

**Global value chains, trade facilitation, and the use of environmental management
practices in SMEs**

Udish Ranasinghe
University of East Anglia
Norwich Business School, United Kingdom
OrcidID: 0000-0002-2873-639X

Sean Ennis
University of East Anglia
Norwich Business School, United Kingdom
OrcidID: 0000-0002-4330-1386

Januario Monteiro
University of East Anglia
Norwich Business School, United Kingdom
OrcidID: 0000-0002-7000-4256

Ricardo Malagueño¹
University of Essex
Essex Business School, United Kingdom
OrcidID: 0000-0002-1481-6487

¹ Corresponding author: rmalag@essex.ac.uk

Acknowledgements: The corresponding author acknowledges support from the project PID2022-139974NB-I00 funded by MICIU/AEI/ 10.13039/501100011033 and by ERDF/EU.

Global value chains, trade facilitation, and the use of environmental management practices in SMEs

Abstract

Purpose: This study investigates the relationship between small and medium enterprises (SMEs) participation in global value chains (GVCs) and the use of environmental management practices. The study examines the role of national governments in shaping this relationship, specifically exploring the role of trade facilitation. The emphasis lies on understanding the extent to which GVCs and governmental policy interaction relate to improved environmental management practices among SMEs.

Design/methodology/approach: The study builds on several publicly available data sources, including the World Bank's Archival Enterprise Surveys and the OECD Trade Facilitation Indicator. The sample includes 1,462 SMEs in 18 countries. To test our hypotheses, we use regression analysis employing bootstrapping techniques for rigorous testing of direct and indirect associations.

Findings: Results indicate that SMEs tend to use environmental management practices when entering GVCs, but not after exiting. Moreover, the study suggests that a non-linear feature of trade facilitation plays an important role in mitigating the relationship between SMEs exit from GVCs and SMEs abandonment of environmental management practices.

Originality: The relationship between SMEs entering and exiting GVCs and environmental management practices is not well understood. It is still unclear whether the external pressures and governmental policies to stimulate trade contribute to improving the sustainability behaviour of SMEs. This study adds to the operations management literature by relating government policies with the use of environmental management practices, providing insights on the relationship between deglobalisation and SMEs sustainability activities.

Keywords: global value chains, exit and entry, small and medium enterprises, sustainability, environmental management practices, trade facilitation, globalisation

1. Introduction

Evidence indicates that the use of environmental management practices designed to minimise the environmental impact of company operations has grown significantly over the past decades (Hsu *et al.*, 2013; Adebajo *et al.*, 2016; El Baz and Laguir, 2017). Participation in global value chains (GVCs) and the influence of regulation have been recognised as major factors driving the use of environmental management practices by small and medium-sized enterprises (SMEs) (Rentizelas *et al.*, 2020; Marttinen and Kähkönen, 2022). [1] Yet, despite extensive research in this area, evidence remains limited concerning the dynamics of SMEs' entry and exit from GVCs, the use of environmental management practices, and the broader impact of socio-political forces (Wahga *et al.*, 2017; Arora and De, 2020; Marttinen and Kähkönen, 2022). For instance, it is still unclear whether firms exiting GVCs would abandon or retain the environmental management practices that were implemented when those firms first engaged in GVCs. SMEs might find compelling reasons for either option regardless of their initial investment or immediate cost-cutting pressures associated with global value chain (GVC) exit.

A greater understanding of the factors that are associated with the environmental management practices of SMEs is important, as estimates suggest that SMEs constitute around 90% of global businesses, account for approximately 40% of gross domestic product in emerging economies (Adian *et al.*, 2020) and contribute to roughly 70% of global pollution (Bakos *et al.*, 2020). This motivates us to examine the relationship between SMEs entering and exiting GVCs and their use of environmental management practices. Given the wide-ranging government policies implemented to facilitate SMEs' operations within GVCs (Mann, 2012; González and Sorescu, 2019), we contend that trade facilitation policies could shape the relationship between SMEs entering and exiting GVCs and their use of environmental management practices. In favourable trade environments, SMEs may value maintaining or increasing their use of environmental practices due to trade-supporting policies and the likelihood of returning to the GVCs in the future. The 'environmental management option value' may play a crucial role in mitigating the otherwise substantial incentives for SMEs to reduce investments in management practices that are not mandated by the state. Hence, we focus on answering the following two questions: a) What is the relationship between SMEs participation in GVCs and the use of environmental management practices? and b) To what extent does national trade facilitation shape the environmental practices of SMEs within the broader context of GVCs?

Drawing on the operations management, environmental and international business literature, we examine the relationship between GVCs and the use of environmental management practices by SMEs. In our research, we consider GVCs as a multi-dimensional form of business relationships in which production, sales and support activities for individual goods are fragmented and distributed between sites (Zhang and Gregory, 2011; Dollar *et al.*, 2016) that are contractually linked. In the context of ongoing discussions surrounding the effects of increasing nationalism, trade restrictions on globalisation, and reshoring manufacturing activities on supply chain management (Fan *et al.*, 2022), concerns arise about the sustainability practices of SMEs' after their disengagement from GVCs. SMEs are often criticised for their lack of robust performance measures to monitor and manage the environmental impact of their activities (Malesios *et al.*, 2020). Consequently, there has been increased pressure for SMEs to implement practices that could lead to rational use of natural resources and address challenges regarding climate change (Sobir, 2020).

Our results are obtained from a sample of 1,462 SMEs across 18 countries and suggest that SMEs use environmental management practices when entering GVCs, but the majority of them do not retain these practices upon GVC exit. Additionally, we find that the negative sustainability impact of SMEs exiting GVCs is less pronounced when government trade facilitation policies provide clear signals regarding their support, or lack thereof, for future SME engagement in GVCs. We hypothesise that, although most SMEs exiting GVCs abandon environmental practices, those in countries with either low or high levels of trade facilitation have greater option value in maintaining these practices.

Our study contributes to the intersection of operations management and GVC literature. First, we add to the literature on the adoption and use of environmental management practices in SMEs (Adebanjo *et al.*, 2016; Song *et al.*, 2022). The study reinforces the importance of supply chains in explaining the use of environmental management practices (Hsu *et al.*, 2013) and sheds light on the abandonment of those practices. Hence, this research contributes to prior operations management literature by illustrating how environmental management practices cascade down supply chains and influence firms' operational choices (Marttinen and Kähkönen, 2022). In contrast to studies suggesting that environmental management practices and host-country institutional conditions drive firms' internationalization (e.g., Ko *et al.*, 2021; Pek *et al.*, 2018; Rivera & Oh, 2013), our arguments align with perspectives indicating that firms' entry and exit in GVCs encourage the development of their environmental capabilities (Attig *et al.*, 2016). In this regard, our analysis provides further evidence to deepen the understanding of a relationship that has not been extensively studied from a global (i.e., multi-

country) perspective (Hardcopf *et al.*, 2019; Koberg and Longoni, 2019). Scholars have emphasised the importance of operations management research to adopt a global perspective (Micheli *et al.*, 2021). While single-country studies can effectively identify and characterise emerging industrial phenomena and illustrate their influences in unique contexts, they lack the wider generalisability of capturing the differences that exist across the many regions and countries involved in GVCs (Özatağan, 2010; Dahlman *et al.*, 2023).

Second, our research contributes to studies examining how national institutional environments shape the use of environmental management practices (Yang *et al.*, 2019; Fan *et al.*, 2020; Johnstone and Hallberg, 2020; Gölgeci *et al.*, 2021). Our research reconciles streams of literature indicating that environmental practices are mostly beneficial for firms operating in countries with weak institutions (Marano, 2017) and studies indicating that sustainable practices are most valuable in contexts with strong institutions (Attig, 2016; Arora and De 2020). Our results suggest that trade facilitation moderates SMEs use of environmental practices, particularly for SMEs exiting GVCs. In this regard, we introduce the concept of environmental management option value to explain this behaviour. We show that in the context of low and high trade facilitation, SMEs maintain environmental management practices after exiting a GVC. We argue that SMEs follow those behaviours as means of counteracting institutional constraints or to better position themselves in securing future involvement in GVCs. Our study, emphasises the importance of comprehensive implementation of trade facilitation policies, demonstrating that they play a critical role in shaping the use of environmentally conscious practices.

2. Theoretical background

2.1 Global value chains and environmental sustainability

Prior studies have acknowledged the powerful influence of GVCs as drivers of the environmental behaviour of SMEs (Mollenkopf *et al.*, 2010; Hsu *et al.*, 2013; Marttinen and Kähkönen, 2022). A theoretical argument that supports such findings is found in the pollution halo hypothesis, which suggests that the large and powerful firms in GVCs transfer their greener technologies such as pollution abatement technologies, renewable energy-related technologies, and energy-conserving technologies to GVCs' participants (Duan and Jiang, 2021). Hence, GVCs improve the environmental management practices of participating firms (Siewers *et al.*, 2024). The proponents of this view suggest that environmental management

practices of firms improve with GVC participation due to GVC partners designing or modifying production practices to reduce the environmental impact of business operations along the value chain (Gölgeci *et al.*, 2021). Such changes are enabled through the networks created by systems of GVC governance, which link various firms together in sourcing and contracting arrangements. Therefore, for a company to secure entry to and remain in a GVC, adherence to the established standards within these arrangements is imperative (Wahga *et al.*, 2017). If the pollution halo hypothesis is supported, SMEs may find themselves compelled to adhere quickly to specific environmental standards and regulations to actively participate in GVCs. As research suggests, such compliance is deemed valuable for elevating their position within the GVC, driven by the imperative to enhance embeddedness, or influenced by the power dynamics exerted by partners (Arora and De, 2020; Johnstone and Hallberg, 2020; Soontornthum *et al.*, 2020).

Although most of the relevant studies in operations management research suggest GVCs are particularly important drivers of environmental management practices in SMEs (Gölgeci *et al.*, 2021; Marttinen and Kähkönen, 2022), this view could be challenged by evidence referring to the pollution haven hypotheses, which suggests that firms relocate their polluting activities to countries with lenient environmental and foreign policies (Duan and Jiang, 2021). This stream of literature illustrates that GVCs give rise to environmental sustainability challenges such as exporting pollution, increasing greenhouse gas emissions, and biodiversity degradation (Duan and Jiang, 2021). Ben-David *et al.* (2021) exemplify the pollution haven hypothesis by showing how large and powerful companies in GVCs shift pollution to countries with vulnerable institutional environments. This pattern is evident in countries characterised by lenient foreign policies, that attract polluting firms, to relocate their GVC activities. From this perspective, GVCs might create an environment where SMEs encounter increasing pressures to cut costs and improve competitiveness, potentially incentivising them to compromise on environmental standards and, consequently, undermining their pro-environmental behaviour.

Evidence exists for both pollution halo and haven hypotheses. Which one predominates is a pivotal question for policymakers, multilateral organisations, environmentalists, and industry stakeholders alike. As nations navigate the current complexities of international relations, face post-pandemic global recession, and re-evaluate their position on frictionless trade (Fan *et al.*, 2022), it becomes imperative to understand the relationship between firms entering and exiting GVCs, trade policies, and their association with environmental outcomes. Our analysis informs these relationships.

2.2 Trade facilitation as a socio-political factor

Throughout history, socio-political forces have played roles in the formation and reconfiguration of global trade flows between countries. National governments have actively shaped this dynamic through their varied political agenda and strategic deployment of policy instruments (Fan *et al.*, 2022). For instance, BREXIT spurred the relocation of GVC activities from the United Kingdom to continental Europe (Moradlou *et al.*, 2021). More recently, the Russia-Ukraine war and its associated trade restrictions led firms to rethink and reconfigure their supply chain links with Russia and the conflict zone (Srai *et al.*, 2023). On the other hand, policy instruments directed at improving the national trade environment and cooperation between regions enhanced international trade, resulting in better macroeconomic and social outcomes (Mann, 2012). Countries implementing reforms to enhance their national trade environment can expect positive outcomes, including a rise in foreign direct investment flows, enhanced firm productivity, and a reduction in poverty levels (Portugal-Perez and Wilson, 2012). In policy forums, improving trade facilitation in national contexts has been in the spotlight as a *prima facie* option to achieve such outcomes (González and Sorescu, 2019). Since the World Trade Organisation (WTO) Trade Facilitation Agreement (TFA) came into force in 2017 countries at all levels of development are making progress in facilitating trade (World Trade Organisation, 2024).

Trade facilitation can be broadly defined as a set of policies aimed at reducing direct and indirect export and import costs (Portugal-Perez and Wilson, 2012). Enhanced trade facilitation allows swift clearance at the borders (Fontagné *et al.*, 2020). This means that improved trade facilitation allows companies to receive inputs (intermediate goods) when needed and respond faster to the demands of buyers, thus introducing greater flexibility into their production and exports. In this paper, we adopt Mann's (2012) view of trade facilitation which encompasses a broad spectrum of policies aimed at streamlining international trade and thus driving more efficient and effective GVCs. It spans traditional measures such as improving port efficiency and modern elements such as technology networks and adherence to global standards. This concept addresses both the border and behind-the-border factors, including improving infrastructure and institutional efficiency enhancements. [2]

In the context of environmental sustainability, there is inconclusive evidence on whether improved trade facilitation at the national level enhances environmental outcomes. Whereas some studies suggest that improved trade facilitation aligns with positive

environmental outcomes (Dou *et al.*, 2021), supporting the pollution halo hypothesis, others indicate a detrimental impact (Le *et al.*, 2016), endorsing the pollution haven hypothesis.

Furthermore, improved trade facilitation fosters inclusivity in trade by creating a more equitable playing field that empowers SMEs to respond more effectively and efficiently to the demands of international trade. As González and Sorescu (2019) suggest, this is achieved through policy improvements that reduce both fixed costs and variable costs of engaging in trade. Their research highlights that despite significant reductions in trade costs driven by growing digital connectivity, the shipping of goods across borders still involves considerable to-the-border, at-the-border, and beyond-the-border costs. At the border, firms engaged in trade are required to present the necessary documentation, comply with customs and other border agencies' procedures, and be subject to clearance and inspection processes. This range of procedures can be both product- and destination-specific, increasing costs in terms of time and uncertainty of delivery. These costs can be particularly burdensome for SMEs, which lack specialised personnel and resources to deal with such aspects and who may only ship infrequently or in small batches. Hence, trade facilitation reforms not only aim to enhance efficiency for firms of all sizes but also promote more inclusive outcomes by helping to level the playing field between large and small firms.

Despite the intentions of national governments to support firms' operations through trade facilitation, such measures can introduce challenges for SMEs. While trade facilitation policies aim to streamline customs procedures, improve trade infrastructure efficiency, and enhance coordination and cooperation among firms, partners and government agencies, they may also intensify competition (Hansen-Addy *et al.*, 2024). Unlike their larger counterparts, SMEs lack the capacity and leverage to effectively compete with foreign counterparts, which hinders their overall performance. Therefore, arguments exist that intense competition emerging from trade facilitation, rather than uplifting national development, might result in the deterioration of the trade balance (Hoekman and Shepherd, 2015) generating socio-political issues such as unemployment, poverty, and hardships. Hence, the expected benefits of trade facilitation may not unfold as linearly as initially presumed, raising concerns among certain SMEs (Hansen-Addy *et al.*, 2024).

3. Hypotheses development

3.1 SMEs entering GVCs and environmental practices

Operating under resource constraints, SMEs are generally specialised business entities that concentrate their resources on a narrow set of value-adding activities within GVCs (Soontornthum *et al.*, 2020). SMEs that are part of GVCs often form exchange relationships with upstream and downstream partners (Wahga *et al.*, 2017). Research suggests that for SMEs operating within GVCs, implementing and adhering to environmental management practices may help them establish these relationships, contributing to long-term trading partnerships (Lund-Thomsen and Lindgreen, 2014). This argument assumes that firms progressively deepen their commitment to relationships, transforming the nature of their exchange interactions from distant transactions to a more adaptive and trusting partnership (Soontornthum *et al.*, 2020). In scenarios as such, where SMEs have entered GVCs, SMEs possess the option – the capacity without the obligation – to choose whether to engage in activities, such as the use of environmental management practices (Figge, 2005). This concept, known as option value, offers flexibility by granting SMEs the ability to prove their capability to enter contracts with sustainability requirements, thus adding value to engaging in these activities. Given that the use of environmental management practices offers mutual benefits, such as financial gains for buyer firms and improved relationships with supplier firms (Thornton *et al.*, 2013; Wahga *et al.*, 2017), SMEs can perceive high value in using these practices upon entry into and while in GVCs.

From another perspective, SMEs operating in GVCs may use environmental management practices due to the influence exerted by their partners (Siewers *et al.*, 2024). Lead firms within a GVC, often under scrutiny from various stakeholders, are likely to utilise and disseminate environmental management practices throughout the chain as a measure to address potential environmental impacts (Jensen and Whitfield, 2022). This establishes a standard that may encourage smaller firms to consider using similar practices, aligning with the overall sustainability goals of the GVC and enhancing their operational standards. Attracted by the potential benefits of being part of GVCs, SMEs follow the code of conduct set within GVCs to secure entry and remain (Arora and De, 2020). In this context, lead firms exert power over SMEs (Soontornthum *et al.*, 2020; Marttinen and Kähkönen, 2022), controlling vital resources such as the provision of continual orders (Wahga *et al.*, 2017). In such scenarios,

SMEs use environmental management practices, as their value is perceived to be significant to remain in GVCs.

Furthermore, SMEs may engage in GVCs through imports or outsourcing, primarily driven by cost considerations (Edvardsson *et al.*, 2020). GVCs expose SMEs, their suppliers and buyers to wider sustainability pressures through various channels and interactions. Recent research suggests that suppliers within the broader GVC may also exert normative pressure on these outsourcing SMEs to adopt environmental management practices (Sawang *et al.*, 2024). Drawing on the above arguments, GVCs have the potential to cultivate and disseminate a culture of sharing technologies and practices to improve environmental standards (i.e., pollution halo effect), thereby shaping and promoting such practices among SMEs. This prompts us to formulate our first hypothesis.

H1: There is a positive relationship between SMEs entering GVCs and the use of environmental management practices.

3.2 SMEs exiting GVCs and environmental practices

More recently, renewed interest in reshoring GVC activities among advanced economies has emerged (Fan *et al.*, 2022). This interest seems to be mainly driven by three transformative trends. First, evidence suggests that firms are giving up global sourcing for more local value chains with fewer supply tiers, to reduce transactional risk and coordination costs (Gray *et al.*, 2017). Second, the use of new technologies has allowed firms to restructure their GVCs by substituting labour-intensive operations abroad, which may entail concealed costs (e.g., non-conformance and quality costs), with capital-intensive operations at home (Cohen, *et al.*, 2018). Third, concerns related to sustainability, particularly environmental pollution, have gained prominence in offshore production (Li and Zhou, 2017). Accordingly, large firms operating in GVCs are increasingly under scrutiny from non-governmental organisations, communities, and environmental, social and governance (ESG) rating agencies (Lund-Thomsen and Lindgreen, 2014). As a result, some firms have resorted to reshoring activities, prioritising environmental considerations over cost advantages (Ashby, 2016).

Reshoring relocates investment, technology and jobs across countries. For example, in the US, more than 1,300 organisations are likely to reshore their manufacturing activities partially or fully, bringing back 138,000 jobs to the US from host countries (Gillani *et al.*, 2023). Reshoring also relates to SME exit from GVCs (Mendoza, 2020). The inherent size of

SMEs and their resource constraints (Bakos *et al.*, 2020), along with their less stable linkages with GVC participants (Mendoza, 2020), make them increasingly susceptible to exiting GVCs and potentially abandoning some of the practices and standards implemented when entering and operating in GVCs. As previously mentioned, there is a lack of evidence on whether SMEs retain or abandon environmental management practices when exiting GVCs. According to the literature on supply chain risk management, SMEs often refrain from making tangible investments when confronted with uncertainty (Roscoe *et al.*, 2020), a trend that is expected to increase with higher levels of reshoring. In scenarios characterised by high uncertainty, such as when SMEs are exiting GVCs, SMEs possess the option to choose whether to retain or abandon existing environmental management practices or use new practices that will support operations that respond to new market demands (Figge, 2005). Since exiting GVCs introduces uncertainties regarding market access, as well as revenue and resources, SMEs may find it challenging to justify investments in environmental management practices. As those firms are no longer embedded in GVCs and subject to the power of various larger GVC players (Soontornthum *et al.*, 2020), it is plausible to expect that SMEs may not make or sustain costly investments or practices that uphold exchange relationships with trading partners as they may not deem it necessary to do so. Hence, SMEs may view the option value of using environmental management practices post-GVC exit as low. Taking the above arguments together, we predict that SMEs reduce their investment in environmental management practices after exiting GVCs. Unless there are strong institutional pressures or clear future opportunities for the enterprise to re-enter GVCs (Ganotakis *et al.*, 2022), it is unlikely that SMEs will invest their scarce resources in environmental management practices. Accordingly, we formulate our second hypothesis.

H2: There is a negative relationship between SMEs exiting GVCs and the use of environmental management practices.

3.3 Trade facilitation shaping SMEs' environmental practices in GVCs

Building on the importance of trade facilitation in explaining the effectiveness and efficiency of firms within GVCs (Mann, 2012), we contend that trade facilitation stands out as a governmental policy that shapes the relationship between GVCs and SMEs' use of environmental management practices. Trade facilitation encompasses a role in creating a

favourable business environment that provides value to firms and motivates socio-economic development. This includes enhancing transactions among partners, simplifying administrative procedures, and reducing trade-related expenses (Mann, 2012; Portugal-Perez and Wilson, 2012). The advantages of these policies reflect the efficiency of SMEs and reduce both fixed and variable trade-related costs (González and Sorescu, 2019). As noted by Mann (2012), adhering to international standards embedded in modern trade facilitation policies can bolster firms' competitive edge within GVCs. Such outcomes have the potential to enhance GVCs' efficiency, enabling them to free up and allocate their limited resources to investments in improving their internal operations (e.g., more environmentally friendly practices) (Wiengarten *et al.*, 2014).

Furthermore, countries adopting trade facilitation reforms not only improve trade efficiency and connectivity but attract more foreign direct investments drawing in international buyers and creating better opportunities for SMEs to be exposed to new buyers (Montalbano, *et al.*, 2018). Prior research has shown that such exposure leads to improved environmental management practices among firms (Kim *et al.*, 2022). However, current knowledge of how trade facilitation amplifies SMEs' operational procedures toward sustainability is limited. The increased exposure of SMEs to GVC participants is expected to contribute to the promotion of cleaner operations using environmental management practices. According to the arguments presented, it is plausible to expect that the association between GVC entry and the use of environmental management practices become stronger as trade facilitation policies are put in place, favouring a more inclusive trading environment for SMEs. Accordingly, we formulate our next hypothesis.

H3: Trade facilitation at the national level moderates the relationship between SMEs entering GVCs and the use of environmental management practices, such that the relationship is more positive at higher levels of trade facilitation.

Empirical evidence suggests that in contexts where trade facilitation is weak, SMEs tend to experience slower growth (González and Sorescu, 2019). Furthermore, in such settings, where institutional constraints, inefficiencies, and trade barriers are common, countries frequently struggle to integrate into global trade networks (Marano *et al.*, 2017). Consequently, these countries may become isolated from global markets, resulting in limited recognition of their products and services internationally (Marano *et al.*, 2017). On one hand, the high trade

costs and less equitable playing field for SMEs prevalent in contexts with low trade facilitation may not be a favourable setting for SMEs to address post-exit challenges. On the other hand, research has shown that the use of environmental management practices or standards can be associated with SMEs conveying credibility and legitimacy, which may help address such challenges (Arora and De, 2020). In such contexts, sustainability practices act as an “institutional bridge” which aligns firms with global standards despite operating in a constrained trading environment (Marano *et al.*, 2017).

As countries transition towards medium levels of trade facilitation, they begin to see reduced trade barriers and enhanced institutional frameworks, which often lead to increased economic activity and trade opportunities (Fontagné *et al.*, 2020). However, enabling trade facilitation brings about increased foreign competition, pushing SMEs to prioritise market capture and competitiveness (Hansen-Addy *et al.*, 2024). As Morandi Stagni (2020) points out, this shift in priorities is a strategic response to increased exposure to international competition, where immediate operational survival takes precedence. Hence, it is expected that resource-constrained SMEs will reallocate their limited resources towards activities that ensure immediate market survival upon GVC exit. As a result, investments in environmental management practices may be deprioritised. Similar to prior studies that have shown how regulation and economic development can have a non-linear effect on environmental management practices (Dinda, 2004; Ko *et al.*, 2021), we argue that as trade policies shift from low to medium levels, SMEs are likely to face challenges in deciding whether to prioritise their limited resources on environmental management practices.

On the other hand, prior evidence has suggested that firms operating in countries with advanced trade facilitation policies experience beneficial outcomes (Portugal-Perez and Wilson, 2012). It is worth noting that while 156 member countries of the WTO have ratified the trade facilitation agreement, its full implementation remains incomplete, particularly in developing countries (World Trade Organisation, 2024). We contend that to realise the full benefits of trade facilitation, comprehensive implementation across all its dimensions is essential. This may suggest that in the context of exiting GVCs, trade facilitation may play a non-linear role, as the level of effectiveness of trade policies varies across countries. This phenomenon aligns with the Environmental Kuznets Curve (EKC) hypothesis, which posits that economic growth temporarily leads to a decline in environmental management efforts before eventually improving environmental outcomes (Dinda, 2004).

In countries with low levels of trade facilitation, SMEs must decide whether to retain or abandon environmental management practices upon exiting GVCs, given the uncertainties

such exits bring. We propose that SMEs could, surprisingly, choose to maintain environmental management practices, building on the concept of environmental option value (Figge, 2005). Retaining these practices serves as a hedge against future uncertainties, particularly the potential for re-engagement with global value chains. In this context, the environmental management practices option value is especially high, as it preserves SMEs' capability to re-enter GVCs and capitalise on future trading opportunities. SMEs retain these practices as an "institutional bridge," ensuring alignment with global standards despite their current disengagement from GVCs. This strategy compensates for institutional constraints, inefficiencies, and trade barriers in low trade facilitation environments, signalling quality and reliability to prospective international partners.

In countries with medium levels of trade facilitation, the immediate pressures of a highly constrained trade environment lessen, and SMEs would perceive a decrease in the strategic value of maintaining environmental practices as a hedge against future uncertainties (Figge, 2005). The option value of these practices appears less critical in countries going through this transitional phase and survival in the business environment becomes more important due to increasing foreign competition (Hansen-Addy *et al.*, 2024). Consequently, SMEs would likely redirect their resources and attention toward immediate operational survival rather than maintaining environmental standards. The perceived long-term benefits of retaining the environmental 'option' are overshadowed by the more immediate need to sustain business operations (Morandi Stagni, 2020).

However, this trade-off may be temporary, as further improvements in trade facilitation may create conditions which would eventually allow SMEs to reinvest in environmental practices. Accordingly, we expect SMEs located in countries with high levels of trade facilitation to perceive increased value for their operations from using environmental management practices. The comprehensive implementation of trade facilitation—through streamlined customs procedures, reduced trade barriers, and improved access to information—would allow SMEs to navigate post-GVC complexities with greater efficiency (González and Sorescu, 2019). By enhancing market connectivity and reducing transaction costs, trade facilitation creates an environment conducive to SMEs increasing the option value of using environmental management practices, even upon exiting GVCs. Consequently, the ongoing investment in those practices can be driven by the value SMEs attribute to the potential to meet expectations and secure future successful contract bids with foreign buyers. A feasible expectation to return to GVCs gives the SME's retention of environmental management practices a positive option value (Wahga *et al.*, 2017; Arora and De, 2020). This expectation

might be tied to how much support national policies offer to SMEs, allowing them to foresee a potential return to GVCs within a more inclusive environment for global trade.

Furthermore, academic literature indicates that buyers in GVCs tend to prefer suppliers that have already adopted desirable standards over collaborating with firms that have not embraced such practices (Marttinen and Kähkönen, 2022). The enhanced probability of winning a GVC contract by maintaining environmental management practices is the source of the option value of keeping such practices compared to when such practices are abandoned. As firms perceive the positive impact of using environmental management practices on their operations, such as energy efficiency and waste reduction initiatives (Hardcopf *et al.*, 2019), SMEs increase their expectation of the intended returns such as cost savings, improved reputation, and enhanced customer loyalty. Hence, when faced with the loss of a GVC contract, the firm must carefully consider the trade-off between the costs associated with maintaining standards without the contract and the potential benefits of securing future GVC contracts with a higher probability by adhering to those standards. Hence,

H4: The relationship between SMEs exiting GVC and the use of environmental management practices is moderated by trade facilitation at the national level, such that it becomes a U-shape relationship.

The Online Supplement-A presents a model that yields insights into the relationship between GVC entry and exit, trade facilitation, and environmental management practices.

4. Methodology and data

4.1 Data sources

The hypotheses proposed in this paper are tested using several publicly available data sources. Firm-level data is obtained from The World Bank's archival Enterprise Surveys (WBES). The WBES are surveys designed to offer national representations of various aspects related to the business environment within an economy. The survey has been applied in numerous countries and covers several topics including finance, infrastructure, competition, and performance measures. The surveys are presented in waves. We gathered data from three waves that cover different periods: Wave 1 (2008-2009), Wave 2 (2012-2013), and Wave 3 (2018-2019). Firms that participated only in waves 1 and 2 were excluded from the final sample, as environmental

information is collected exclusively in wave 3 of the WBES. Furthermore, firms that only took part in a single wave (e.g., wave 1 only) were not included in the final sample, as appearing in at least two waves is a prerequisite for calculating GVC entry and exit (see section 4.2). SMEs that had missing values in their imports and exports activity were excluded from our sample. [3] Moreover, we excluded 10 countries that had fewer than 10 observations. Additionally, we excluded one country from the sample due to the absence of OECD Trade Facilitation indicator data. Ultimately, we derived our final sample which consists of 1,462 SMEs encompassing 18 countries. These firms are from various sectors, including manufacturing (37%), retail trade (18%), accommodation and food services (12%), wholesale (10%), information (6%), transportation (3%), administrative, waste, and remediation services (<1%), and other services (13%). Table I illustrates the processes used for sample selection.

{Insert_Table_I_about_here}

4.2 Main independent and moderating variables

4.2.1 GVC entry

Following Reddy *et al.* (2021) we define GVC participant firms as all international traders (i.e., exporters, importers, and two-way traders) that have engaged in direct and/or indirect exporting, and importers of inputs from foreign sources. To operationalise GVC entry we used WBES data. GVC entry represents firms that entered or started operating as a GVC participant in wave 3 of the WBES and did not operate as a GVC participant in waves 1 and/or 2. Firms meeting these criteria are coded as 1; otherwise, they are coded as 0.

4.2.2 GVC exit

To operationalise GVC exit we used WBES data. GVC exit represents firms that operated as a GVC participant in waves 1 and 2 or only in wave 2 of WBES and exited or stopped operating as a GVC participant in wave 3 of the WBES. Firms that meet these criteria are coded as 1; otherwise, they are coded as 0. A similar method has been employed in prior studies to examine firms exiting markets (Aga and Francis, 2017).

4.2.3 Trade facilitation

In line with academic research on international trade, we use the OECD trade facilitation indicator to capture a country's state of trade facilitation (Beverelli and Ticku, 2022). These indicators were constructed based on the relevant provisions of the WTO TFA. The OECD trade facilitation indicator constitutes 11 indicators, which were developed in 2012 to support governments in their efforts to improve their border procedures, reduce trade costs and reap greater benefits from international trade. They currently cover the full spectrum of administrative procedures at the border for more than 160 countries across income levels, geographical regions, and development stages. Following González and Sorescu (2019), we employ the OECD's composite measure of trade facilitation, which is obtained from an average of 11 individual indicators.

4.3 Dependent variable – use of environmental management practices

In this research, we capture the use of environmental management practices that are of an operational type, rather than the strategic and tactical environmental management practices (Hardcopf *et al.*, 2019). These practices are internally focused and related to the firm's operations. To measure it we rely on wave 3 of WBES. Of the 38 questions about management and the environment and the environmental impact of the establishment in WBES, we selected all the questions that were related to the use of environmental practices. A similar procedure has been used in GVC research to measure environmentally sustainable practices (Arora and De, 2020). The selected items were cross-checked with the UN report "Micro, small and medium-sized enterprises and their role in achieving the Sustainable Development Goals" (Sobir, 2020) which identifies relevant sustainable development goals in the domain of SMEs. A score for the use of environmental management practices is calculated using 26 indicators. For example, we captured questions about energy consumption and water usage (i.e., "Over the last three years, did this establishment monitor its energy consumption?" and "Over the last three years, did this establishment monitor its water usage?"). For each indicator that a respondent marked as "Yes" a score of 1 is given. For indicators marked as "No", a score of 0 is given. The sum of all 26 indicators is utilised as the score of the use of environmental management practices. Accordingly, the maximum score that a firm can achieve is 26. Table II depicts the questions used.

{Insert_Table_II_about_here}

4.4 Control variables

Operations management literature suggests that older and larger firms are more resistant to adopt new routines and practices (Sartal *et al.*, 2020). Following Arora and De (2020), we compute a firm's age by subtracting the year of formation from the year of the survey. To account for variations in firm size, we apply the natural log transformation to the number of employees as a control variable. In addition, the WBES contains questions that enquire about the total sales revenue of the SMEs in the current year and three years prior. The difference between these two values is calculated to operationalise the financial performance of SMEs. We convert the resulting value to a percentage.

We controlled for foreign ownership using information provided by WBES. To capture foreign ownership, we code SMEs that indicate a percentage of foreign ownership greater than zero (>0), as foreign-owned, assigning them a code of 1. Conversely, firms with 0% foreign ownership are coded as 0. Firms with higher financial leverage, are often faced with greater survival and environmental protection pressures (Ren *et al.*, 2019), and are more likely to take action to comply with laws and use environmental management practices. Following Maksimov *et al.* (2017), we collected data from the WBES on the ratio of a company's working capital sourced from external channels such as banks, non-bank financial institutions, supplier credit, customer advances, moneylenders, friends, or relatives, in contrast to internal funds and retained earnings. This metric provides information on financial risk and accessibility and also offers insights into the company's operational effectiveness and creditworthiness.

Moreover, research indicates that industry associations play a crucial role in supporting SMEs with developing capabilities to enter GVCs and implement sustainable practices (Wahga *et al.*, 2017). We control for the effect arising from industry associations by utilising a question in the WBES which enquires whether a firm is a member of an industry association. If yes, it is coded as 1 and 0 if otherwise. We control whether access to finance is an obstacle. Prior literature has considered it to be a key factor driving management practices (Xu *et al.*, 2022). We operationalise this variable based on the WBES question that asks firms to what extent access to finance is an obstacle to their current operations (on a scale from 0=no obstacle, to 4=very severe obstacle). Additionally, we control whether a firm had government contracts (1=yes, 0=no), as it represents a focal firm's contracting ability (Maksimov *et al.*, 2017).

We used information about environmentally related tax revenue from the OECD Statistics to control for country environmental regulation (OECD, 2024a). If a national

government had imposed an environmental tax, it is coded as 1 and 0 if otherwise. Finally, industry dummies control cross-industry differences. Research shows that the use of environmental management practices varies between industries (Busse *et al.*, 2017). Hence, the 2022 North American Industry Classification System was used to classify firms in nine different industries.

4.5 Model

To test our hypotheses, we run our models using regression analysis. More specifically, moderated regression analyses are employed to predict the relations of GVC entry and exit to the use of environmental management practices and the moderating role of trade facilitation in this relationship. This analysis was carried out using the Hayes process models 1 and 2 (Hayes, 2017), which have been commonly used in production and operation management studies (Prajogo *et al.*, 2021). The Hayes process model facilitates the implementation of bootstrapping techniques, enabling rigorous testing of direct and indirect relationships. To test our hypotheses, we have employed the bootstrapping approach considering 5,000 sub-sample iterations with 95% confidence intervals. Before conducting the analyses, we mean centred the continuous variables to mitigate the potential issue of multicollinearity when testing moderating hypotheses (Hayes, 2017).

First, we estimate the direct relation of GVC entry and GVC exit on the use of environmental management practices to test H1 and H2 according to the following equation:

$$\text{Environmental management practices}_{is} = \beta_0 + \beta_1(\text{GVC entry})_{is} + \beta_2(\text{GVC exit})_{is} + \beta_3(\text{Trade facilitation})_{is} + \beta_4(\text{Trade facilitation squared})_{is} + \beta_5(\text{Control variables})_{is} + \varepsilon \quad (1)$$

Next, to determine the moderating role of trade facilitation on GVC entry and environmental management practices, as predicted in H3, we estimate the following equation:

$$\text{Environmental management practices}_{is} = \beta_0 + \beta_1(\text{GVC entry})_{is} + \beta_2(\text{GVC exit})_{is} + \beta_3(\text{Trade facilitation})_{is} + \beta_4(\text{GVC entry} \times \text{Trade facilitation})_{is} + \beta_5(\text{Control variables})_{is} + \varepsilon \quad (2)$$

Finally, to estimate the non-linear moderating role of trade facilitation in the association between GVC exit and environmental management practices, as predicted in H4, the following equation was considered:

$$\text{Environmental management practices}_{is} = \beta_0 + \beta_1(\text{GVC entry})_{is} + \beta_2(\text{GVC exit})_{is} + \beta_3(\text{Trade facilitation})_{is} + \beta_4(\text{Trade facilitation squared})_{is} + \beta_5(\text{GVC exit} \times \text{Trade facilitation})_{is} + \beta_6(\text{GVC exit} \times \text{Trade facilitation squared})_{is} + \beta_7(\text{Control variables})_{is} + \varepsilon \quad (3)$$

where the subscripts refer to a firm i belonging to country s .

5. Results

5.1 Descriptive analysis

In Table III, we provide information about the descriptive statistics and the correlation between the variables described above. The table shows that on average, SMEs use four environmental management practices and that GVC entry is positively and significantly associated with environmental management practices.

{Insert_Table_III_about_here}

5.2 Hypotheses testing

Table IV presents the results of our analysis, showing a significant positive association between GVC entry by SMEs and their use of environmental management practices ($\beta=0.062$, $p<0.05$). This result suggests that GVC engagement and the use of environmental management practices by SMEs are intertwined (Siewers *et al.*, 2024). The result supports our H1 and is consistent with the notions of exchange relationships and power dynamics enabled by sourcing and contracting arrangements, that are formed among GVC participants regarding the use of environmental management practices (Jensen and Whitfield, 2022). In terms of GVC exit, the results indicate a significant negative relationship with SMEs' use of environmental management practices ($\beta=-0.070$, $p<0.05$). This result supports our H2. The results suggest that SMEs' inherent size, combined with the resource and productivity constraints that follow GVC exit, are associated with a reduction in their investment in environmental management practices

(Mendoza, 2020). Consequently, SMEs' exit from GVCs may reflect a reallocation of scarce resources away from environmental management practices. These dynamics appear to impact the option value of using environmental management practices, particularly in the context of entering or exiting GVCs.

Regarding H3, we find no evidence that trade facilitation positively moderates the relationship between GVC entry and the use of environmental management practices ($\beta = -0.005$, $p > 0.05$). On the other hand, we find support for H4. The results indicate a significant non-linear moderation effect of trade facilitation on the relationship between GVC exit and the use of environmental management practices ($\beta = 0.765$, $p < 0.05$). Testing u-shaped function hypotheses commonly rely on quadratic regressions, however as noted by Simonsohn (2018) this approach imposes an arbitrary functional form that sometimes yields a false positive rate—mistakenly identifying various function shapes as u-shaped. Simonsohn (2018) suggests the two lines test, a more robust method which involves estimating separate regression lines, allowing for sign change detection without assuming a specific functional form. Following the analysis of the two lines test for u-shaped relationships using interrupted regression, we find the two slopes for low and high levels of the moderating interactions have opposite signs, and are individually statistically significant ($\beta_{\text{low}} = -0.31$, $p < 0.01$; $\beta_{\text{high}} = 0.14$, $p < 0.05$) (see Figure 1). These findings suggest that among the SMEs that exited GVCs, the ones located in countries with low and high trade facilitation have more environmental management practices than the ones located in countries with mid-levels of trade facilitation.

{Insert_Table_IV_about_here}

{Insert_Figure_1_about_here}

5.3 Robustness tests

We conducted an additional robustness test to examine whether the association between GVC entry and exit and the use of environmental management practices varies according to the degree of SME engagement in GVCs. Specifically, the tests differentiated between SMEs with direct engagement in GVCs and those with indirect engagement. Data from the WBES was used to capture the direct and indirect engagement of SMEs with the GVCs. Direct engagement refers to firms exporting, importing and acting as two-way traders directly, while indirect engagement refers to SMEs selling domestically to third parties that export. The results indicate that our main conclusions hold for SMEs directly engaged in GVCs, while this is not the case

for those enterprises indirectly engaged (see Table V). Also, following the literature that emphasises the importance of international quality certification for the successful integration of companies into GVCs (Reddy *et al.*, 2021), we conducted an additional robustness test. This test involved examining the interaction between SMEs' entry and exit from GVCs and the variable representing international quality certification. The quality certification variable, obtained from WBES, indicates whether a firm holds international quality certification (1=yes, 0=no). The non-tabulated results do not reveal international quality certification as a significant variable explaining the relationship between GVC entry and exit and environmental management practices. We conducted a post-hoc analysis isolating SMEs engaged in importing/outsourcing from those focused on exporting, recognising that motivations and processes for adopting environmental management practices vary with different levels of GVC involvement. The results suggest that importing SMEs often use environmental management practices due to normative pressures from suppliers, aligning with recent research (Sawang *et al.*, 2024). Similarly, exporting SMEs implement environmental practices upon entering GVCs, suggesting that GVC participation, whether through importing or exporting, is associated with environmental management practice use (See Table B-1 in Online Supplement-B).

Finally, to mitigate concerns about potential endogeneity between GVC participation and environmental management practices, we employed two-stage least squares regressions (2SLS), a standard practice in operations research (Lu *et al.*, 2018). Three instrumental variables were utilised for GVC entry (foreign technology usage, top manager experience, and GVC position), and three distinct instrumental variables were used for GVC exit (political stability, economic complexity, and product complexity).

Next, we present the instruments used for GVC entry. The usage of foreign technology is common among GVC entrants (Siewers *et al.*, 2024). Such technology can be a prerequisite for firms to meet the competitive standards and requirements of GVCs. The data relating to the firm's usage of foreign technology was extracted from the WBES. Top management experience has been recognised in prior research to influence a firm's internationalisation efforts (Fernández-Ortiz and Lombardo, 2009). The professional experience, obtained through previous work, technical expertise, or product knowledge of top management, equips the firm with knowledge, industry connections, and operational skills necessary to enter international markets. The data relating to top management experience was also extracted from the WBES. GVC position refers to a country's position in GVCs on an aggregate level (Koopman *et al.*, 2014). This position can be understood by examining whether a country contributes more value-added to other countries' exports or relies more on foreign value-added inputs for its

exports. If a country contributes more to other countries' exports, it takes an upstream position in GVCs. On the other hand, if it relies more on foreign inputs for its own exports, it occupies a downstream position in GVCs. Countries in an upstream position are exporters of raw materials and specialised intermediate inputs crucial at the start of production processes. Conversely, a downstream position often involves assembly activities and services such as marketing, sales, and distribution of finished products. As previously mentioned, SMEs are typically characterised by their specialisation in specific value-adding activities within GVCs (Soontornthum *et al.*, 2020). When countries occupy upstream positions and provide inputs at the early stages of production, they create opportunities for SMEs to contribute with their specialised capabilities. Although countries occupying downstream positions in GVCs provide opportunities for SMEs to enter these chains, they often face challenges related to resource and knowledge scarcity. Moreover, predominantly downstream activities involving SMEs are retail or distribution (OECD, 2008). We utilise OECD's trade-in value-added database to determine a country's position in the value chain (OECD, 2024b). [4]

The instruments used for GVC exit, include political stability, economic complexity, and product complexity. As Antràs (2020) indicates a country's political stability is an important factor related to GVC trade. Hence, we employ the political stability measure of World Governance Indicators developed by the World Bank as an instrument for GVC exit. The Economic Complexity Index (ECI) measures how sophisticated a country's economy is by considering two main factors: the diversity of products it exports and the global uniqueness of those products (Hartmann *et al.*, 2017). Economic complexity indicates that sophisticated economies export a wide variety of products that are not commonly produced by many countries. Less sophisticated economies tend to export fewer types of products that are widely available across many countries. Therefore, economic complexity reflects both the breadth and uniqueness of a country's productive capabilities in the global market. In the context of GVC exit, it suggests that countries with lower economic complexity may face challenges due to limited diversification and reliance on products that are widely available globally. Conversely, higher economic complexity scores indicate greater economic sophistication within GVCs, potentially reducing the likelihood of GVC exit. We rely on the Atlas of Economic Complexity database/data visualisation tool to extract the economic complexity index of each country in our sample. Furthermore, we included a firm-level product complexity measure as an instrumental variable which identifies an SMEs productive capabilities and the diversity of its product portfolio. SMEs with lower productive capabilities or reliance on a single or limited product portfolio are more likely to face a higher risk of exiting GVCs.

These instruments are correlated with the potential endogenous variables (GVC entry and GVC exit) but not directly with the dependent variable (use of environmental management practices). The strength of the instruments was confirmed using *ivreg* and *weakiv* procedures in STATA. We re-estimated the regression model using the instrumental variables. Results in Table VI confirm our predicted relationships.

{Insert_Table_V_about_here}

{Insert_Table_VI_about_here}

6. Discussion and conclusion

Our analysis reveals a positive relationship between SMEs entering GVCs and the use of environmental management practices. These results are in line with prior studies that indicate GVCs can be viewed as powerful vehicles that promote environmental sustainability and the use of greener technologies among their participants (Mollenkopf *et al.*, 2010; Marttinen and Kähkönen, 2022; Siewers *et al.*, 2024). Driven by their perception of option value and/or pressures by GVCs, SMEs use environmental management practices to maintain a favourable position in GVCs. Furthermore, SMEs often adhere to the codes of conduct within GVCs to secure access and to retain their position as suppliers (Arora and De, 2020).

Importantly, our findings suggest a negative association between GVC exit and the use of environmental management practices. SMEs' inherent size and resource constraints (and constraints that often follow GVC exit) may induce them not to sustain some of the practices and standards used to enter and remain in GVCs. Exiting GVCs introduces uncertainties regarding market access, revenue, and resources, making it challenging for SMEs to justify investments in environmental management practices. Consequently, SMEs may perceive the costs associated with retaining environmental technologies and processes as prohibitively high. This finding further illustrates how reshoring activities might harm global sustainability by mitigating the pollution halo effect of GVCs. In essence, reshoring may displace jobs around the world and is expected to negatively impact the natural environment by reducing the use of environmental management practices in GVCs. However, when considering the non-linear moderating features of trade facilitation in a national context, our findings become intriguing.

Results suggest that SMEs operating in countries with weak trading conditions dedicate their limited resources to sustainability practices. We contend that this behaviour represents an attempt by SMEs to counterbalance institutional constraints. In this regard, environmental management practices serve as a means for SMEs to legitimise their products and services aligning with global market standards (Marano *et al.*, 2017). Hence, those practices constitute "institutional bridges" that compensate for unfavourable trade conditions, maintain their reputation with international partners, and preserve their capacity to rejoin the GVC in the future. Furthermore, results indicate that as trade facilitation in the national context shifts from low to medium levels, SMEs exiting GVCs abandon their use of environmental management practices. This may be explained by the increase in pressure from foreign competitors (Hansen-Addy *et al.*, 2024), leading SMEs to prioritize short-term needs, such as immediate financial returns and market survival, which overshadow the "option value" of environmental management practices. Nonetheless, when companies operate in an environment with strong trade facilitation, even if SMEs lose their favourable position in a GVC that requires responsible business practices, they may choose to continue to sustain environmental management practices. This is due to trade facilitation outcomes, such as streamlined customs procedures and improved access to information, that empower SMEs to navigate post-GVC complexities effectively. In addition, when national trade policy facilitates international trading and reduces transaction costs, SMEs perceive the benefit in terms of a greater value from the option of maintaining their sustainable technology and processes, leading them to invest in long-term practices (e.g., environmental management practices) while complying with established policies. The option value is rooted in heightened expectations of finding future contracts that align with responsible supply chains (Soontornthum *et al.*, 2020), when trade facilitation is high, especially when such practices are already in place within the company (Arora and De, 2020). Hence, as trade facilitation becomes strongly positive, the option value of maintaining sustainable technologies upon GVC exit is prioritised by SMEs, which may enhance operational efficiency and increase their investments in environmental management practices.

Despite conflicting findings in existing research, with some suggesting that increasing trade may harm environmental sustainability (Dou *et al.*, 2021), while others argue for a benign effect (Le *et al.*, 2016), our findings strongly support the prediction that trade facilitation plays a pivotal role in shaping the outcomes of GVC dynamics and SMEs' sustainability initiatives.

6.1 Theoretical contribution

Our study contributes to the literature on the adoption and use of environmental sustainability by examining the context of SMEs operating in GVCs (Hardcopf *et al.*, 2019; Koberg and Longoni, 2019; Rentizelas *et al.*, 2020; Marttinen and Kähkönen, 2022). Our results advance the literature by suggesting that engagement in GVCs and SMEs' environmentally responsible behaviour are closely intertwined, thereby extending the literature in intersection of operations management (González *et al.*, 2008; Macchion *et al.*, 2017) and sustainability in GVCs (Hsu *et al.*, 2013; Busse *et al.*, 2017; Dahlmann *et al.*, 2023). In particular, this paper represents one of the pioneering studies examining the relationship between GVC exit and environmental management practices at the firm level. It offers a theoretical perspective to explain how GVC exit may disrupt the benefits associated with this context.

Second, our research contributes to studies examining how the national and institutional context shapes the use of environmental practices (Yang *et al.*, 2019; Fan *et al.*, 2020; Johnstone and Hallberg, 2020; Gölgeci *et al.*, 2021). The study suggests that trade facilitation policies can assist in mitigating the tendency of SMEs to abandon environmental management practices when exiting GVCs. We argue these policies that are designed to facilitate cross-border transactions, reduce costs, and simplify administrative procedures present opportunities for SMEs to reinforce and retain environmental management practices. In this regard, we introduce the concept of option value and advance the prior literature (Attig, 2016; Marano, 2017; Arora and De, 2020) by demonstrating how trade facilitation exerts a U-shape moderating effect on the relationship between GVC exit and use of environmental management practices. This approach yields a nuanced understanding of how national policies shape SMEs' environmental practices aimed at GVCs. Hence, this study contributes to theory by developing a testable model that explains the option value for environmental management practices and trade facilitation. Our study illustrates the relationship between factors related to the use of environmental management practices when a company enters and exits GVCs. Our contribution to the operations management literature demonstrates that trade facilitation is crucial for policymakers to foster more sustainable behaviour from SMEs, leading to sustainable growth even when they exit GVCs.

Finally, extending our results to the context of increasing reshoring decisions provides significant insights into the environmental implications (Sena *et al.*, 2023) of SMEs behaviour and the achievement of global sustainability development goals. The focus of multinational enterprises on reshoring and reducing production footprints (Fan *et al.*, 2022) often results in an increased exit of SMEs from GVCs. Our work highlights the unintended environmental

consequences of these changes, indicating that the withdrawal of multinational enterprises from broad value chains will likely be associated with a reduction in the use of sustainable production processes by SMEs that are no longer involved in GVCs.

6.2 Practical contributions

Our study provides practical insights for managers and policymakers. First, for owner-managers of SMEs, it highlights the critical importance of using environmental management practices to effectively operate within GVCs. Building on the insights of Yang *et al.* (2019) and Johnstone and Hallberg (2020), our study identifies environmental management practices as part of a broader institutional phenomenon aimed at improving environmental performance. Recognising this importance is essential for allowing the owner-managers of those enterprises to navigate environmental considerations within GVCs and adequately prepare their SMEs for using such practices. This involves gaining knowledge about necessary environmental measures and allocating budgets for their implementation within SME operations.

Second, Maksimov *et al.* (2017) highlight the challenge of identifying and leveraging institutional facilitators for SMEs to operate in the international marketplace, which improves their long-term competitiveness and sustainability. This challenge arises from the dispersed, disconnected, or inadequate nature of institutional facilitators, creating significant barriers for SMEs seeking to capitalise on international trade opportunities. In response, our research identifies trade facilitation as a key factor in addressing these challenges and empowering SMEs, particularly those exiting GVCs (Mann, 2012). Our research emphasises the need for national governments and policymakers to prioritise the comprehensive implementation of trade facilitation policies. These policies not only enhance the international operations of SMEs but also encourage environmentally sustainable practices among them. Policymakers can leverage trade facilitation policies to enhance the value of environmental management practices by encouraging SMEs to maintain their commitment to sustainability even after exiting GVCs.

6.3 Limitations and future research suggestions

Several directions for future research stem from our limitations. First, a future researcher could make use of upcoming waves of the WBES to acquire panel data that would allow investigation of temporal links between GVC entry/exit and the use of environmental management practices among SMEs over an extended period. Second, our research takes a very broad approach to investigating the use of environmental management practices. Future research should attempt

to understand the individual practices that are adopted, kept, or abandoned in the dynamics of GVC entry and exit. Third, in our research, we investigate trade facilitation at the country level. As a result, we are unable to capture regional and local policies to stimulate trade, encourage cluster development, and support sustainable practices at their most basic level. Future research should investigate these regional variations to provide a more comprehensive understanding of how localised policies intersect with GVC dynamics, influencing SMEs' environmental practices. Fourth, in this research, GVC entry and exit are operationalised in terms of SMEs' exporting and importing activities, based on data available from the WBES. Although similar methodology has been employed in GVC studies (Reddy *et al.*, 2021; Agostino *et al.*, 2023), this approach is limited as it does not capture the full range of supply chain actors and their linkages within a multi-tier supply chain (Koberg and Longoni, 2019). Fifth, our dataset does not enable us to identify the source/destination of imported/exported goods, preventing us from isolating the potential effects of suppliers/buyers in countries with stringent environmental regulations. Future research could explore whether SMEs importing from/exporting to countries with higher environmental standards use more robust environmental practices compared to those exporting to countries with less stringent regulations. Finally, future research could enhance understanding of the investigated phenomenon by incorporating qualitative methods. For instance, employing semi-structured interviews and focus groups could yield more specific insights into the motivations and perspectives of individuals within SMEs. This approach is likely to unveil significant patterns concerning the influence of GVCs and national policies on the environmental practices of SMEs.

Notes:

- [1] See Hardcopf *et al.* (2019) for a comprehensive review of factors influencing the adoption of environmental management practices.
- [2] The ratification of the TFA stands at 95.1% among member countries of the WTO while the implementation commitments stand at 79.3% among the members (World Trade Organisation, 2024).
- [3] The WBES stratifies the sample by firm size by dividing the population of firms into three strata: small firms (5-19 employees), medium-size firms (20-99 employees), and large firms (100+ employees).
- [4] We calculate the GVC position of a country following the conceptualisations of Koopman *et al.* (2014) as operationalised by Riera and Paetzold (2020) in the European Bank of Reconstruction and Development (EBRD), “Global Value Chains and Trade in the EBRD regions” policy strategy report. The formula is as follows:

$$GVC\ position = \ln\left(1 + \frac{\text{Intermediates sent to importer and then reexported to third country}}{\text{Gross exports}}\right) - \ln\left(1 + \frac{\text{Foreign value added}}{\text{Gross exports}}\right)$$

References

- Adebanjo, D., Teh, P.L. and Ahmed, P.K. (2016), “The impact of external pressure and sustainable management practices on manufacturing performance and environmental outcomes”, *International Journal of Operations & Production Management*, Vol.36 No.9, pp.995-1013, doi:10.1108/IJOPM-11-2014-0543.
- Adian, I., Doumbia, D., Gregory, N., Ragoussis, A., Reddy, A. and Timmis, J. (2020), Small and medium enterprises in the pandemic: impact, responses and the role of development finance, Policy Research Working Paper, No.9414, The World Bank.
- Aga, G. and Francis, D. (2017), “As the market churns: productivity and firm exit in developing countries”, *Small Business Economics*, Vol.49 No.2, pp.379–403, doi:10.1007/s11187-016-9817-7.
- Agostino, M., Giunta, A., Ruberto, S. and Scalera, D. (2023), “Global value chains and energy-related sustainable practices. Evidence from Enterprise Survey data”, *Energy Economics*, Vol.127, p.107068, doi:10.1016/j.eneco.2023.107068.
- Antràs, P. (2020), “Conceptual aspects of global value chains”, *The World Bank Economic Review*, Vol.34 No.3, pp.551-574, doi:10.1093/wber/lhaa006.
- Arora, P. and De, P. (2020), “Environmental sustainability practices and exports: The interplay of strategy and institutions in Latin America”, *Journal of World Business*, Vol.55 No.4, p.101094, doi:10.1016/j.jwb.2020.101094.
- Ashby, A. (2016), “From global to local: reshoring for sustainability”, *Operations Management Research*, Vol.9 No.3, pp.75–88, doi:10.1007/s12063-016-0117-9.
- Atlas of Economic Complexity (2024), Country Complexity Rankings. <https://atlas.cid.harvard.edu/rankings> (accessed_21/June/2024).
- Attig, N., Boubakri, N., El Ghouli, S. and Guedhami, O. (2016), “Firm internationalization and corporate social responsibility”, *Journal of Business Ethics*, Vol.134, pp.171-197, doi:10.1007/s10551-014-2410-6.
- Bakos, J., Siu, M., Orengo, A. and Kasiri, N. (2020), “An analysis of environmental sustainability in small & medium-sized enterprises: Patterns and trends”, *Business Strategy and the Environment*, Vol.29 No.3, pp.1285–1296, doi:10.1002/bse.2433.
- Ben-David, I., Jang, Y., Kleimeier, S. and Viehs, M. (2021), “Exporting pollution: where do multinational firms emit CO₂?”, *Economic Policy*, Vol.36 No.107, pp.377–437, doi:10.1093/epolic/eiab009.

- Beverelli, C. and Ticku, R. (2022), "Reducing tariff evasion: The role of trade facilitation", *Journal of Comparative Economics*, Vol.50 No.2, pp.534–554, doi: 10.1016/j.jce.2021.12.004.
- Busse, C., Meinschmidt, J. and Foerstl, K. (2017), "Managing information processing needs in global supply chains: A prerequisite to sustainable supply chain management", *Journal of Supply Chain Management*, Vol.53 No.1, pp.87–113, doi:10.1111/jscm.12129.
- Cohen, M.A., Cui, S., Ernst, R., Huchzermeier, A., Kouvelis, P., Lee, H.L., Matsuo, H., Steuber, M. and Tsay, A.A. (2018), "OM Forum—Benchmarking global production sourcing decisions: Where and why firms offshore and reshore", *Manufacturing & Service Operations Management*, Vol.20 No.3, pp.389-402, doi:10.1287/msom.2017.0666.
- Dahlmann, F., Brammer, S. and Roehrich, J.K. (2023), "Navigating the "performing-organizing" paradox: tensions between supply chain transparency, coordination, and scope 3 GHG emissions performance", *International Journal of Operations & Production Management*, Vol. 43 No. 11, pp. 1757-1780. doi:10.1108/IJOPM-09-2022-0622.
- Dinda, S. (2004), "Environmental Kuznets curve hypothesis: a survey", *Ecological Economics*, Vol.49 No.4, pp.431-455, doi:10.1016/j.ecolecon.2004.02.011.
- Dollar, D., Ge, Y. and Yu, X. (2016), "Institutions and participation in global value chains", Global Value Chain Development Report Background Paper, World Bank, Washington-DC.
- Dou, Y., Zhao, J., Malik, M.N. and Dong, K. (2021), "Assessing the impact of trade openness on CO2 emissions: Evidence from China-Japan-ROK FTA countries", *Journal of Environmental Management*, Vol.296, p.113241, doi:10.1016/j.jenvman.2021.113241.
- Duan, Y. and Jiang, X. (2021), "Pollution haven or pollution halo? A Re-evaluation on the role of multinational enterprises in global CO2 emissions", *Energy Economics*, Vol.97, p.105181, doi:10.1016/j.eneco.2021.105181.
- Edvardsson, I.R., Durst, S. and Oskarsson, G.K. (2020), "Strategic outsourcing in SMEs", *Journal of Small Business and Enterprise Development*, Vol.27 No.1, pp. 73-84, doi:10.1108/JSBED-09-2019-0322.
- El Baz, J. and Laguir, I. (2017), "Third-party logistics providers (TPLs) and environmental sustainability practices in developing countries: The case of Morocco", *International Journal of Operations & Production Management*, Vol.37 No.10, pp.1451-1474, doi:10.1108/IJOPM-07-2015-0405.
- Fan, D., Zhou, Y., Yeung, A.C., Lo, C.K. and Tang, C. (2022), "Impact of the US–China trade war on the operating performance of US firms: The role of outsourcing and supply base

- complexity”, *Journal of Operations Management*, Vol.68 No.8, pp.928-962, doi:10.1002/joom.1225.
- Fernández-Ortiz, R. and Lombardo, G.F. (2009), “Influence of the capacities of top management on the internationalization of SMEs”, *Entrepreneurship and Regional Development*, Vol.21 No.2, pp.131-154, doi:10.1080/08985620802176104.
- Figge, F. (2005), “Value-based environmental management. From environmental shareholder value to environmental option value”, *Corporate Social Responsibility and Environmental Management*, Vol.12 No.1, pp.19–30, doi:10.1002/csr.74.
- Fontagné, L., Orefice, G., and Piermartini, R. (2020), “Making small firms happy? The heterogeneous effect of trade facilitation measures”, *Review of International Economics*, Vol.28 No.3, pp.565-598, doi:10.1111/roie.12463.
- Ganotakis, P., Konara, P., Kafouros, M. and Love, J.H. (2022), “Taking a time-out from exporting: Implications for the likelihood of export re-entry and re-entry export performance”, *Journal of World Business*, Vol.57 No.5, p.101349, doi:10.1016/j.jwb.2022.101349.
- Gillani, A., Kutaula, S. and Budhwar, P.S. (2023), “Heading home? Reshoring and sustainability connectedness from a home-country consumer perspective”, *British Journal of Management*, Vol.34 No.3, pp.1117–1137, doi:10.1111/1467-8551.12658.
- Gölgeci, I., Makhmadshoev, D. and Demirbag, M. (2021), “Global value chains and the environmental sustainability of emerging market firms: A systematic review of literature and research agenda”, *International Business Review*, Vol.30 No.5, p.101857, doi:10.1016/j.ibusrev.2021.101857.
- González, J.L. and Sorescu, S. (2019), “Helping SMEs Internationalise through Trade Facilitation”, *OECD Trade Policy Papers*, No.229, OECD Publishing, Paris, doi:10.1787/2050e6b0-en.
- González, P., Sarkis, J. and Adenso-Díaz, B. (2008), "Environmental management system certification and its influence on corporate practices: Evidence from the automotive industry", *International Journal of Operations & Production Management*, Vol. 28 No.11, pp. 1021-1041, doi:10.1108/01443570810910179.
- Gray, J.V., Esenduran, G., Rungtusanatham, M.J. and Skowronski, K. (2017), “Why in the world did they reshore? Examining small to medium-sized manufacturer decisions”, *Journal of Operations Management*, Vol.49, pp.37-51, doi:10.1016/j.jom.2017.01.001.

- Hansen-Addy, A.E., Parrilli, D.M. and Tingbani, I. (2024), “The impact of trade facilitation on African SMEs’ performance”, *Small Business Economics*, Vol.62 No.1, pp.105–131, doi:10.1007/s11187-023-00756-4.
- Hardcopf, R., Shah, R. and Mukherjee, U. (2019), “Explaining heterogeneity in environmental management practice adoption across firms”, *Production and Operations Management*, Vol.28 No.11, pp.2898-2918, doi:10.1111/poms.13083.
- Hartmann, D., Guevara, M.R., Jara-Figueroa, C., Aristarán, M. and Hidalgo, C.A., (2017), “Linking economic complexity, institutions, and income inequality”, *World Development*, Vol.93, pp.75-93, doi:10.1016/j.worlddev.2016.12.020.
- Hayes, A.F. (2017), *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*, Guilford Publications, New York, NY.
- Hoekman, B. and Shepherd, B. (2015), “Who profits from trade facilitation initiatives? Implications for African countries”, *Journal of African Trade*, Vol.2 No.1, pp.51–70, doi:10.1016/j.joat.2015.08.001.
- Hsu, C.C., Choon Tan, K., Hanim Mohamad Zailani, S. and Jayaraman, V. (2013), “Supply chain drivers that foster the development of green initiatives in an emerging economy”, *International Journal of Operations & Production Management*, Vol.33 No.6, pp.656-688, doi:10.1108/IJOPM-10-2011-0401.
- Jensen, F. and Whitfield, L. (2022), “Leveraging participation in apparel global supply chains through green industrialization strategies: Implications for low-income countries”, *Ecological Economics*, Vol.194, pp.107331, doi:10.1016/j.ecolecon.2021.107331.
- Johnstone, L. and Hallberg, P. (2020), “ISO 14001 adoption and environmental performance in small to medium sized enterprises”, *Journal of Environmental Management*, Vol.266, p.110592, doi:10.1016/j.jenvman.2020.110592.
- Kim, N., Sun, J., Yin, H. and Moon, J.J. (2022), “Do foreign firms help make local firms greener? Evidence of environmental spillovers in China”, *Journal of International Business Studies*, Vol.53 No.7, pp.1370–1393, doi:10.1057/s41267-022-00504-y.
- Ko, W.W., Chen, Y., Chen, C.H.S., Wu, M.S.S. and Liu, G. (2021), “Proactive environmental strategy, foreign institutional pressures, and internationalization of Chinese SMEs”, *Journal of World Business*, Vol 56 No.6, 101247, doi:10.1016/j.jwb.2021.101247.
- Koberg, E. and Longoni, A. (2019), “A systematic review of sustainable supply chain management in global supply chains”, *Journal of cleaner production*, Vol.207, pp.1084-1098, doi:10.1016/j.jclepro.2018.10.033.

- Koopman, R., Wang, Z. and Wei, S.J., (2014), “Tracing value-added and double counting in gross exports”, *American Economic Review*, Vol.104 No.2, pp.459-494, doi:10.1257/aer.104.2.459.
- Le, T.-H., Chang, Y. and Park, D. (2016), “Trade openness and environmental quality: International evidence”, *Energy Policy*, Vol.92, pp.45–55, doi:10.1016/j.enpol.2016.01.030.
- Li, X. and Zhou, Y.M. (2017), “Offshoring pollution while offshoring production?”, *Strategic Management Journal*, Vol.38 No.11, pp.2310–2329, doi:10.1002/smj.2656.
- Lu, G., Ding, X.D., Peng, D.X., and Chuang, H.H.C. (2018), “Addressing endogeneity in operations management research: Recent developments, common problems, and directions for future research”, *Journal of Operations Management*, Vol.64, pp.53-64, doi:10.1016/j.jom.2018.10.001.
- Lund-Thomsen, P. and Lindgreen, A. (2014), “Corporate Social Responsibility in Global Value Chains: Where Are We Now and Where Are We Going?”, *Journal of Business Ethics*, Vol.123 No.1, pp.11–22, doi:10.1007/s10551-013-1796-x.
- Macchion, L., Moretto, A., Caniato, F., Caridi, M., Danese, P., Spina, G., & Vinelli, A. (2016). “Improving innovation performance through environmental practices in the fashion industry: the moderating effect of internationalisation and the influence of collaboration.” *Production Planning & Control*, Vol.28, No.3, pp. 190–201. doi:10.1080/09537287.2016.1233361.
- Maksimov, V., Wang, S.L. and Luo, Y. (2017), “Reducing poverty in the least developed countries: The role of small and medium enterprises”, *Journal of World Business*, Vol.52 No.2, pp.244–257, doi:10.1016/j.jwb.2016.12.007.
- Malesios, C., Prasanta, K.D., and Abdelaziz, F.B. (2020) “Supply chain sustainability performance measurement of small and medium sized enterprises using structural equation modelling”, *Annals of Operations Research*, Vol.294 No.1, pp.623-653, doi:10.1007/s10479-018-3080-z.
- Mann, C.L. (2012), “Supply chain logistics, trade facilitation and international trade: A macroeconomic policy view”, *Journal of Supply Chain Management*, Vol.48 No.3, pp.7-14, doi:10.1111/j.1745-493X.2012.03270.x.
- Marano, V., Tashman, P. and Kostova, T. (2017), “Escaping the iron cage: Liabilities of origin and CSR reporting of emerging market multinational enterprises”, *Journal of International Business Studies*, Vol.48, pp.386-408, doi:10.1057/jibs.2016.17.

- Marttinen, K. and Kähkönen, A.K. (2022), “Fostering firms’ ability to cascade sustainability through multi-tier supply chains: an investigation of power sources”, *International Journal of Operations & Production Management*, Vol.42 No.8, pp.1146-1172, doi:10.1108/IJOPM-11-2021-0739.
- Mendoza, A.R. (2020), “What matters for the GVC entry and exit of manufacturing SMEs in the Philippines?”, ADBI Working Paper Series No. 1147, Asian Development Bank Institute (ADBI), Tokyo.
- Micheli, P., Johnson, M. and Godsell, J. (2021), "Editorial How the Covid-19 pandemic has affected, and will affect, operations and supply chain management research and practice", *International Journal of Operations & Production Management*, Vol.41 No.6, pp. 773-780, doi:10.1108/IJOPM-06-2021-902.
- Mollenkopf, D., Stolze, H., Tate, W. L., and Ueltschy, M. (2010), “Green, lean, and global supply chains”, *International journal of physical distribution & logistics management*, Vol.40 No.1/2, pp.14-41, doi:10.1108/09600031011018028.
- Montalbano, P., Nenci, S. and Pietrobelli, C. (2018), “Opening and linking up: firms, GVCs, and productivity in Latin America”, *Small Business Economics*, Vol.50 No.4, pp.917–935, doi:10.1007/s11187-017-9902-6.
- Moradlou, H., Reefke, H., Skipworth, H. and Roscoe, S. (2021), “Geopolitical disruptions and the manufacturing location decision in multinational company supply chains: a Delphi study on Brexit”, *International Journal of Operations & Production Management*, Vol.41 No.2, pp.102–130, doi:10.1108/IJOPM-07-2020-0465.
- Morandi Stagni, R., Santalo, J. and Giarratana, M.S. (2020), “Product-market competition and resource redeployment in multi-business firms”, *Strategic Management Journal*, Vol.41 No.10, pp.1799-1836, doi:10.1002/smj.3207.
- OECD (2008), *Enhancing the Role of SMEs in Global Value Chains*, OECD Publishing.
- OECD (2024a), OECD Statistics: Environmentally related tax revenue. <https://data-explorer.oecd.org> (accessed_16/July/2024).
- OECD (2024b), OECD Trade in Value-Added (TiVA). <https://www.oecd.org/en/topics/sub-issues/trade-in-value-added.html> (accessed_21/June/2024).
- Özatağan, G. (2010). Dynamics of Value Chain Governance: Increasing Supplier Competence and Changing Power Relations in the Periphery of Automotive Production—Evidence from Bursa, Turkey. *European Planning Studies*, Vol.19 No.1, 77–95, doi:10.1080/09654313.2011.530393.

- Pek, S., Oh, C. H., & Rivera, J. (2018). MNC foreign investment and industrial disasters: The moderating role of technological, safety management, and philanthropic capabilities. *Strategic Management Journal*, Vol.39 No.2, pp. 502-526, doi:10.1002/smj.2737.
- Portugal-Perez, A. and Wilson, J.S. (2012), “Export Performance and Trade Facilitation Reform: Hard and Soft Infrastructure”, *World Development*, Vol.40 No.7, pp.1295–1307, doi:10.1016/j.worlddev.2011.12.002.
- Prajogo, D., Mena, C., and Chowdhury, M. (2021), “The role of strategic collaborations and relational capital in enhancing product performance—a moderated-mediated model”, *International Journal of Operations & Production Management*, Vol.41 No.3, pp.206-226, doi:10.1108/IJOPM-05-2020-0256.
- Reddy, K., Chundakkadan, R. and Sasidharan, S. (2021), “Firm innovation and global value chain participation”, *Small Business Economics*, Vol.57 No.4, pp.1995–2015, doi:10.1007/s11187-020-00391-3.
- Ren, S., He, D., Zhang, T. and Chen, X. (2019), “Symbolic reactions or substantive pro-environmental behaviour? An empirical study of corporate environmental performance under the government’s environmental subsidy scheme”, *Business Strategy and the Environment*, Vol.28 No.6, pp.1148–1165, doi:10.1002/bse.2308.
- Rentizelas, A., de Sousa Jabbour, A.B.L., Al Balushi, A.D. and Tunı, A. (2020), “Social sustainability in the oil and gas industry: institutional pressure and the management of sustainable supply chains”, *Annals of Operations Research*, Vol.290, pp.279-300, doi:10.1007/s10479-018-2821-3.
- Riera, O. and Paetzold, P. (2020), “Global Value Chains and Trade in the EBRD regions”. European Bank of Reconstruction and Development.
- Rivera, J., & Oh, C. H. (2013). “Environmental regulations and multinational corporations' foreign market entry investments”, *Policy Studies Journal*, Vol.41 No 2, pp. 243-272, doi: 10.1111/psj.12016.
- Roscoe, S., Skipworth, H., Aktas, E. and Habib, F. (2020), “Managing supply chain uncertainty arising from geopolitical disruptions: evidence from the pharmaceutical industry and Brexit”, *International Journal of Operations & Production Management*, Vol.40 No.9, pp.1499–1529, doi:10.1108/IJOPM-10-2019-0668.
- Sartal, A., Rodríguez, M. and Vázquez, X.H. (2020), “From efficiency-driven to low-carbon operations management: Implications for labour productivity”, *Journal of Operations Management*, Vol.66 No.3, pp.310–325, doi:10.1002/joom.1060.

- Sawang, S., Ng, P.Y., Kivits, R.A., Dsilva, J. and Locke, J. (2024), “Examining the influence of customers, suppliers, and regulators on environmental practices of SMEs: Evidence from the United Arab Emirates”, *Business Strategy and the Environment*, pp.1–14, doi:10.1002/bse.3831.
- Sena, V., Kanungo, R.P., Ozdemir, S., Yannopoulou, N. and Patel, P. (2023), “Are reshoring decisions influenced by external stakeholders and country-level environmental regulation?”, *British Journal of Management*, Vol.34 No.3, pp.1184–1214, doi:10.1111/1467-8551.12680.
- Simonsohn, U. (2018), “Two lines: A valid alternative to the invalid testing of U-shaped relationships with quadratic regressions”, *Advances in Methods and Practices in Psychological Science*, Vol.1 No.4, pp.538-555, doi:10.1177/2515245918805755.
- Siewers, S., Martínez-Zarzoso, I. and Baghdadi, L. (2024), “Global value chains and firms’ environmental performance”, *World Development*, Vol.173, p.106395, doi:10.1016/j.worlddev.2023.106395.
- Sobir, R. (2020), “Micro-, small and medium-sized enterprises (MSMEs) and their role in achieving the sustainable development goals”, *United Nations Department of Economic and Social Affairs*, pp.2–39.
- Song, W., Han, Y.H. and Sroufe, R. (2022), “Substitution and complementarity dynamics in configurations of sustainable management practices”, *International Journal of Operations & Production Management*, Vol.42 No.11, pp.1711-1731, doi:10.1108/IJOPM-10-2021-0647.
- Soontornthum, T., Cui, L., Lu, V.N. and Su, J. (2020), “Enabling SMEs’ learning from global value chains: linking the logic of power and the logic of embeddedness of interfirm relations”, *Management International Review*, Vol.60 No.4, pp.543–571, doi:10.1007/s11575-020-00425-8.
- Srai, J.S., Graham, G., Van Hoek, R., Joglekar, N. and Lorentz, H. (2023), “Impact pathways: unhooking supply chains from conflict zones—reconfiguration and fragmentation lessons from the Ukraine–Russia war”, *International Journal of Operations & Production Management*, Vol.43 No.13, pp.289–301, doi:10.1108/IJOPM-08-2022-0529.
- Thornton, L.M., Autry, C.W., Gligor, D.M. and Brik, A.B. (2013), “Does socially responsible supplier selection pay off for customer firms? A cross-cultural comparison”, *Journal of Supply Chain Management*, Vol.49 No.3, pp.66–89, doi:10.1111/jscm.12014.
- Wahga, A.I., Blundel, R. and Schaefer, A. (2017), “Understanding the drivers of sustainable entrepreneurial practices in Pakistan’s leather industry: A multi-level approach”,

International Journal of Entrepreneurial Behavior & Research, Vol.24 No.2, pp.382–407, doi:10.1108/IJEER-11-2015-0263.

Wiengarten, F., Pagell, M., Ahmed, M.U. and Gimenez, C. (2014), “Do a country’s logistical capabilities moderate the external integration performance relationship?”, *Journal of Operations Management*, Vol.32 No.1, pp.51–63, doi:10.1016/j.jom.2013.07.001.

World Bank (2024), World Governance Indicators. <https://www.worldbank.org/en/publication/worldwide-governance-indicators> (accessed_21/June/2024).

World Trade Organisation (2024), “Implementation commitments dashboard | TFAD - Trade Facilitation Agreement Database”, available at: <https://tfadatabase.org/en/implementation> (accessed_26/March/2024).

Xu, B., Li, S., Afzal, A., Mirza, N. and Zhang, M. (2022), “The impact of financial development on environmental sustainability: A European perspective”, *Resources Policy*, Vol.78, p.102814, doi:10.1016/j.resourpol.2022.102814.

Yang, Y., Lau, A.K., Lee, P.K., Yeung, A.C. and Cheng, T.E. (2019), “Efficacy of China’s strategic environmental management in its institutional environment”, *International Journal of Operations & Production Management*, Vol.39 No.1, pp.138-163, doi:10.1108/IJOPM-11-2017-0695.

Zhang, Y. and Gregory, M. (2011), “Managing global network operations along the engineering value chain”, *International Journal of Operations & Production Management*, Vol.31 No.7, pp. 736-764, doi:10.1108/01443571111144832.

Table I. Sample selection

Source/Filter	Number of firms
Initial sample on the WBES dataset. Firms that appear in more than one wave (excludes Waves 1 & 2)	9,575
Remove large firms (more than 100 employees)	8,074
Remove firms not part of GVCs	3,586
Remove SMEs with missing observations	1,513
Remove countries with limited observations	1,492
Remove countries without trade facilitation data	1,462

Note: The countries that were excluded due to the small representation are Albania, Armenia, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, Georgia and Hungary. Kosovo was excluded due to the absence of OECD trade facilitation indicator data. The final sample includes the following countries along with the percentage of firms for each: Kazakhstan (3%), Kyrgyz Republic (4%), Latvia (2%), Lithuania (2%), Macedonia FYR (2%), Moldova (2%), Mongolia (3%), Montenegro (1%), Poland (3%), Romania (6%), Russian Federation (22%), Serbia (5%), Slovak Republic (2%), Slovenia (3%), Tajikistan (3%), Turkey (25%), Ukraine (6%), Uzbekistan (5%).

Indicator No	Indicator description	UN_SDG
1	Over last 3 years, did this establishment monitor its energy consumption?	UN_SDG 7
2	Over last 3 years, completed external energy consumption audit?	UN_SDG 7
3	Over last 3 years, did this establishment monitor its water usage?	UN_SDG 6 UN_SDG 15
4	Over last 3 years, did this establishment complete external water usage audit?	UN_SDG 6
5	Over last 3 years, did this establishment monitor its CO2 emissions?	UN_SDG 13
6	Over last 3 years, completed external audit of CO2 emissions?	UN_SDG 13
7	Over last 3 years, monitor CO2 emissions along its supply chain?	UN_SDG 13
8	Over last 3 years, did this establishment monitor pollutants other than CO2?	UN_SDG 13
9	Over last 3 years, completed external audit on pollutants other than CO2?	UN_SDG 13
10	Over last 3 years, did this establishment have targets on energy consumption?	UN_SDG 7
11	Over last 3 years, did this establishment have targets for CO2 emissions?	UN_SDG 13
12	Over last 3 years, have targets for pollution emissions other than CO2?	UN_SDG 13
13	Is environment/Climate change manager evaluated on meeting environmental targets?	UN_SDG 12
14	Over last 3 years, did this establishment adopt heating and cooling improvements?	UN_SDG 13
15	Over last 3 years, did this establishment adopt more climate-friendly energy generation on site?	UN_SDG 13
16	Over last 3 years, did this establishment adopt machinery upgrades?	UN_SDG 12
17	Over last 3 years, did this establishment adopt energy management?	UN_SDG 7
18	Over last 3 years, did this establishment adopt waste minimisation, recycling, and waste management	UN_SDG 12 UN_SDG 15
19	Over last 3 years, did this establishment adopt air pollution control measures	UN_SDG 13
20	Over last 3 years, did this establishment adopt water management	UN_SDG 6 UN_SDG 15
21	Over last 3 years, did this establishment perform upgrades of vehicles, vessels, aircraft in the fleet?	UN_SDG 12
22	Over last 3 years, did this establishment adopt improvement of lighting systems?	UN_SDG 7
23	Over last 3 years, did this establishment adopt other pollution control measures?	UN_SDG 12 UN_SDG 15
24	Over last 3 years, did this establishment adopt any measures to enhance energy efficiency?	UN_SDG 7
25	Over last 3 years, were any of these measures developed by the establishment?	UN_SDG 12
26	In last FY, use energy from its own renewable sources?	UN_SDG 13

Table II. Items used to capture the use of environmental management practices

Table III. Descriptive statistics and Pearson correlation matrix

Variables	Mean	Median	Var.	SD	1	2	3	4	5	6	7	8	9
1. Envir. management practices	4.00	3.00	15.66	3.96	1								
2. GVC entry	0.17	0.00	0.15	0.38	0.09**	1							
3. GVC exit	0.22	0.00	0.17	0.41	-0.05	0.02	1						
4. Trade facilitation	1.43	1.56	0.09	0.30	-0.06*	0.04	0.09**	1					
5. Firm age	19.41	17.00	125.25	11.2	0.09**	0.09**	0.03	-0.04	1				
6. Firm size	22.89	14.00	695.24	26.37	0.09**	0.18**	0.07**	0.01	0.09**	1			
7. Financial performance	0.18	0.13	0.08	0.28	0.02	0.04	0.02	-0.06*	-0.04	0.04	1		
8. Firm ownership	0.01	0.00	0.04	0.11	0.08**	0.08**	0.02	-0.07*	0.01	0.07*	-0.03	1	
9. Financial leverage	9.95	0.00	368.70	19.2	0.04	0.10**	-0.04	-0.00	0.03	0.06*	0.01	-0.03	1
10. Industry association	0.4	0.00	0.24	0.49	0.11**	0.07**	0.13**	0.15**	0.13**	0.06*	0.07*	0.01	0.07**
11. Access to finance	2.76	3.00	1.80	1.34	-0.02	-0.02	-0.04	-0.04	0.01	0.00	-0.02	-0.02	-0.04
12. Contracting ability	0.22	0.00	0.17	0.41	0.02	-0.04	0.00	0.02	-0.03	-0.02	-0.02	-0.05*	0.02
13. Environmental regulations	0.60	1.00	2.40	0.49	0.06*	0.09**	0.15**	0.18**	0.25**	-0.04	0.03*	0.01*	0.06*
14. Use of foreign technology	0.11	0.00	0.10	0.32	0.11**	0.14**	-0.03	0.03	0.02	0.11**	0.02	0.10**	0.06*
15. Top manager experience	20.50	20.00	112.78	0.50	0.06*	0.07**	0.03	0.05*	0.45**	0.02	-0.03	0.01	0.08**
16. GVC position	0.47	0.00	0.25	0.50	-0.01	-0.09**	-0.11**	-0.09**	-0.23**	-0.00	-0.04	-0.12**	-0.08**
17. Political stability	-0.49	-0.55	0.54	6.03	0.07**	-0.03	-0.16**	0.02	-0.02	-0.13**	-0.10**	0.09**	0.02
18. Economic complexity	0.32	0.23	0.36	0.60	0.04	0.08**	0.13**	0.62**	0.21**	-0.01	-0.04	0.05*	0.03
19. Product complexity	89.83	100	260.38	16.08	-0.06*	-0.05*	0.07**	-0.00	-0.02	-0.01	0.01	-0.03	-0.02

Table III. Continued

Variables	10	11	12	13	14	15	16	17	18
11. Access to finance	-0.11**	1							
12. Contracting ability	-0.04	-0.03	1						
13. Environmental regulations	0.38**	-0.08**	-0.06*	1					
14. Use of foreign technology	0.05	0.00	-0.01	0.08**	1				
15. Top manager experience	0.22**	-0.07**	-0.03	0.21**	0.05	1			
16. GVC position	-0.46**	0.11**	0.10**	-0.48**	-0.12**	-0.32**	1		
17. Political stability	-0.34**	0.04	0.04	-0.05**	0.06*	-0.13**	0.08**	1	
18. Economic complexity	0.22**	0.03	-0.06*	0.56**	0.16**	0.24**	-0.52**	0.11**	1
19. Product complexity	0.10**	-0.08**	-0.04	0.15**	-0.06*	0.04	-0.11**	-0.11**	0.00

Note: ** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed). Var.= Variance. SD= Standard deviation. Descriptive statistics are based on non-transformed data. We acknowledge that environmental regulations are highly correlated with trade association membership. We run our regressions without this variable to derive the same result.

Table IV. Results of moderated regression predicting the use of environmental management practices

Variables	Model 1	Model 2	Model 3	Model 4	Model 5
GVC entry	0.062* (0.029)	0.062* (0.030)	0.062* (0.027)	0.059* (0.027)	0.056* (0.027)
GVC exit	-0.072** (0.027)	-0.070* (0.027)	-0.072** (0.027)	-0.060* (0.028)	-0.040 (0.028)
Trade facilitation	-0.071** (0.027)	-0.774* (0.303)	-0.072** (0.027)	-0.087** (0.029)	-1.130*** (0.327)
Trade facilitation squared		0.698* (0.304)			1.024** (0.322)
Interaction effects					
GVC entry x Trade facilitation			-0.005 (0.028)		
GVC exit x Trade facilitation				-0.092** (0.030)	-0.883* (0.346)
GVC exit x Trade facilitation squared					0.765* (0.338)
Control variables					
Firm age	0.061* (0.028)	0.061* (0.027)	-0.060* (0.027)	0.062** (0.027)	0.063** (0.027)
Firm size	0.064* (0.028)	0.063* (0.029)	0.064* (0.027)	0.066* (0.027)	0.066* (0.027)
Financial performance	0.014 (0.026)	0.007 (0.026)	0.014 (0.026)	0.018 (0.026)	0.015 (0.026)
Firm ownership	0.068** (0.026)	0.067** (0.026)	0.068** (0.026)	0.069** (0.026)	0.067 (0.026)
Financial leverage	0.016 (0.031)	0.018 (0.026)	0.016 (0.026)	0.013 (0.026)	0.014 (0.026)
Industry association	0.098** (0.028)	0.106*** (0.031)	0.097*** (0.029)	0.102*** (0.029)	0.120*** (0.029)
Access to finance	-0.005 (0.026)	-0.013 (0.028)	-0.006 (0.026)	-0.065 (0.026)	-0.015 (0.026)
Contracting ability	0.038 (0.026)	0.040 (0.026)	0.038 (0.026)	0.037 (0.026)	0.036 (0.026)
Environmental regulations	0.022 (0.031)	0.050 (0.034)	0.022 (0.030)	0.016 (0.030)	0.051 (0.032)
Industry effect	YES	YES	YES	YES	YES
R ²	0.044	0.052	0.048	0.054	0.062
Adjusted R ²	0.032	0.039	0.035	0.041	0.048
F-statistic	3.658	3.928	3.661	4.144	4.347
Number of observations	1,462	1,462	1,462	1,462	1,462

Note: *** Significant level 0.001, ** Significant level 0.01, * Significant level 0.05. Moderation was run using PROCESS Models 1 and 2. Dependent variable = environmental management practices. The standard errors for each estimate are shown in parentheses.

Table V. Robustness test considering direct and indirect participation in GVCs

Panel A: Regression for the level of participation in GVCs (Direct)			
Variables	Model 1	Model 2	Model 3
Direct GVC entry	0.046† (0.027)	0.043 (0.027)	0.040 (0.027)
Direct GVC exit	-0.075** (0.027)	-0.060* (0.028)	-0.042 (0.029)
Trade facilitation	-0.067* (0.027)	-0.078** (0.027)	0.980** (0.319)
Trade facilitation squared			0.888** (0.315)
Interaction effects			
Direct GVC entry x Trade facilitation	-0.014		
Direct GVC exit x Trade facilitation		-0.077* (0.030)	-0.838* (0.330)
Direct GVC exit x Trade facilitation squared			0.739* (0.322)
Control variables			
	Yes	Yes	Yes
R ²	0.048	0.052	0.059
Adjusted R ²	0.033	0.038	0.046
F-statistic	3.578	3.872	4.052
Number of observations	1,443	1,443	1,443
Panel B: Regression for the level of participation in GVCs (Indirect)			
Variables	Model 1	Model 2	Model 3
Indirect GVC entry	0.033 (0.028)	0.036 (0.028)	0.035 (0.027)
Indirect GVC exit	-0.043 (0.027)	-0.033 (0.028)	-0.028 (0.031)
Trade facilitation	-0.087** (0.029)	-0.095*** (0.030)	-1.311*** (0.360)
Trade facilitation squared			1.200*** (0.352)
Interaction effects			
Indirect GVC entry x Trade facilitation	0.023 (0.030)		
Indirect GVC exit x Trade facilitation		-0.062 (0.034)	-0.145 (0.465)
Indirect GVC exit x Trade facilitation squared			0.071 (0.449)
Control variables			
	Yes	Yes	Yes
R ²	0.047	0.049	0.058
Adjusted R ²	0.036	0.038	0.042
F-statistic	3.403	3.546	3.794
Number of observations	1,389	1,389	1,389

Note: *** Significant level 0.001, ** Significant level 0.01, * Significant level 0.05, † Significant level 0.10. Moderation was run using PROCESS Models 1 and 2. After accounting for missing values for direct and indirect participation we lose 19 observations for panel A and 73 observations for panel B. Dependent variable = environmental management practices. The standard errors for each estimate are shown in parentheses.

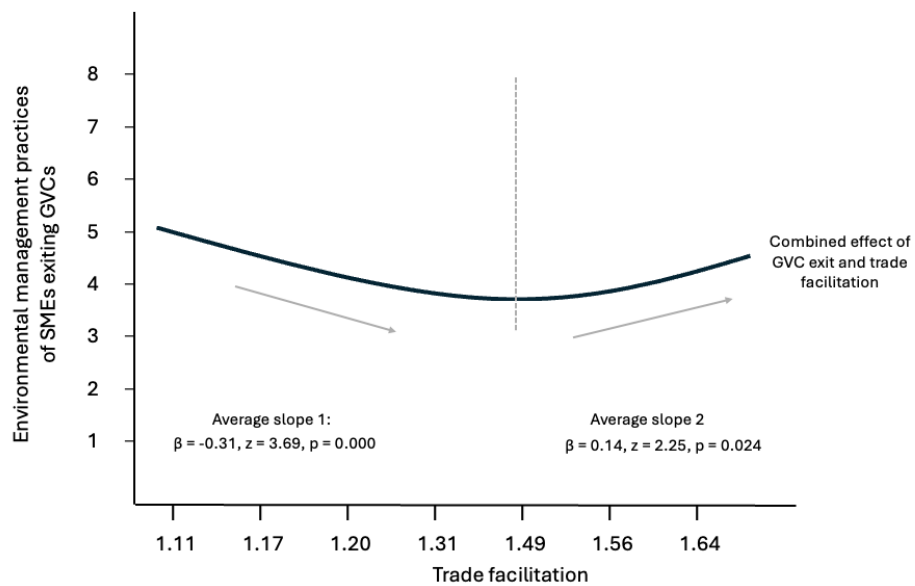
Table VI. Results of two-stage least squares regression predicting the use of environmental management practices

Variables	Model 1	Model 2	Model 3	Model 4	Model 5
GVC entry	0.072** (0.029)	0.068** (0.031)	0.069* (0.029)	0.063* (0.027)	0.060* (0.027)
GVC exit	-0.073*** (0.028)	-0.123*** (0.033)	-0.077*** (0.028)	-0.200*** (0.035)	-0.099* (0.052)
Trade facilitation	-0.878*** (0.316)	-0.657* (0.299)	-0.071* (0.032)	-0.156*** (0.034)	-2.637*** (0.599)
Trade facilitation squared	0.807** (0.314)	-0.614*(0.300)			2.401*** (0.576)
Interaction effects					
GVC entry x Trade facilitation			0.089 (0.302)		
GVC exit x Trade facilitation				-0.247*** (0.040)	-1.657** (0.546)
GVC exit x Trade facilitation squared					1.377* (0.547)
Control variables					
Firm age	0.049 (0.028)	0.083*** (0.029)	0.049 (0.029)	0.071* (0.028)	0.067* (0.028)
Firm size	0.078*** (0.027)	0.067* (0.029)	0.080*** (0.028)	0.066* (0.027)	0.068* (0.027)
Financial performance	0.012 (0.026)	0.018 (0.027)	0.019 (0.026)	0.042 (0.026)	0.042 (0.026)
Firm ownership	0.072*** (0.027)	0.053* (0.026)	0.073** (0.027)	0.045 (0.026)	0.035 (0.026)
Financial leverage	0.014 (0.027)	0.022 (0.026)	0.012 (0.027)	0.024 (0.026)	0.028 (0.026)
Industry association	0.096*** (0.029)	0.126*** (0.035)	0.087*** (0.029)	0.200*** (0.033)	0.230*** (0.034)
Access to finance	-0.021 (0.027)	-0.004 (0.028)	-0.013 (0.026)	-0.022 (0.026)	-0.037 (0.027)
Contracting ability	0.042 (0.026)	0.032 (0.027)	0.040 (0.026)	0.024 (0.026)	0.024 (0.026)
Environmental regulations	0.045 (0.033)	0.069 (0.036)	0.014 (0.032)	0.022 (0.031)	0.073 (0.034)
Industry effect	YES	YES	YES	YES	YES
R ²	0.057	0.057	0.053	0.079	0.093
Adjusted R ²	0.043	0.044	0.039	0.067	0.078
F-statistic	4.214	4.185	3.869	6.083	6.510
Number of observations	1,415	1,427	1,415	1,427	1,427

Note: *** Significant level 0.001, ** Significant level 0.01, * Significant level 0.05, † Significant level 0.10. Moderation was run using PROCESS Models 1 and 2. In the model 1 GVC entry is instrumented and in the Model 2 GVC exit is instrumented. Dependent variable = environmental management practices. The standard errors for each estimate are shown in parentheses. 1. Diagnostic tests for instrumental variables were conducted using STATA. 2. Relevant extracts for the first stage in 2SLS regression – GVC entry instruments: foreign technology usage ($\beta = 0.159^{***}$), top manager experience ($\beta = 0.064^\dagger$), GVC position ($\beta = -0.042^*$) and F-test statistic (13.26***). For GVC exit instruments: product complexity (0.001*), economic complexity (0.098***), political stability (-0.094***) and F-test statistic (23.96***). The Kleibergen-Paap rk LM statistic for GVC entry instruments (10.421), GVC exit instruments (24.297). The instruments surpass the critical values for the Stock and Yogo test indicating that the instruments are relevant and not

weak. 3. weakiv results for ivreg: GVC entry instruments - Conditional likelihood ratio test (14.29***), J over-identification test (8.82**), Anderson-Rubin (AR) test statistic (19.80***), and Wald's χ^2 (11.44***). GVC Exit instruments - Conditional likelihood ratio test (2.84†), J over-identification test (10.00**), Anderson-Rubin test statistic (11.95**), and Wald's χ^2 (3.63†).

Figure 1. Testing U-shape effects of trade-facilitation



Note: Values used to estimate average slopes are based on trade facilitation squared.

Global value chains, trade facilitation, and the use of environmental management practices in SMEs

- 1. Online Supplement – A: The option value for environmental management practices and trade facilitation**
- 2. Online Supplement – B: Post hoc analysis**

Online supplement - A

Examining the factors that are associated with companies' use of environmental management practices in GVCs can enhance the understanding of how GVC participation generates an option value for these practices and their broader implications. We consider that these environmental management practices have an operational cost to maintain c_e . In general, if a profit-maximising firm has a choice, it will not choose to incur such costs unless there is a counterbalancing profit opportunity made possible by incurring these costs. This section develops a simplified model of these factors. In this model, we focus on a genuine and common choice for law-abiding firms: the choice to use environmental management practices that are not necessarily adopted to comply with domestic law.

We assume that the order of decision-making is that the firm, assumed not in a GVC, chooses whether to use the practices and then experiences a probability of *new* integration into a GVC. The GVC can itself be either favouring or not favouring environmental management practices. If the firm wins a customer as part of a GVC with environmental management practices, it receives revenue R_e and if the firm wins a customer as part of a GVC that does not reward environmental management practices, it receives revenue R_{ne} .

If the firm receives a GVC contract, the additional profits of a firm that has maintained its environmental management practices are $R - c_e$. Maintenance of such practices is not strictly necessary to obtain new contracts, however. If the firm has no environmental management practices but receives a new GVC contract, the additional revenues of the firm are R , and thus profits from a new customer are somewhat higher because the firm did not incur the operational costs without having a strict necessity to do so.

The probability of a new customer arriving is given by λ , where λ_e is the arrival probability when environmental management practices are maintained in place and λ_{ne} represents the probability when such practices were not maintained (and then must be instituted upon the arrival of the new GVC customer) and λ_n represents the probability of winning a contract in a GVC with no environmental management practice requirement. We assume that the likelihood of new GVC customer arrival is higher for a firm that is currently engaging in environmental management practices, due to increased certainty of meeting pro-environmental supply chain criteria and the lack of uncertainty over the speed of adoption of such practices in case they had not been present. Thus $1 > \lambda_e > \lambda_{ne} > 0$. The probability of winning a contract in a GVC with no environment management practice requirement is assumed not related to the maintenance of environmental management practices.

The probability of a GVC customer arrival is related to the trade facilitation environment. Let γ be a continuous variable representing trade facilitation's effect on the probability of winning of contracts that varies between 1 and 0, with $1 \geq \gamma > 0$. The highest trade facilitation environment is equivalent to $\gamma = 1$. As the trade facilitation environment becomes less amenable to trade, the trade facilitation variable declines in value. It approaches zero in the worst trade environments but as long as trade can occur, it is greater than zero. Trade facilitation can itself have different GVC consequences. In particular, γ_e represents the strength of the trade facilitation environment towards environmental management practice GVCs and γ_{ne} represents the strength of the connection to low environment management practice GVCs.

The profits for a firm from purely domestic customers for which no environmental management practices are mandated (besides those in law) is a . These occur whether the firm enters a GVC or not.

The expected profits for a firm are a combination of revenue, cost, customer contracting, and trade facilitation features.

We can now characterise expected profits, first in the case in which a firm uses environmental management practices (which thus affect operational costs), which we denote $E\pi_e$, and second in the case in which no environmental management practices are used, apart from those mandated by domestic law, which we denote $E\pi_{ne}$.

In the case of maintaining the practices, expected profits are given by:

$$\begin{aligned} E\pi_e &= a + \gamma_e \lambda_e (R_e - c_e) + \gamma_{ne} \lambda_{ne} (R_{ne} - c_e) \\ &\quad - (1 - \gamma_e \lambda_e - \gamma_{ne} \lambda_{ne}) c_e E\pi_e \\ &= a + \gamma \lambda_e (R - c_e) - (1 - \gamma \lambda_e) c_e \end{aligned} \tag{A1}$$

This represents the sum of domestic profits, expected earnings from environmental management practices given the trade facilitation towards environmental practices GVCs, expected earnings from non-environmental practice management from profits in GVCs with low environment management practices, and costs from maintaining environment management practices in absence of any success with GVCs.

In the case of not maintaining the practices, expected profits are given by:

$$E\pi_{ne} = a + \gamma_e \lambda_{ne} R_e + \gamma_{ne} \lambda_{ne} R_{ne} \gamma \lambda_{ne} R \tag{A2}$$

This represents the sum of domestic profits, expected earnings from environmental management practices given the trade facilitation towards GVCs with environmental practices, but with the firm not having sustained environmental management practices, and the expected earnings from non-environmental practice management from profits in GVCs with low environment management practices. In this case, there are no costs from maintaining environment management practices without a related GVC contract.

Proposition A1. There exist values of new customer revenue and environmental management operation costs such that a firm may wish to use environmental management practices to maintain the option of GVC business gains.

Proof: To find whether and when profits may be higher from using the environmental business practices, i.e., when $E\pi_e > E\pi_{ne}$, we note, by substitution of A1 and A2, that the inequality is satisfied when:

$$\begin{aligned} a + \gamma_e \lambda_e (R_e - c_e) + \gamma_{ne} \lambda_{ne} (R_{ne} - c_e) - (1 - \gamma_e \lambda_e - \gamma_{ne} \lambda_{ne}) c_e & \quad (A3) \\ > a + \gamma_e \lambda_{ne} R_e + \gamma_{ne} \lambda_n R_{ne} \end{aligned}$$

Simplifying and rearranging,

$$\gamma_e (\lambda_e - \lambda_{ne}) R_e + \gamma_{ne} (\lambda_e - \lambda_n) R_{ne} > (1 - \gamma_e \lambda_e - \gamma_{ne} \lambda_{ne}) c_e$$

And dividing through by $\gamma (\lambda_e - \lambda_{ne})$ which is positive by construction,

$$R_e > \frac{(1 - \gamma_e \lambda_e - \gamma_{ne} \lambda_{ne}) c_e + \gamma_{ne} (\lambda_e - \lambda_n) R_{ne}}{\gamma_e (\lambda_e - \lambda_{ne})} \quad (A4)$$

From this relation, the proposition is established by feasibility. The feasibility most fundamentally follows from the fact that the numerator could be negative, notably if the profits from non-environmental practices for GVC were zero and if the multiplier on costs, c_e , is negative, if $1 < \gamma_e \lambda_e + \gamma_{ne} \lambda_{ne}$.

The relationship underlying the operational choice to use environmental management practices explains how firm benefits, in the form of profits, support H1 and H2. We note that this proposition hinges upon the greater likelihood for a company with established environmental management practices of entering a GVC than the likelihood when the practice

is not implemented. In the absence of such a difference in likelihoods, the profit-maximising firm would not exceed the legally mandated requirements.

Proposition A2. The desirability of using costly environmental management practices depends on the orientation of trade facilitation toward GVCs that either prioritize or disregard environmental management, as well as on their relative profitability.

Proof: As the indicator of trade facilitation to GVCs with environmental management practices falls, the numerator becomes smaller and the right-hand side of the inequality in A4 increases. This means that the minimum revenue value needed to justify the ongoing maintenance of environmental management practices goes up. On the other hand, as the indicator of trade facilitation to GVCs with low environment management practices falls, the numerator decreases. As the profits from a contract with a GVC with low environment management practices falls, the numerator decreases. These relationships in isolation may be considered to support H3. But the relationship is more complex, due to distinct impacts of different types of trade facilitation. As the profits from a contract with a GVC with environment management practices rises, the relative size of the left-hand side increases, as does the probability of the relationship being satisfied. This means that there are forces moving in directions against environment management practices depending on the end-GVC destination of trade facilitation and potential differences in relative profits from each. The variable for trade facilitation in this model does not have a simple linear relationship with a profit-maximising outcome but appears more complex and non-linear. These relationships are consistent with the U-shaped relationship suggested by H4. To limit the complexity, we do not model the possible relationship between import and export trade facilitation, but to the extent these are associated, they may also inversely affect the value of domestic profits as well as GVC profits.

Online supplement - B

Discussing exports and imports in aggregate can obscure important distinctions in their association with the use of environmental management practices of SMEs, as the motivations and processes behind these activities are often distinct. For instance, SMEs engaged in outsourcing may prioritise cost savings, potentially at the expense of selecting green suppliers, while companies with international buyers—particularly from countries with stringent environmental regulations—may face external pressures to use environmental management practices. Our study acknowledges these complexities.

While our initial analysis utilised exporting and importing as proxies for GVC participation, consistent with prior research (Reddy et al., 2021), we recognise that SMEs at different stages of GVC involvement may encounter diverse motivations and pressures related to environmental practices. To explore this further, we conducted a post-hoc analysis focusing separately on SMEs involved in importing/outsourcing and those engaged in exporting.

The results, presented in Panel A of Table B-1, indicate that SMEs involved in importing and outsourcing are more likely to use environmental management practices upon entering GVCs. This may reflect normative pressures from suppliers within the broader GVC. Recent research (Sawang et al., 2024) similarly suggests that while outsourcing decisions may initially be driven by cost concerns, participation in GVCs exposes SMEs to sustainability-related pressures that encourage the use of environmental practices. This finding suggests that, whereas the initial motivation for outsourcing may relate to cost savings, participation in GVCs is associated with broader sustainability pressures that coincide with the use of environmental management practices.

Similarly, our analysis of exporting SMEs, detailed in Panel B of Table B-1, indicates a consistent pattern: exporting SMEs also use environmental management practices as they integrate into GVCs. While our dataset does not permit identification of export destinations, limiting our ability to examine the potential effects of exporting to countries with stronger environmental regulations, this presents an avenue for future research. Such studies could explore whether SMEs exporting to highly regulated markets exhibit greater engagement with environmental practices than those exporting to less regulated environments.

These findings suggest that SMEs recognise the necessity of meeting environmental standards as a condition for participating in GVCs, regardless of the primary motivations of buyers. Importantly, our results support the view that SMEs often perceive environmental management as an option value—a strategic capability enabling flexibility in responding to market demands and regulatory changes. This aligns with previous studies (Wahga et al., 2019;

Arora & De, 2020), which highlight the role of environmental management practices in helping SMEs maintain their competitive position within GVCs.

Table B-1 Post-hoc analysis considering the level of participation in GVCs

Panel A: Regression for the level of participation in GVCs (Importing/Outsourcing)	
Variables	Model 1
Import entry	0.045† (0.027)
Trade facilitation	-0.074** (0.027)
Control variables	Yes
R ²	0.042
Adjusted R ²	0.030
F-statistic	3.486
Number of observations	1,462
Panel B: Regression for the level of participation in GVCs (Exporting)	
Variables	Model 1
Exports entry	0.11*** (0.028)
Trade facilitation	-0.080** (0.027)
Control variables	Yes
R ²	0.049
Adjusted R ²	0.037
F-statistic	4.151
Number of observations	1,462

Note: *** Significant level 0.001, ** Significant level 0.01, * Significant level 0.05, † Significant level 0.10. Moderation was run using PROCESS Models 1 and 2.

References

- Arora, P. and De, P. (2020), “Environmental sustainability practices and exports: The interplay of strategy and institutions in Latin America”, *Journal of World Business*, Vol.55 No.4, p.101094, doi:10.1016/j.jwb.2020.101094.
- Reddy, K., Chundakkadan, R. and Sasidharan, S. (2021), “Firm innovation and global value chain participation”, *Small Business Economics*, Vol.57 No.4, pp.1995–2015, doi:10.1007/s11187-020-00391-3.
- Sawang, S., Ng, P.Y., Kivits, R.A., Dsilva, J. and Locke, J. (2024), “Examining the influence of customers, suppliers, and regulators on environmental practices of SMEs: Evidence from the United Arab Emirates”, *Business Strategy and the Environment*, pp.1–14, doi:10.1002/bse.3831.
- Wahga, A.I., Blundel, R. and Schaefer, A. (2017), “Understanding the drivers of sustainable entrepreneurial practices in Pakistan’s leather industry: A multi-level approach”,

International Journal of Entrepreneurial Behavior & Research, Vol.24 No.2, pp.382–407,
doi:10.1108/IJEBR-11-2015-0263.