relationships with internal stakeholders

(employees) and external stakeholders (policymakers, clients and vendors) to reach a common objective (Buysse & Verbeke, 2003). For instance, proactive firms could perceive carbon neutrality as helpful to developing a company's social reputation as there is increasing urgency to achieve carbon neutrality in society. Thus, a proactive business is more likely to capture a new environment-conscious consumers/customers market and reduce business risks.

2.2.2 | Normative pressure

Normative pressure stems from shared beliefs in business and social norms (DiMaggio & Powell, 1983). Normative pressures from entities such as professional associations and academic facilities justify the types of activities deemed 'normal' for various organisations. Voluntary emissions data disclosure is one example. Vendors, clients, trade unions, the media and other social actors exert normative pressure (DiMaggio & Powell, 1983).

Normative pressures from diverse stakeholders could generate urgent concerns for businesses to move beyond merely improving carbon awareness to implement more meaningful carbon-reduction strategies (Sprengel & Busch, 2011). It may not be favourable to a corporation's reputation if it does not respond to customer opinions and opposes public sector unions (Roxas & Coetzer, 2012). However, normative pressures are often less effective than coercive pressures (Dhanda et al., 2022). In transitioning to carbon neutrality, firms can attempt to control public sentiment by adopting a strategy that lays out detailed plans to achieve carbon neutrality at the firm and supply chain level.

2.2.3 | Mimetic pressure

Instead of analysing the pros and cons, a firm may imitate the practices of early adopters within their industries to reduce uncertainty (DiMaggio & Powell, 1983). Studies have shown how peer pressure is used to shape attitudes, behaviours and viewpoints of firms within the same industry as competitive responses (Klassen & Vachon, 2003), for sustainability reporting (Kolk, 2010), and adoption of sustainability practices (Okhmatovskiy & David, 2012). Firms respond to such pressure from their stakeholders to prevent peers within the same industry from gaining a competitive advantage.

In the carbon neutrality context, a firm might be concerned that its slow response to such a new initiative may give its competitors an advantage of capturing new markets and business opportunities (DiMaggio & Powell, 1983). If more peers embrace carbon neutrality, a firm could be pressured to mimic its peers and join in a similar cause because it faces uncertainty about emerging sustainability practices. Moreover, a supplier may foresee that its customers can readily compare its emissions performance with its peers, potentially making the firm vulnerable to competition. If an industry is transitioning to carbon neutrality, a supplier firm could be compelled to join carbon neutrality efforts for survival.

2.3 | Implications of emissions reductions for firm performance and SCM

Firms could achieve competitive advantages from new climate change-related business opportunities by introducing corporate measures to mitigate climate risk (Agrawala et al., 2011; Eleftheriadis & Anagnostopoulou, 2017). Research shows firms with a high commitment to climate change initiatives and elaborate environmental management systems garner a positive reputation and better credit ratings (Dahlström et al., 2003; Lemma et al., 2021). Though the literature on firm environmental performance has been increasing (Bhattacharyya & Cummings, 2015), more specific attention needs to be given to the under-research areas regarding the conditions for GHG emission reduction in companies (Boiral et al., 2012). Jacobs et al. (2010) suggest that investors are pessimistic about the financial performance outcomes of emissions reduction initiatives, which may discourage businesses from investing in emissions reductions. However, Lewandowski (2017) reports a significantly positive relationship between emission reductions and return on sales. Nevertheless, firms have been slow to reduce emissions beyond efficiency improvements from picking 'low-hanging fruits'. These contradictory findings demand further investigations on the implications of transitioning to carbon neutrality for firm performance, which may be a key determinant of a firm's commitment.

As issues concerning sustainable growth affect every firm in a supply chain, it is also necessary to examine the implications of a firm's carbon neutrality commitment for SCM. Firms should consider their direct emissions as well as those of their suppliers (both direct and lower-tier suppliers) and customers to mitigate carbon emissions by sharing information, providing incentives or direct assistance (Plambeck, 2012). The emissions from direct operations in some industries may be low, but they can be multiplied by 10 times by their suppliers (Bataille et al., 2016). As carbon footprint rises significantly in a supply chain, decarbonisation in a multi-tier supply chain has been recognised as one of the most critical practices that require adoption (Bataille et al., 2016; Labanca et al., 2020).

Researchers have called for firms to play a leadership role within the supply chain regarding carbon emission mitigation (Jia

et al., 2019). Further, scholars are increasingly looking at supply chain learning and supply chain leadership's role in supporting corporate sustainability initiatives in their business processes (Gong et al., 2018; Jia et al., 2019). In addition, studies concurred that various emerging technology solutions are essential in firms' attempts to eliminate GHG emissions (Quarton & Samsatli, 2021; Tasleem et al., 2019). Beyond the firm level, technological innovations are crucial in enhancing visibility in supply chains and achieving sustainable growth (Choi et al., 2021).

To summarise, literature has shown the relevance of both stakeholder theory and institutional theory for explaining why a firm embraces sustainability initiatives, including emissions reduction. However, the extant literature does not offer insights into the specific drivers behind a firm's commitment to carbon neutrality, a relatively new phenomenon. It is also unclear what implications for firm performance and SCM may arise from a commitment and transition to carbon neutrality. This paper is an initial step to addressing this knowledge gap by studying multiple early movers from the lens of stakeholder and institutional theories.

3 | RESEARCH FRAMEWORK AND METHODOLOGY

Figure 1 depicts the research framework that integrates the stakeholder theory and institutional theory to account for external and internal drivers for a firm's commitment to carbon neutrality. In the framework, all stakeholders are categorised as either external or internal. The external stakeholders exert institutional pressures, including coercive pressure, normative pressure and mimetic pressure. The internal stakeholders may be motivated to transit to carbon neutrality due to an intrinsic sustainable business value or a belief in potential benefits. Apart from studying the drivers, this research also investigates the implications of a transition to carbon neutrality on firm performance and SCM.

According to the literature review in the preceding section, although ample research exists on emissions reductions, the concept of carbon neutrality is relatively new, so empirical research is still very

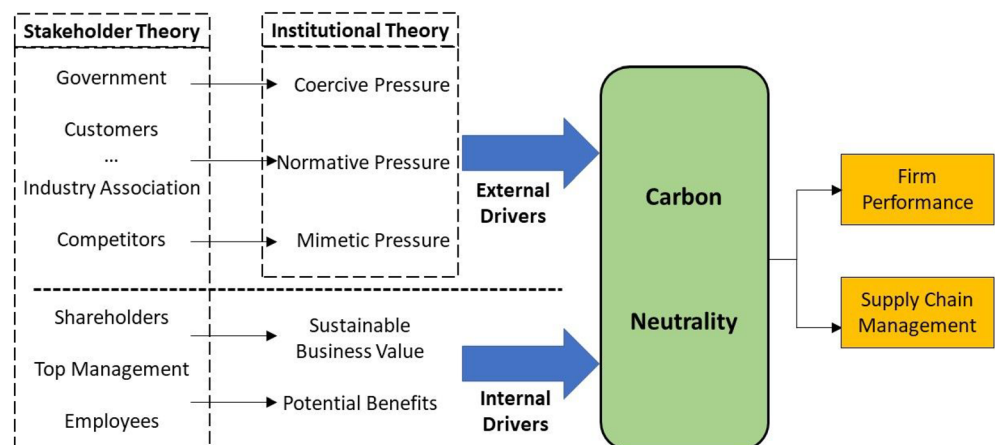


FIGURE 1 Research framework

limited on this emerging topic. A qualitative research design is chosen because it is a good fit for exploring new concepts and emerging research phenomena. Specifically, this study applies a case study method with an exploratory purpose. The case study method fits our descriptive and explanatory research questions (Yin, 2013). It is suitable to explore the drivers for carbon neutrality and the relationship with firm performance. More importantly, the case study approach allow us to explore the multi-tier supply chain perspective that is commonly complex and entangled.

We use multiple cases to gain insights into the effect of varying contexts, for example, different industry sectors, host countries at different economic development stages and others. We employ an abductive approach to theory development that integrates induction (generalising findings from novel aspects and new insights in data) and deduction (conceptualising a framework through the lenses of stakeholder and institutional theories) approaches (Dubois & Gadde, 2002; Kovács & Spens, 2005).

We employed a purposive sampling approach in selecting case firms (Yin, 2013). The inclusion criteria include: firms need to have made commitments and taken actions on carbon neutrality at a supply chain level; they are willing to take part in our research; they need to come from multiple economic backgrounds and industry sectors. We first searched online to identify firms that have committed to carbon neutrality. We then approached their senior managers, who had an in-

depth understanding of SCM and carbon neutrality initiatives to ensure data validity. We recruited case firms in the United Kingdom, Bulgaria, and Pakistan, which were at different economic development stages. The case firms were from various industry sectors, enabling us to analyse their contextual effects. We continued to recruit case firms until we observed theoretical saturation, which happened after the sixth and seventh cases because their data provided little new knowledge.

Primary data collection was done by a semi-structured interview approach as it balances focus and flexibility in interview conversations (Eisenhardt, 1989). The interview questions are provided in Appendix A. All interviews were conducted in July and August 2021 online via Zoom due to the COVID-19 pandemic. Table 1 outlines the profiles of case firms and interviewees and data sources. The interviewees had an average of 7.2 years of experience in sustainability initiatives. We followed Tracy (2010) to triangulate interview data with multiple secondary data sources.

We attempted to recruit multiple interviewees from all firms but did not succeed. This is partly because we required that an interviewee must be a senior manager who had in-depth knowledge of sustainability projects and SCM; such a candidate often had limited availability. However, we managed to interview an external consultant who advised Company A on their carbon neutrality initiatives and conducted four interviews with Company D. For both Companies A

TABLE 1 Profile of case companies, interviewees and data sources

Firm	Country	Industry sector and business activities	Number of employees	Number of interviews	Interviewee designation and years of experiences	Data sources
A	UK	Logistics and transport (international logistics, courier and package delivery)	12,000-13,000	2	UK International Freight Manager (15) Managing Director of a consultancy firm (10)	Interviews and company website
B	UK	Logistics and transport (freight exchange services)	50-100	1	Sales and Marketing Manager (4)	Interview and company website
C	Bulgaria	Packaging (imports and distributes sustainable and compostable food packaging)	50-100	1	Managing Director (5)	Interview and archive files
D	Pakistan	Textile (manufacture and export textile and garments)	5000-6000	4	Manager Project and Compliance (8) Senior Deputy Manager Utility (8) Sustainable Technical Manager (4) Administrative MTO in Waste Management (2)	Interviews, company website and archive files
E	Pakistan	Food and beverages (franchisee manufacturer of a multinational brand)	4000-5000	1	General Manager Supply Chain and Operations (8)	Interview and company website
F	Pakistan	Packaging (manufacture and sales to domestic and overseas markets)	700-1000	1	Manager Integrated Management System (5)	Interview, archive files and company website
G	Pakistan	Textile (manufacture textile and garments and sales to domestic and overseas markets)	20,000+	1	Director of Projects and Sustainability (10)	Interview, archive files and company website

and D, our interview data are consistent across different interviewees and agree with other data sources, which gives us confidence in validity and reliability of the whole data set.

Each interview lasted about 60 min on average, ranging between 45 and 90 min. All interviews were recorded and transcribed. The interviewer transcribed the recordings, and two other researchers checked the transcripts. Two researchers read the transcripts multiple times to code all the case data separately and reconciled the differences in coding results. They also consulted several interviewees for clarification when needed to ensure accurate data interpretations.

Following the process outlined by Miles and Huberman (1994), we extracted the most relevant information from the interview data to answer each research question and performed within-case analyses. Our case analyses compared and contrasted the homogeneities and heterogeneities in key stakeholders and drivers for carbon neutrality commitment. We also looked for the different types of institutional pressures driving a commitment to carbon neutrality. Our cross-case analyses revealed the implications for business performance and SCM as firms move towards carbon neutrality.

Table 2 summarises how the research design ensures validity and reliability according to the four tests suggested by Yin (2008).

4 | FINDINGS

4.1 | Drivers for carbon neutrality

Table 3 summarises the drivers for carbon neutrality and the effects of contextual factors. There are four major drivers: customer enforcement (D1), sustainable business value (D2), environmental legitimacy (D3) and competitive pressures (D4). The other two drivers—namely, long-term economic benefits (D5) and regulatory pressures (D6)—are

TABLE 2 Research reliability and validity

Tests	Application in this research
Construct validity	Multiple sources of evidence, including semi-structured interviews and various forms of secondary data A chain of evidence: multiple informants when possible Review of findings by two uninvolved senior academics Interviewees reviewed the transcripts with clarification and feedback
Internal validity	Structured data coding and analysis
External validity	Purposive sampling approach Use replication in multiple case studies
Reliability	Use case study protocol to guide field research and analysis Develop case study database including recordings, transcripts, internal documents and news coverage Iterative discussion among the research team

also present depending on the role of the government and the firms' expectations of long-term economic performance.

4.1.1 | D1 Customer enforcement

This driver is behind six out of seven case firms' commitment to carbon neutrality. Interviewees from different companies surfaced similar concerns, revealing that it would be challenging for them to stay in the market if they do not adhere to environmentally sustainable standards and do not follow the demand of their customers. The interviewee at Company A said,

I can compare it to going back a few years: a customer would ask you whether you are ISO accredited; if you were then you could qualify. If you were not, then you were excluded and asked to leave. That's kind of where it's going with managing the carbon footprint. So, I would say the main driver is customer compliance.

4.1.2 | D2 Sustainable business value

We found an organisation-wide sustainable business value is an important driver, which needs to be established by the top management. Top management is crucial for diffusing and implementing a sustainable business value (Burke et al., 2021). They play a major role in initiating various sustainability strategies and projects to control pollution, reduce resource consumption and reduce emissions. Considering the example of Company E, their main reason for the transition towards carbon neutrality was their top management's sustainable business value. The employees in the organisation worked for carbon neutrality according to the directives of the board of directors. Similarly, the interviewee from Company G shared:

This is no longer an option—Not doing environmentally good things is not an option now. Our CEO is committed. If we do not do it, we cannot exist. Although customer enforcement was also a driver towards carbon neutrality, our main goal was to overcome environmental challenges to achieve carbon neutrality from the inside out

4.1.3 | D3 Environmental legitimacy

In modern society, firms are expected to prove their 'legitimacy' to the stakeholders and the broader society by complying with business and social norms. Our sample firms' certifications and accreditations on carbon reduction (e.g. ISO 14001) were primarily driven by their pursuit of environmental legitimacy. For social credits, they embarked on a journey to carbon neutrality to prove that they are environmentally sustainable. Company B's consultant stated,

TABLE 3 Cross-case analysis of drivers for carbon neutrality

Firm	Main drivers by order of influence	Contextual reasons
A	D1. Customer enforcement D2. Sustainable business value D3. Environmental legitimacy D4. Competitive pressures D5. Long-term economic benefits	There is a high level of awareness on climate issues among clients in the United Kingdom. Company A had to prove its environmental legitimacy by committing to and making progress to achieve carbon neutrality to compete in the B2B market. The corporation had a long-standing commitment to environmental sustainability
B	D2. Sustainable business value D1. Customer enforcement D3. Environmental legitimacy D4. Competitive pressures D5. Long-term economic benefits	Shareholders were keen on sustainable business value. They wanted to prove their legitimacy with customers by getting different environmental accreditations. They were aware of the risk from the market competition if they had not embraced carbon neutrality. They also anticipated the government to start enforcing net-zero legislation at the industry level very soon
C	D2. Sustainable business value D1. Customer enforcement D3. Environmental legitimacy	This start-up was founded by business owners who wanted to make a difference in protecting the environment by transitioning to a circular economy and carbon neutrality. Customer requests for greener packaging had been growing in the country
D	D1. Customer enforcement D4. Competitive pressures D3. Environmental legitimacy D5. Long-term economic benefits	This export business in Pakistan dealt with customers in Europe and America, which led them towards carbon neutrality. Some of its competitors adopted this concept which was pressure to this firm. The top management and shareholders encouraged carbon neutrality-related innovations, which improved business legitimacy and reputation
E	D5. Long-term economic benefits D2. Sustainable business value D3. Environmental legitimacy	Business owners and top management headed towards carbon neutrality mainly because of the potential return on investments (ROI) from the emissions reduction projects. Consumers in the country did not play any role in this transition because they had little awareness. However, the firm was partly influenced by its overseas franchisor, so it aggressively moved to more sustainable business models
F	D2. Sustainable business value D1. Customer enforcement D3. Environmental legitimacy D6. Regulatory pressures D5. Long-term economic benefits	The regulatory bodies in Pakistan pushed firms for environmental protection but not strictly towards carbon neutrality. The main push was from the top management, partly because some overseas customers are concerned about environmental sustainability
G	D2. Sustainable business value D1. Customer enforcement D4. Competitive pressures D5. Long-term economic benefits D3. Environmental legitimacy	Family business owners had solid environmental values, so they quickly embraced carbon neutrality. External enforcement was mainly from overseas customers in Europe and America. Domestic customers were not very aware of the concept. A competitor gained market share after making an aggressive commitment to carbon neutrality by 2030

Their customer base sees it (carbon neutrality) as very important. The people who invest in their company need them to prove their carbon neutral credentials.

4.1.4 | D4 Competitive pressure

In a competitive market, firms are concerned if they cannot offer their customers what their competitors can. A straightforward approach to overcoming such a competitive disadvantage is to imitate what competitors have adopted. This proposition of the institutional theory is observed in our sample firms' carbon neutrality initiatives. Four case companies (A, B, D, G) considered competitive pressures a major driver of their commitment to carbon neutrality. When asked about

whether its main competitors had benefited from a commitment to carbon neutrality, the interviewee from Company G said,

Yes, they have a benefit in terms of gaining market share, and they have declared we are going to be carbon neutral by 2030, for example, ..., they have got good benefits in terms of market attraction.'

4.1.5 | D5 Long-term economic benefits

Although often not a primary driver, 'long-term economic benefits' is a driver to carbon neutrality for most case companies (A, B, D, E, F and G). When asked what drives his firm to commit to carbon

neutrality, a general manager from Company E in Pakistan said without hesitation,

ROI (return on investments), because our customers are not much oriented towards this carbon neutral concept, this does not matter to them at all.

Company E considered carbon neutrality as a pathway towards a more efficient business model, which helped them preserve energy through various sustainability projects, leading to lower operating expenses. However, most sample firms acknowledged short-run financial uncertainties despite their confidence in a good long-term ROI.

4.1.6 | D6 Regulatory pressure

Our sample contains firms across multiple countries where governmental policies regarding GHG emissions vary. In contrast to the United Kingdom, the regulatory pressures towards carbon neutrality in developing countries like Pakistan are much lower. For instance, Company D in Pakistan indicated that the government strengthened regulations and provided incentives to businesses going carbon neutral. However, they are mainly relevant to the export sector. One participant from Company D, a Pakistan textile manufacturer, stated,

The Environmental Protection Agency (EPA) in Pakistan is the regulatory agency in charge of ecologically beneficial initiatives and legislation. They do not have any carbon emission-related rules, but they are working on various initiatives to minimise pollution. For instance, the government is helping to promote electric vehicles to cut pollution. These benefits are mainly for the export businesses, and the government is charging them less tax as well.

It appears that the regulatory pressures in Pakistan were partly driven by the demand of overseas customers in the industrialised economies. To illustrate, in the textile industry, production is primarily outsourced by Western firms to Pakistan manufacturers due to low costs. To secure the export revenue, the Pakistani government (at a macro level) responded to the customer enforcement pressures from the Western firms (at a micro level) to support carbon neutrality commitments by establishing regulatory changes and supportive export tax structure for the textile export businesses.

4.2 | Stakeholder impact and institutional pressures

Table 4 compares the influential stakeholders and institutional pressures for each firm's commitment to carbon neutrality. Overall, the most influential stakeholders are 'Customers', 'Shareholders and top

management' and 'Competitors'. Among the three dimensions of institutional pressures, coercive and normative pressures were very prominent, applicable to almost all the seven case firms, albeit to a varying extent. Generally, normative pressures were higher in the United Kingdom than in Bulgaria and Pakistan. The normative pressures faced by the case firms in Pakistan were mainly from the norms established in overseas markets. The local markets lacked awareness of the importance and urgency of moving to carbon neutrality. Mimetic pressures were perceived as high by Companies D and G and moderate by Companies A and B. The results corroborate our finding in the preceding section that customer enforcement and environmental legitimacy, which are directly linked to coercive and normative pressures, respectively, are the primary external drivers, followed by competitive pressures. Sustainable business value as an influential driver comes from shareholders and top management. Coercive pressures from the government are yet to kick in because all the countries are still at a very early stage of developing or implementing carbon neutrality-related legislation.

4.3 | Implications for firm performance and SCM

Table 5 summarises the implications of carbon neutrality initiatives for firm performance and SCM. The results show a good synergy between long-term economic and environmental performance among the early movers to carbon neutrality. We also synthesise the implications for SCM across all case firms when they embark on a journey to carbon neutrality.

For example, Company A achieved marketing advantages and reaped economic benefits from transitioning to carbon neutrality. The firm's carbon neutrality practices and achievements became an order-winning attribute to its existing and prospective customers. Part of its success lies in a strategic partnership with a carbon-neutral courier specialising in last-mile deliveries. The partnership was a win-win outcome for both parties because it enabled Company A to cut its emissions drastically without making capital investments. At the same time, its partner improved its market share and economy of scale. Company B also has improved economic and environmental performance in transitioning to carbon neutrality. It planned further to create greater supply chain transparency on carbon footprints. The sales and marketing manager from this firm stated,

I think it mainly benefited us on the economic and environmental side by making us more profitable, saving our fuel and money while taking care of the environment. And in the future we are trying to have transparency between all the entities in a supply chain, so everything goes smoothly.

All sample firms invested in decarbonisation, including in various technologies that helped reduce and control their carbon footprints. They had increasingly adopted advanced digital technologies to

TABLE 4 Cross-case analysis of stakeholder impact and institutional pressures

Firm	Key stakeholders by order of influence	CP	MP	NP	Explanation
A	S1. Customers S2. Shareholders and top management S3. Competitors S5. Industry associations	H	M	H	The main pressures were from customers, shareholders, top management and competitors. The UK government has committed to carbon neutrality, but the implementation at the industry level has not started yet. However, industry associations had started their promotion toward carbon neutrality
B	S2. Shareholders and top management S1. Customers S3. Competitors S4. Government	M	M	H	Shareholders and top management were proactive and firmly committed to environmental sustainability. The firm faced pressures from some, but not all, customers and competitors. The UK government had been behind a drive to carbon neutrality, but they had not started to work closely with the industry on the transition yet
C	S2. Shareholders and top management S1. Customers	M	N	M	The founders started the business because of their passion for environmental protection, so they had an intrinsic motivation to move to carbon neutrality. The external pressure they got was from some B2B customers, which were pushed by some environmentally conscious consumers
D	S1. Customers S3. Competitors	H	H	M	Customers and rival companies are the most significant stakeholders that pressurised the firm to move towards carbon neutrality. If the firm did not commit to carbon neutrality, it would have lost its overseas customers. If its competitors did better in sustainability, it would risk losing out in the competition
E	S2. Shareholders and top management S6. Franchisor	N	N	L	Shareholders and top management drove the firm's commitment to carbon neutrality as they believed in good ROI from carbon neutrality projects. The firm learned sustainable business models from its overseas franchisor
F	S2. Shareholders and top management S1. Customers S4. Government	M	N	M	Shareholders and top management were committed to environmental sustainability. The firm served domestic and overseas markets, but only some overseas customers were concerned about emissions. The government had general environmental protection laws, but it did not enforce emissions reductions
G	S2. Shareholders and top management S1. Customers S3. Competitors	H	H	M	Family business owners had strong environmental values. Overseas customers, but not domestic customers, required a commitment to carbon neutrality. Competitors moving towards carbon neutrality had been gaining market share

Abbreviations: CP, coercive pressures; H, high; M, moderate; L, low; MP, mimetic pressures (MP); N, non-existent. NP, normative pressures.

enhance supply chain transparency and collaboration that could allow tracking and reporting of carbon emissions over time (e.g. ESG reporting). A transition to carbon neutrality substantially enforced supply chain digitalisation and thus improved supply chain visibility and integration. This, in turn, helped to enhance operational performance (e.g. flexibility, quality and speed) because of more synchronised supply chain planning and operations. Our sample firms were generally optimistic about investments in decarbonisation and supply chain digitisation. For example, the interviewee from Company E stated,

For the future, I plan to have more projects which can help me save my scope 3 emissions by working on route optimisation of my products from our centres to distributors.

Our data show that focal firms played a crucial role in driving carbon neutrality among all supply chain entities. For instance, Company D produced for major brands like H&M, ZARA and Levi's, among others. These brands were the focal firms in their supply chains, leading the whole supply chain towards carbon neutrality. They created new processes and standards—for example, using innovative methods that use less water for manufacturing clothes, which indirectly emits less carbon. They provided training to Company D on sustainability practices. Company D had to be audited by a third party on its emissions and enforce its suppliers to limit their emissions; otherwise, both Company D and its suppliers will lose business. The major brands not only offered strong supply chain leadership but also supported their manufacturer suppliers and sub-suppliers to facilitate knowledge transfer and learning on carbon neutrality practices. Consequently, Company D achieved cost savings from improved energy efficiency.

TABLE 5 Implications for firm performance and SCM

Firm	Business performance	Supply chain implications
A	This transition towards carbon neutrality has enabled them to continue working with many more customers and has also helped them become a more attractive prospect to potential customers	<ul style="list-style-type: none"> • Investments in decarbonisation • Leadership of a focal firm to lead supply chain players towards carbon neutrality
B	The firm has become efficient by route optimisation through different telematics to reduce fuel costs, which indirectly helps their customers reduce logistics costs, thus attracting more customers	<ul style="list-style-type: none"> • Supply chain collaboration • Supply chain actors learn from each other and other sources on decarbonisation knowledge and practices
C	The start-up had suffered a high product price (70% higher than plastic packaging), so it only had a tiny market share in the country. Moving towards carbon neutrality further increased cost pressure as its products were imported from Asia. However, its customer base was very loyal, and its sales had quadrupled over the 4 years in business	<ul style="list-style-type: none"> • Supply chain digitisation that supports the integration of multi-tier supply chain and enables data management for decarbonisation • Supply chain visibility for emissions disclosures and environmental, social and governance (ESG) reporting
D	Going green has benefited them greatly in terms of increasing sales. Their sustainability projects helped them save energy and gain good ROI	
E	Benefited from a great ROI and generating an outstanding reputation compared to competitors due to environmental legitimacy	
F	They have won many environmental awards, which helped them gain a good reputation in the export market and ultimately led to an increase in sales	
G	GHG emission reductions required investments, but they reaped economic benefits. On the market side, their customers have started trusting them more than their competitors, which has given them more business	

5 | DISCUSSION

Figure 2 presents a framework that encapsulates the findings presented above. The six building blocks at the bottom highlight the required transformation for achieving carbon neutrality in a multi-tier supply chain. Drivers, stakeholder influences and institutional pressures are highlighted at the centre. The top outlines a desired outcome: synergy between long-term economic and environmental performance. The following subsections discuss the key components of the framework.

5.1 | Drivers and performance outcome

We can advance several general propositions on the drivers for carbon neutrality. *First*, among early movers for carbon neutrality, coercive pressures from customer enforcement and normative pressures from environmental legitimacy are the most powerful exogenous drivers, followed by mimetic pressures from competitors. *Second*, the sustainable business value of top management is an influential endogenous driver, followed by long-term economic benefits. *Third*, regulatory pressures were less prominent, particularly in developing countries. There is a general consensus that governments could do more to steer the industry and support businesses in their move towards carbon neutrality, regardless of a firm's industry sector and a host country's economic development stage.

These findings on the drivers support Okereke (2007) on the innate concerns of a firm relating to profit when it seeks to reduce

emissions. It also corroborates de Sousa Jabbour et al. (2019) on the importance of a firm's pursuit of legitimacy, pressures from supply chain stakeholders and the support from the top management for low-carbon operations. However, our findings go beyond the extant literature to reveal which drivers are most significant among the early movers to carbon neutrality—coercive pressures from major customers, normative pressures for legitimacy and top management's sustainable business value.

Our results show that carbon neutrality commitment and initiatives generated positive economic performance among the early movers, which suggests an early mover advantage. This contradicts the results of an early and authoritative event study by Jacobs et al. (2010), which reports negative financial performance associated with voluntary emissions reduction initiatives among publicly listed firms in the United States and Europe. A more recent event study by Jacobs (2014) identifies changing market reactions to voluntary emissions reduction over time. Some other relevant empirical studies report mixed results. The inconsistency between our findings and those of Jacobs et al. (2010) may be due to the differences in the concept investigated (carbon neutrality vs emissions reduction), sampling strategy (non-probability vs probability sampling), research method (case study vs event study) and/or timeframe (2021 vs more than a decade ago). It is also unclear whether firm size affects the results because our sample includes both large and small enterprises, while Jacobs et al. (2010) and Jacobs (2014) only include large firms that are publicly listed. Further studies need to understand the differences in study results and the contingency factors affecting the results.

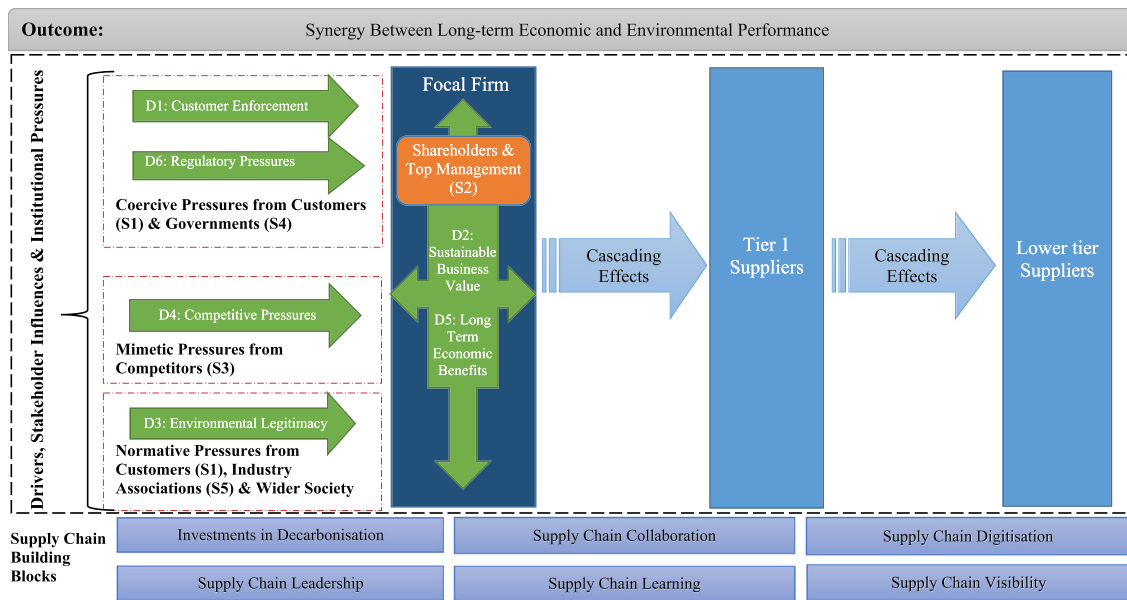


FIGURE 2 A framework for engendering carbon neutrality commitment in a multi-tier supply chain

5.2 | Supply chain implications

A focal firm's *supply chain leadership* is instrumental in the journey to carbon neutrality. This study shows that shareholders' and top management's support and commitment are integral to a firm's transition to carbon neutrality. This finding is consistent with those in the context of other sustainability initiatives (Jabbour et al., 2015; Wang et al., 2022). It underscores the critical role of supply chain leadership (Gong et al., 2021; Jia et al., 2019) because a corporation's average supply chain emissions are 5.5 times more than its operational emissions (CDP, 2019). Our case data provide evidence of focal firms assuming supply chain leadership in enforcing their multi-tier suppliers to move towards carbon neutrality. Such supply chain leadership creates a cascading effect of committing to carbon neutrality in a multi-tier supply chain (Lee et al., 2014).

Supply chain collaboration emerged as a significant implication in our case analyses. This resonates with the call for a collaborative, coordinated and integrated supply chain (Chan et al., 2018; Jaber et al., 2013). Some case firms established long-term strategic partnerships to achieve carbon neutrality. However, the power dynamics in the supply chain may mean that there could be a certain level of pushback when changes and transformations are required in the transition. Pushback and resistance are particularly true when working with mega-vendors. Therefore, it is essential to establish collaborative relationships with value-aligned partners in the supply chain to sustain decarbonisation efforts.

We infer that *supply chain learning* (Gong et al., 2018) is essential and beneficial for achieving carbon neutrality. Our case firms in Pakistan benefited from knowledge transfer from the sustainability departments of their overseas clients. We, therefore, advocate for more focal firms to take on proactive roles in transferring technical knowledge and carbon neutrality standard requirements to their

multi-tier suppliers (Gong et al., 2021; Jia et al., 2019). Given the critical importance of decarbonising the supply chain, businesses need to extend the boundaries of their organisational learning to embrace supply chain learning (Gong et al., 2018). Supply chain learning facilitates and motivates materials suppliers and logistics providers in the supply chain to align their business strategies with the carbon neutrality goal. There is ample room for researchers to explore how to foster effective supply chain learning mechanisms.

A carbon neutrality transition requires substantial *decarbonisation investments*, particularly for firms in emission-intensive industries. Our sample covers the transport and logistics industry, which is emission intensive, and several manufacturing industries with moderate emission intensity. Most sample firms see the heavy upfront investments leading to long-term financial benefits—that is, a synergy between long-term economic and environmental performance. Nevertheless, they were still at an early stage of transitioning to carbon neutrality, although they were among the early movers. Firms often construct an abatement curve that ranks potential carbon neutrality projects in ascending order of cost per ton of abated carbon (Blum et al., 2021). When picking the low-hanging fruit, it is not surprising to see good ROI from carbon neutrality projects; however, deeper emissions reductions may not generate good ROI. Firms should consider various finance options, particularly those that offer favourable terms to sustainability projects, to lower the capital cost (Blum et al., 2021).

Supply chain visibility is a pre-condition for the proper calculation and allocation of GHG emissions in the supply chain. As carbon neutrality is a generic goal achievable by a single organisation, corporate leaders need to consider the overall emissions from the three scopes (Scope 1, Scope 2 and Scope 3 emissions). They need to ensure that these measures align with the business strategy and effectively implement them across the supply chain. The case companies recognise the need to create supply chain visibility so that emissions data

throughout the multiple tiers of the supply chain can be tracked and reported accurately, particularly for Scope 3 emissions data.

All our case companies stressed the importance of *supply chain digitisation*. They perceived advanced technologies as essential enablers for achieving end-to-end digital transparency in the supply chains, from upstream suppliers to consumers. This finding aligns well with the extant literature that established supply chain transparency and enabling technologies as drivers for a firm's sustainability mission (Bai & Sarkis, 2020; Luthra et al., 2020; Saberi et al., 2019). Supply chain data can be used to drive improvement, programmes and investments that support further emission reductions and decarbonisation. Therefore, supply chain digitalisation supports to develop robust governance and emissions reporting structure (Manupati et al., 2020; Saberi et al., 2019).

In the coming years, governments worldwide will likely implement specific laws and regulations related to businesses and supply chains to fulfil their commitment to carbon neutrality. Hence, it is highly likely that coercive pressure will become more influential in both developed and developing economies. We expect more established standards for ESG reporting and emissions disclosure for business ecosystems and supply chains. When that happens, an organisation's carbon neutrality roadmap will likely evolve from an order-winner to an order-qualifier to its downstream customers and consumers.

6 | CONCLUSION

The United Nations considers carbon neutrality by 2050 the world's most urgent mission because of the severity and urgency of the climate issue. Many nations have committed to carbon neutrality by 2050, but limited research has been done at the firm and supply chain levels. Against this backdrop, this study investigates carbon neutrality drivers and their implications for business performance and SCM. It complements the general environmental management and supply chain sustainability literature by providing novel insights into the drivers for carbon neutrality commitment through multiple case studies of early movers.

This research makes several original contributions. *First*, it is believed to be the first study that examines drivers for carbon neutrality and the implications for businesses and multi-tier supply chains. It is also the first to employ an integrative theoretical lens that integrates the stakeholder theory and institutional theory to systematically examine stakeholders' influence and the impact of different institutional pressures. This topic warrants further studies as collective efforts across nations, corporates and individuals are essential to mitigate the threats of climate change.

Second, this study identifies that drivers for carbon neutrality among the early movers are primarily related to coercive pressures from customer enforcement and normative pressures for environmental legitimacy, followed by mimetic pressures from competitors. It reveals that the shareholders' and top management's sustainable business value plays a pivotal role in a commitment to carbon neutrality. They generally believe that transitioning to carbon neutrality will

provide long-term economic benefits. There is also strong evidence that a focal firm's move to carbon neutrality creates a cascading effect in a multi-tier supply chain.

Finally, this study develops a framework to encapsulate the findings and discusses managerial implications. We highlight six building blocks of supply chain decarbonisation: supply chain leadership, supply chain collaboration, supply chain learning, investments in decarbonisation, supply chain visibility and supply chain digitisation.

Despite its original contributions, this study has its limitations. We had a relatively small sample size of 11 participants from the United Kingdom, Pakistan, and Bulgaria with industry and practical expertise in carbon neutrality initiatives. The carbon neutrality goal is nascent; therefore, recruiting participants with sufficient knowledge of the topic proved challenging. Future studies may recruit more participants across a wider range of industries in more countries. The depth of this study is limited because of the breadth that is covered in an exploratory research design. Future research can focus on the identified key drivers to collect more comprehensive data for in-depth investigations. For example, dyad data can be collected from both firms and their customers to understand the role of 'customer enforcement' as one of the most influential drivers of a firm's commitment to carbon neutrality.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

Conceptualisation: A. Zhang and J. Wang. Supervision: A. Zhang. Formal analysis: M. F. Alyi and A. Zhang. Methodology: M. F. Alyi, A. Zhang and Y. Gong. Writing-original draft: A. Zhang and M. F. Alyi. Writing—review and editing: A. Zhang, H. L. Tay, J. Wang and Y. Gong. All authors have read and agreed to the published version of the manuscript.

ORCID

Abraham Zhang  <https://orcid.org/0000-0002-3804-6392>

Huay Ling Tay  <https://orcid.org/0000-0002-2462-3240>

Jason X. Wang  <https://orcid.org/0000-0001-6807-5496>

Yu Gong  <https://orcid.org/0000-0002-5411-376X>

REFERENCES

- Agrawala, S., Carraro, M., Kingsmill, N., Lanzi, E., Mullan, M., & Prudent-Richard, G. (2011). Private sector engagement in adaptation to climate change: Approaches to managing climate risks (no. 30). Paris. OECD. <https://doi.org/10.1787/5kg221jfk1g7-en>
- Bai, C., & Sarkis, J. (2020). A supply chain transparency and sustainability technology appraisal model for blockchain technology. *International Journal of Production Research*, 58(7), 2142–2162. <https://doi.org/10.1080/00207543.2019.1708989>
- Bataille, C., Waisman, H., Colombier, M., Segafredo, L., Williams, J., & Jotzo, F. (2016). The need for national deep decarbonization pathways for effective climate policy. *Climate Policy*, 16(sup1), S7–S26.
- Berrone, P., Fosfuri, A., Gelabert, L., & Gomez-Mejia, L. R. (2013). Necessity as the mother of green inventions: Institutional pressures and environmental innovations. *Strategic Management Journal*, 34(8), 891–909. <https://doi.org/10.1002/smj.2041>

- Bhattacharyya, A., & Cummings, L. (2015). Measuring corporate environmental performance – Stakeholder engagement evaluation. *Business Strategy and the Environment*, 24(5), 309–325. <https://doi.org/10.1002/bse.1819>
- Blum, P., Helmcke, H. S., Heuss, R., Hundertmark, T., Marlier, S., Pinner, D., & Somers, K. (2021). Net zero or bust: Beating the abatement cost curve for growth. McKinsey & Company.
- Boiral, O., Henri, J. F., & Talbot, D. (2012). Modeling the impacts of corporate commitment on climate change. *Business Strategy and the Environment*, 21(8), 495–516. <https://doi.org/10.1002/bse.723>
- Burke, H., Zhang, A., & Wang, J. X. (2021). Integrating product design and supply chain management for a circular economy. *Production Planning and Control*, 1–17. <https://doi.org/10.1080/09537287.2021.1983063>
- Buysse, K., & Verbeke, A. (2003). Proactive environmental strategies: A stakeholder management perspective. *Strategic Management Journal*, 24(5), 453–470. <https://doi.org/10.1002/smj.299>
- Cadez, S., Czerny, A., & Letmathe, P. (2019). Stakeholder pressures and corporate climate change mitigation strategies. *Business Strategy and the Environment*, 28(1), 1–14. <https://doi.org/10.1002/bse.2070>
- CDP. (2019). CDP supply chain report changing the chain. <https://www.cdp.net/en/research/global-reports/changing-the-chain>
- Chan, H., Shen, B., & Cai, Y. (2018). Quick response strategy with cleaner technology in a supply chain: Coordination and win-win situation analysis. *International Journal of Production Research*, 56(10), 3397–3408. <https://doi.org/10.1080/00207543.2016.1278283>
- Chen, J. M. (2021). Carbon neutrality: Toward a sustainable future. *The Innovation*, 2(3), 100127. <https://doi.org/10.1016/j.xinn.2021.100127>
- Chen, L., Msigwa, G., Yang, M., Osman, A. I., Fawzy, S., Rooney, D. W., & Yap, P.-S. (2022). Strategies to achieve a carbon neutral society: A review. *Environmental Chemistry Letters*, 20, 2277–2310. <https://doi.org/10.1007/s10311-022-01435-8>
- Ching, H. Y., & Gerab, F. (2017). Sustainability reports in Brazil through the lens of signaling, legitimacy and stakeholder theories. *Social Responsibility Journal*, 13(1), 95–110. <https://doi.org/10.1108/SRJ-10-2015-0147>
- Chithambo, L., Tingbani, I., Agyapong, G. A., Gyapong, E., & Damoah, I. S. (2020). Corporate voluntary greenhouse gas reporting: Stakeholder pressure and the mediating role of the chief executive officer. *Business Strategy and the Environment*, 29(4), 1666–1683. <https://doi.org/10.1002/bse.2460>
- Choi, T.-M., Kumar, S., Yue, X., & Chan, H.-L. (2021). Disruptive technologies and operations Management in the Industry 4.0 era and beyond. *Production and Operations Management*, 31(1), 9–31. <https://doi.org/10.1111/poms.13622>
- COP26. (2021). COP26: The Glasgow climate pact. UN Climate Change Conference UK 2021, Glasgow, UK. <https://ukcop26.org/wp-content/uploads/2021/11/COP26-Presidency-Outcomes-The-Climat-Pact.pdf>
- Dahlström, K., Howes, C., Leinster, P., & Skea, J. (2003). Environmental management systems and company performance: Assessing the case for extending risk-based regulation. *European Environment*, 13(4), 187–203. <https://doi.org/10.1002/eet.323>
- de Sousa Jabbour, A. B. L., Jabbour, C. J. C., Sarkis, J., Gunasekaran, A., Furlan Matos Alves, M. W., & Ribeiro, D. A. (2019). Decarbonisation of operations management—looking back, moving forward: A review and implications for the production research community. *International Journal of Production Research*, 57(15–16), 4743–4765. <https://doi.org/10.1080/00207543.2017.1421790>
- Delmas, M., & Toffel, M. W. (2004). Stakeholders and environmental management practices: An institutional framework. *Business Strategy and the Environment*, 13(4), 209–222. <https://doi.org/10.1002/bse.409>
- Dhanda, K. K., Sarkis, J., & Dhavale, D. G. (2022). Institutional and stakeholder effects on carbon mitigation strategies. *Business Strategy and the Environment*, 31(3), 782–795. <https://doi.org/10.1002/bse.2917>
- DiMaggio, P. J., & Powell, W. W. (1983). The iron cage revisited: Institutional isomorphism and collective rationality in organisational fields. *American Sociological Review*, 48(2), 147–160. <https://doi.org/10.2307/2095101>
- Donaldson, T., & Preston, L. E. (1995). The stakeholder theory of the corporation: Concepts, evidence, and implications. *Academy of Management Review*, 20(1), 65–91. <https://doi.org/10.5465/amr.1995.9503271992>
- Dubois, A., & Gadde, L. E. (2002). Systematic combining: An abductive approach to case research. *Journal of Business Research*, 55(7), 553–560. [https://doi.org/10.1016/S0148-2963\(00\)00195-8](https://doi.org/10.1016/S0148-2963(00)00195-8)
- Edmund Bell. (2021). Edmund Bell signs The Climate Pledge. <https://www.edmundbell.com/news/news/edmund-bell-signs-the-climate-pledge/#:~:text=As%20of%20September%202021%2C%20The,signatories%20to%20join%20the%20Pledge!>
- Eisenhardt, K. M. (1989). Building theories from case study research. *Academy of Management Review*, 14(4), 532–550.
- Eleftheriadis, I., & Anagnostopoulou, E. (2017). Measuring the level of corporate commitment regarding climate change strategies. *International Journal of Climate Change Strategies and Management*, 9(5), 626–644. <https://doi.org/10.1108/IJCCSM-09-2016-0145>
- Freeman, R. E. (1984). *Strategic management: A stakeholder approach*. Cambridge University Press.
- Freeman, R. E., & Reed, D. L. (1983). Stockholders and stakeholders: A new perspective on corporate governance. *California Management Review*, 25(3), 88–106. <https://doi.org/10.2307/41165018>
- Gong, Y., Jia, F., Brown, S., & Koh, S. C. (2018). Supply chain learning of sustainability in multi-tier supply chains: A resource orchestration perspective. *International Journal of Operations & Production Management*, 38(4), 1061–1090. <https://doi.org/10.1108/IJOPM-05-2017-0306>
- Gong, Y., Jiang, Y., & Jia, F. (2021). Multiple multi-tier sustainable supply chain management: A social system theory perspective. *International Journal of Production Research*, 1–18. <https://doi.org/10.1080/00207543.2021.1930238>
- Guterres, A. (2020). Carbon neutrality by 2050: The world's most urgent mission. <https://www.un.org/sg/en/content/sg/articles/2020-12-11/carbonneutrality-2050-the-world%E2%80%99s-most-urgent-mission>, accessed on 10 January 2022.
- Haque, F., & Ntim, C. G. (2020). Executive compensation, sustainable compensation policy, carbon performance and market value. *British Journal of Management*, 31(3), 525–546. <https://doi.org/10.1111/1467-8551.12395>
- Haque, F., & Ntim, C. G. (2022). Do corporate sustainability initiatives improve corporate carbon performance? Evidence from European firms. *Business Strategy and the Environment*, 1–17. <https://doi.org/10.1002/bse.3078>
- Hong, Z., Zhang, H., Gong, Y., & Yu, Y. (2021). Towards a multi-party interaction framework: State-of-the-art review in sustainable operations management. *International Journal of Production Research*, 60, 2625–2661. <https://doi.org/10.1080/00207543.2021.1894368>
- Hörisch, J., Freeman, R. E., & Schaltegger, S. (2014). Applying stakeholder theory in sustainability management: Links, similarities, dissimilarities, and a conceptual framework. *Organization & Environment*, 27(4), 328–346. <https://doi.org/10.1177/1086026614535786>
- Jabbour, C. J. C., Neto, A. S., Gobbo, J. A. Jr., de Souza Ribeiro, M., & de Sousa Jabbour, A. B. L. (2015). Eco-innovations in more sustainable supply chains for a low-carbon economy: A multiple case study of human critical success factors in Brazilian leading companies. *International Journal of Production Economics*, 164, 245–257. <https://doi.org/10.1016/j.ijpe.2014.11.015>
- Jaber, M. Y., Glock, C. H., & El Saadany, A. M. (2013). Supply chain coordination with emissions reduction incentives. *International Journal of Production Research*, 51(1), 69–82. <https://doi.org/10.1080/00207543.2011.651656>

- Jacobs, B. W. (2014). Shareholder value effects of voluntary emissions reduction. *Production and Operations Management*, 23(11), 1859–1874. <https://doi.org/10.1111/poms.12201>
- Jacobs, B. W., Singhal, V. R., & Subramanian, R. (2010). An empirical investigation of environmental performance and the market value of the firm. *Journal of Operations Management*, 28(5), 430–441. <https://doi.org/10.1016/j.jom.2010.01.001>
- Jansson, J., Nilsson, J., Modig, F., & Hed Vall, G. (2017). Commitment to sustainability in small and medium-sized enterprises: The influence of strategic orientations and management values. *Business Strategy and the Environment*, 26(1), 69–83. <https://doi.org/10.1002/bse.1901>
- Jawahar, I. M., & McLaughlin, G. L. (2001). Toward a descriptive stakeholder theory: An organisational life cycle approach. *The Academy of Management Review*, 26(3), 397–414. <https://doi.org/10.2307/259184>
- Jia, F., Gong, Y., & Brown, S. (2019). Multi-tier sustainable supply chain management: The role of supply chain leadership. *International Journal of Production Economics*, 217, 44–63. <https://doi.org/10.1016/j.ijpe.2018.07.022>
- Klassen, R. D., & Vachon, S. (2003). Collaboration and evaluation in the supply chain: The impact on plant-level environmental investment. *Production and Operations Management*, 12(3), 336–352. <https://doi.org/10.1111/j.1937-5956.2003.tb00207.x>
- Koh, S. L., Genovese, A., Acquaye, A. A., Barratt, P., Rana, N., Kuylenstierna, J., & Gibbs, D. (2013). Decarbonising product supply chains: Design and development of an integrated evidence-based decision support system—the supply chain environmental analysis tool (SCEnAT). *International Journal of Production Research*, 51(7), 2092–2109. <https://doi.org/10.1080/00207543.2012.705042>
- Kolk, A. (2010). Trajectories of sustainability reporting by MNCs. *Journal of World Business*, 45(4), 367–374. <https://doi.org/10.1016/j.jwb.2009.08.001>
- Kovács, G., & Spens, K. M. (2005). Abductive reasoning in logistics research. *International Journal of Physical Distribution and Logistics Management*, 35(2), 132–144. <https://doi.org/10.1108/09600030510590318>
- Labanca, N., Pereira, A. G., Watson, M., Krieger, K., Padovan, D., Watts, L., Moezzi, M., Wallenborn, G., Wright, R., Laes, E., Fath, B. D., Ruzzenenti, F., De Moor, T., Bauwens, T., & Mehta, L. (2020). Transforming innovation for decarbonisation? Insights from combining complex systems and social practice perspectives. *Energy Research & Social Science*, 65, 101452. <https://doi.org/10.1016/j.erss.2020.101452>
- Lee, S.-Y. (2012). Corporate carbon strategies in responding to climate change. *Business Strategy and the Environment*, 21(1), 33–48. <https://doi.org/10.1002/bse.711>
- Lee, S.-Y., Klassen, R. D., Furlan, A., & Vinelli, A. (2014). The green bullwhip effect: Transferring environmental requirements along a supply chain. *International Journal of Production Economics*, 156, 39–51. <https://doi.org/10.1016/j.ijpe.2014.05.010>
- Lemma, T. T., Lulseged, A., & Tavakolifar, M. (2021). Corporate commitment to climate change action, carbon risk exposure, and a firm's debt financing policy. *Business Strategy and the Environment*, 30(8), 3919–3936. <https://doi.org/10.1002/bse.2849>
- Lewandowski, S. (2017). Corporate carbon and financial performance: The role of emission reductions. *Business Strategy and the Environment*, 26(8), 1196–1211. <https://doi.org/10.1002/bse.1978>
- Luthra, S., Kumar, A., Zavadskas, E. K., Mangla, S. K., & Garza-Reyes, J. A. (2020). Industry 4.0 as an enabler of sustainability diffusion in supply chain: An analysis of influential strength of drivers in an emerging economy. *International Journal of Production Research*, 58(5), 1505–1521. <https://doi.org/10.1080/00207543.2019.1660828>
- Manupati, V. K., Schoenherr, T., Ramkumar, M., Wagner, S. M., Pabba, S. K., & Inder Raj Singh, R. (2020). A blockchain-based approach for a multi-echelon sustainable supply chain. *International Journal of Production Research*, 58(7), 2222–2241. <https://doi.org/10.1080/00207543.2019.1683248>
- Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook* (2nd ed.). SAGE.
- Miles, S. (2019). Stakeholder Theory and Accounting. In J. B. Barney, J. S. Harrison, R. E. Freeman, & R. A. Phillips (Eds.), *The Cambridge handbook of stakeholder theory* (pp. 173–188). Cambridge University Press. <https://doi.org/10.1017/9781108123495.011>
- Okereke, C. (2007). An exploration of motivations, drivers and barriers to carbon management: The UK FTSE 100. *European Management Journal*, 25(6), 475–486. <https://doi.org/10.1016/j.emj.2007.08.002>
- Okhmatovskiy, I., & David, R. J. (2012). Setting your own standards: Internal corporate governance codes as a response to institutional pressure. *Organisation Science*, 23(1), 155–176. <https://doi.org/10.1287/orsc.1100.0642>
- Pålsson, H., & Kovács, G. (2014). Reducing transportation emissions: A reaction to stakeholder pressure or a strategy to increase competitive advantage. *International Journal of Physical Distribution and Logistics Management*, 44(4), 283–304. <https://doi.org/10.1108/IJPDLM-09-2012-0293>
- Pinkse, J., & Busch, T. (2013). The emergence of corporate carbon norms: Strategic directions and managerial implications. *Thunderbird International Business Review*, 55(6), 633–645. <https://doi.org/10.1002/tie.21580>
- Plambeck, E. L. (2012). Reducing greenhouse gas emissions through operations and supply chain management. *Energy Economics*, 34, S64–S74. <https://doi.org/10.1016/j.eneco.2012.08.031>
- Quarton, C. J., & Samsatli, S. (2021). How to incentivise hydrogen energy technologies for net zero: Whole-system value chain optimisation of policy scenarios. *Sustainable Production and Consumption*, 27, 1215–1238. <https://doi.org/10.1016/j.spc.2021.02.007>
- Roxas, B., & Coetzer, A. (2012). Institutional environment, managerial attitudes and environmental sustainability orientation of small firms. *Journal of Business Ethics*, 111(4), 461–476. <https://doi.org/10.1007/s10551-012-1211-z>
- Roy, M.-J., Boiral, O., & Lagacé, D. (2001). Environmental commitment and manufacturing excellence: A comparative study within Canadian industry. *Business Strategy and the Environment*, 10(5), 257–268. <https://doi.org/10.1002/bse.304>
- Saberi, S., Kouhizadeh, M., Sarkis, J., & Shen, L. (2019). Blockchain technology and its relationships to sustainable supply chain management. *International Journal of Production Research*, 57(7), 2117–2135. <https://doi.org/10.1080/00207543.2018.1533261>
- Sprengel, D. C., & Busch, T. (2011). Stakeholder engagement and environmental strategy—the case of climate change. *Business Strategy and the Environment*, 20(6), 351–364.
- Tasleem, M., Khan, N., & Nisar, A. (2019). Impact of technology management on corporate sustainability performance: The mediating role of TQM. *International Journal of Quality & Reliability Management*, 36(9), 1574–1599. <https://doi.org/10.1108/IJQR-01-2018-0017>
- Tracy, S. J. (2010). Qualitative quality: Eight ‘big-tent’ criteria for excellent qualitative research. *Qualitative Inquiry*, 16(10), 837–851. <https://doi.org/10.1177/1077800410383121>
- Wang, J. X., Burke, H., & Zhang, A. (2022). Overcoming barriers to circular product design. *International Journal of Production Economics*, 243, 108346. <https://doi.org/10.1016/j.ijpe.2021.108346>
- Yin, R. K. (2008). *Case study research: Design and methods* (4th ed.). Sage.
- Yin, R. K. (2013). Validity and generalisation in future case study evaluations. *Evaluation*, 19(3), 321–332. <https://doi.org/10.1177/1356389013497081>
- Yunus, S., Eljido-Ten, E. O., & Abhayawansa, S. (2020). Impact of stakeholder pressure on the adoption of carbon management strategies: Evidence from Australia. *Sustainability Accounting, Management and Policy Journal*, 11(7), 1189–1212. <https://doi.org/10.1108/SAMPJ-04-2019-0135>

Zhang, Y., Pan, C.-L., & Liao, H.-T. (2021). Carbon neutrality policies and technologies: A scientometric analysis of social science disciplines. *Frontiers in Environmental Science*, 9, 761736. <https://doi.org/10.3389/fenvs.2021.761736>

How to cite this article: Zhang, A., Tay, H. L., Alvi, M. F., Wang, J. X., & Gong, Y. (2023). Carbon neutrality drivers and implications for firm performance and supply chain management. *Business Strategy and the Environment*, 32(4), 1966–1980. <https://doi.org/10.1002/bse.3230>

APPENDIX A.

INTERVIEW QUESTIONS

- Q1: What drives your firm to make a commitment to carbon neutrality or becoming carbon neutral?
- Q2: Which stakeholders (customers, competitors, government, shareholders, employees, etc.) do you consider to be most influential in your firm's commitment to carbon neutrality? And why?
- Q3: For your main competitors who have made a commitment to carbon neutral (or net zero), if any, have they greatly benefited from or been favourably perceived by their suppliers and customers, and others in the same industry?
- Q4: Do the government, your major customers and industry associations require your firm to make a commitment to becoming carbon neutral?
- Q5: Has your firm being influenced by your suppliers' and customers' commitment, if any, to becoming carbon neutral? How about the promotion of carbon neutrality by the government and the industry and professional associations? To what extent is the influence if your firm has been influenced?
- Q6: To what extent is your firm's commitment to carbon neutrality being influenced by the key decision makers' environmental values and beliefs? Can you please explain how it exerts an impact?
- Q7: What business opportunities does your firm believe in, or have already benefited from, by going carbon neutral?
- Q8: How has your journey to carbon neutrality impacted on your firm and supply chain performance considering all three dimensions of economic, environmental and social sustainability? What changes did you make or plan to make in your internal operations as well in your supply chain operations for achieving carbon neutrality?