



Learning-by-exporting: The strategic role of organizational innovation

Jill Josefina Juergensen^a, James H. Love^b, Irina Surdu^{c,*}, Rajneesh Narula^d

^a Assistant Professor of International Business and Strategy, Surrey Business School, University of Surrey, United Kingdom A: Rik Medlik Building, Guildford, Surrey GU2 7XH, United Kingdom

^b Professor of International Business, Leeds University Business School, University of Leeds, United Kingdom A: Leeds University Business School, Maurice Keyworth Building, Woodhouse, Leeds LS2 9JT, United Kingdom

^c Professor of International Business Strategy, Warwick Business School, University of Warwick, United Kingdom A: Warwick Business School, Scarman Road, CV4 7AL, United Kingdom

^d Professor of International Business Regulation, Henley Business School, University of Reading, United Kingdom, A: University of Reading, Whiteknights, PO Box 217, Reading, Berkshire RG6 6AH, United Kingdom

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ABSTRACT

Drawing on organizational learning theory, this study examines the strategic role of organizational innovation in learning to innovate by exporting, commonly known as ‘learning-by-exporting’ (LBE). We explain that mere knowledge access is distinct from the enactment of knowledge, and this matters for LBE. Despite growing interest in how firms enhance product innovation performance through exporting and thus, LBE, previous literature has remained silent on the role played by strategically induced changes to organizational routines when learning. We hypothesize that some exporters will introduce organizational innovations – aimed at changing internal practices and routines – which then allows them to enact new knowledge and enhance innovation performance following engagement in export markets. We study our hypotheses, using panel data of 1489 medium-sized manufacturing firms taken from the Mannheim Innovation Panel, the German contribution to the Community Innovation Survey (CIS). We find LBE effects solely amongst firms which adopted organizational innovations during the studied period. Further, our findings revealed that the extent and type of organizational innovation markedly influences LBE. Our study uses a novel context to explain that it is the presence and extent of organizational innovations which influence firms’ abilities to enhance product innovation performance following international engagement through exports.

1. Introduction

Exporting and innovation are interdependent, and together, they affect a firm’s competitiveness, growth and survival (D’Angelo, Ganotakis, & Love, 2020; Freixanet & Rialp, 2022; Golovko & Valentini, 2011; Massini, Piscitello, & Shevtsova, 2023). While the so-called self-selection hypothesis proposes that more innovative firms enter the export market, the learning-by-exporting (hereafter LBE) hypothesis asserts that exporting exposes firms to (new) knowledge not available at home, thereby offering important learning opportunities (Vendrell-Herrero, Darko, Gomes, & Lehman, 2022). Provided that the knowledge acquired from exporting is used effectively, it can enhance product innovation performance (Freixanet & Rialp, 2022; Golovko & Valentini, 2014; Salomon & Shaver, 2005; Salomon & Jin, 2010).

Regarded as the most common form of foreign market entry mode (Gkypali, Love, & Roper, 2021), understanding how exporting can strategically contribute to a firm’s innovation outputs remains pertinent to scholars, managers, and policymakers alike.

But how is the knowledge accessed internationally used and converted into learning? Increasingly, studies found the LBE effect to be highly nuanced and context-specific, resulting in mixed findings around whether and how modern firms learn from exporting. Where LBE is explored in more depth, studies concluded that some exporters are better equipped to learn from exporting than others, which is mainly due to firm-specific factors (Ganotakis, Konara, Kafourous, & Love, 2022; Golovko & Valentini, 2014; Sánchez-Marín, Pemartín, & Monreal-Pérez, 2020). Several studies highlighted the moderating role of a firm’s technological and research and development (R&D) capabilities which

* Corresponding author.

E-mail addresses: j.juergensen@surrey.ac.uk (J.J. Juergensen), J.H.Love@leeds.ac.uk (J.H. Love), irina.surdu@wbs.ac.uk (I. Surdu), r.narula@henley.ac.uk (R. Narula).

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are reflective of absorptive capacity (D'Angelo et al., 2020; Salomon & Jin, 2010). Other works identified a firm's engagement with external business partners (Ogasavara, Boehe, & Cruz, 2016) and the type of firm ownership (Freixanet, Monreal, & Sánchez-Marín, 2021; Sánchez-Marín et al., 2020) as factors enabling LBE in the focal firm. More recently, studies considered firms' marketing capabilities (Golovko, Lopes-Bento, & Sofka, 2022; Golovko, Lopes-Bento, & Sofka, 2023). Taken together, research on LBE is, indeed, vast. Even so, little effort has been placed on the *organizational routines* which enable some firms not only to learn from foreign markets, but to then convert the knowledge accessed abroad into tangible innovation outputs (c.f. Freixanet & Federo, 2023).

In this paper, we propose that some firm managers strategically induce changes to firm routines, via so-called *organizational innovation*, following engagement in the export market. Organizational innovation - "a new organizational method in the firm's business practices, workplace organization or external relations" (OECD/Eurostat, 2005: 51) - we propose, explains the heterogeneity observed in exporters' learning and innovation performance outcomes. Whilst the full antecedents of organizational innovation are multifaceted (for a comprehensive discussion, see Damanpour & Aravind, 2012), we specifically argue that some exporters will engage in organizational innovations, whilst others will not. In some cases, managers may view and pursue their firms' exporting activities based on purely exploitative goals, thereby primarily paying attention to the firms' existing products and organizational routines (Lages, Jap, & Griffith, 2008; Ocasio, 1997, 2011). Thus, more explorative learning opportunities arising from engagement in export markets, and relevant for innovation, may get lost (March, 1991). In turn, others are more receptive to learning opportunities in export markets, strategically integrating new knowledge and amending internal practices and routines via organizational innovation. While not all exporters engage in organizational innovation, those which do may be better equipped to learn from exporting activities. We therefore ask: What is the strategic role of organizational innovation for LBE?

Drawing on organizational learning theory and behavioral reasoning (Cyert & March, 1963; Levitt & March, 1988), this paper examines the distinct role of organizational innovation in explaining LBE. By conceptualizing learning as a function of both knowledge access and integration (Huber, 1991), we explain why and how organizational innovation serves as an important structural mechanism for firms to alter their routines and evolve internally, to foster effective LBE. We test our hypotheses on a sample of 1489 manufacturing firms, taken from three consecutive waves (2013–2017) of the Mannheim Innovation Panel (MIP), which is the German contribution to the Community Innovation Survey (CIS). Empirically, we distinguish between firms which did engage in organizational innovation efforts during the studied period and those which did not, by incorporating moderation effects. Surprisingly perhaps, we find little support for LBE amongst German exporters, until we include organizational innovation in our models. Firms which adopted organizational innovation experienced clear LBE effects, unlike firms which did not adopt organizational innovation. Importantly, we find, and discuss, that the extent to which firms adopted organizational innovations also matters.

Our study makes several contributions to theory and practice. First, we offer a more nuanced understanding of LBE by considering that some firms, following engagement in the export market, adopt organizational innovation(s), allowing them to access and integrate knowledge from export markets more effectively, compared to firms which leave their routines unchanged. Despite the wealth of LBE studies to date, few studies have considered how strategic changes to internal organizational routines, via organizational innovation, can enhance firms' ability to LBE (Freixanet & Federo, 2023). Second and relatedly, because exporters' behaviors are not static (D'Angelo et al., 2020), some exporters strategically evolve and adapt internally, in parallel to greater export intensity. Those firms which show the ability, and commitment, to upgrade their routines, through organizational innovation, become more effective learners in foreign markets. Here, we explain LBE effects not

only in terms of *whether* a firm upgrades its organizational practices and routines, but also to *what extent* the firm does so, contributing to a more nuanced understanding of the strategic role of organizational innovation for LBE. In this regard, our paper offers important insights into the internal organizational mechanisms which explain why only some firms, in fact, experience LBE effects while others may miss out on the rich learning opportunities that export markets tend to offer practicing managers.

Third, we discuss and interpret our findings by drawing on the behavioural lens. From a behavioral theoretical view, firms often experience possibly conflicting organizational goals (Cyert & March, 1963; Gavetti, Greve, Levinthal, & Ocasio, 2012). Previous research suggests that firms may, indeed, be faced with being able to enhance either their product innovation or their presence in export markets, likely due to limited (financial and human) resources (e.g., see Bahl, Lahiri, & Mukherjee, 2021; Kriz & Welch, 2018; Roper & Love, 2002). Notably, our results could suggest that the strategic upgrading of organizational routines, via targeted organizational innovations, to match an increased international footprint, can help firms overcome goal-related conflicts, thereby - we note - aiding exporters' ability to create clear synergies between exporting and product innovation. Finally, a key takeaway for managers is to consider early on in their international growth activities how the strategic upgrading of internal practices and routines can aid the translation of knowledge accessed abroad into tangible innovation outputs. In the following sections, we proceed with our theoretical rationale, explain our empirical modelling, and unpack key implications of our findings for theory and practice.

2. Background

LBE literature spans over four decades and finds its origins in the economics literature, with scholars examining the effects of trade on firms' productivity and technological knowledge (for a review, see Silva, Afonso, & Africano, 2012). In the management literature, LBE has manifested primarily in innovation-related outcomes (Salomon & Shaver, 2005). Conceptually, this research strand is rooted in organizational learning theory, according to which organizations are "cognitive entities" which learn through interacting with their external environment (Ipek, 2019: 545). Through a learning lens, firms 'learn' by accumulating experiences, either directly or vicariously, which over time manifest themselves in organizational routines, thereby shaping the focal firm's overall behavior (Levitt & March, 1988). By operating in the export market, firms become exposed to a new environment which differs from their domestic one and which generally holds more complex economic, legal, and socio-cultural dynamics (Ipek, 2019). Firms therefore accumulate market-specific and general internationalization knowledge and develop routines to enhance future performance, including innovation (Ganotakis et al., 2022). Whilst this heterogeneity between the domestic and export market setting holds important organizational learning opportunities, an important pre-condition for LBE is not merely the engagement in the export market, i.e., export status, but rather sustained commitment to the export market, i.e., its export *intensity* (Castellani, 2002; Freixanet & Federo, 2023). Without frequent interactions, we note, experiential learning is less likely to occur or be effective.

Conceptually, there are two inter-related arguments for a LBE effect, both centered around the benefits of gaining access to new, valuable knowledge. First, firms which compete in the export market are generally under more intense pressure to innovate and to generate new, or adapted, products than their domestic counterparts (Kirner, Kinkel, & Jaeger, 2009). Central to this argument is that managers perceive foreign markets as more challenging and dynamic than the home environment, in which the focal firm enjoys embeddedness and established networks (Meyer, Mudambi, & Narula, 2011). When going abroad, firms may experience a 'liability of outsidership' and may have (yet) to gain legitimacy with local stakeholders, whilst competing with local players

(Johanson & Vahlne, 2009). These competitive pressures encourage exporters to pursue the development of new products, or the improvement/adaptation of existing ones, through increased innovation efforts. From a learning perspective, managers learn by initiating dedicated search for new solutions for the problems experienced in uncertain environments (Huber, 1991). Hence, operating in export markets exhibits several challenges for firms, and many seek to overcome these by offering superior products (compared to local players), achieved through enhanced product innovation.

Second and relatedly, by operating in the export market, organizational members experience an external environment which differs from their domestic one. This heterogeneity between a focal firm's home and export market offers opportunities to access new knowledge, allowing exporters to enjoy an information advantage over domestic counterparts. Such knowledge includes market and technological knowledge (Salomon & Shaver, 2005; Salomon & Jin, 2010). Market knowledge refers to customer tastes and preferences, and it is mainly accessed through interaction with international buyers. It tends to be realized through product adaptations or minor changes to distribution and marketing channels (Castellani, 2002). Technological knowledge influences operational processes and scientific methods and tends to be unlocked in interactions with other businesses (Rosenberg, 1982). Exporting can therefore boost a firm's innovation capabilities by granting access to relevant knowledge and learning channels not available in domestic markets. Firms competing abroad benefit from the technological and non-technological capabilities of their foreign customers and intermediaries, as they may have direct and relevant information on the technical and non-technical development of the products and business methods being marketed and used, respectively, by their main competitors (Salomon & Shaver, 2005). Exporters may also benefit from the host market's domestic innovation systems by exploiting knowledge spillovers (Thakur-Wernz & Samant, 2019).

The empirical literature is, however, mixed. The LBE literature exhibits considerable heterogeneity in terms of its key propositions and findings, ranging from clear evidence of LBE effects on innovation, to limited, or no evidence (see Table 1 for an overview of selected LBE studies manifested in innovation). The conceptual and empirical focus on accessing knowledge in foreign export markets, has led scholars to neglect evidence on (whether and) how firms enact this new knowledge, and make subsequent changes to their internal practices and routines (for learning to truly take place). Our contention is that organizational innovation significantly moderates the relationship between exporting and product innovation, an effect not previously considered. In this manner, by distinguishing between exporting firms which engage in organizational innovation and those which do not, we hope to also explain the mixed findings that characterize much of previous LBE research.

3. Hypotheses

In this section, we proceed to explain why we view the nature of the relationship between a firm's export intensity and its subsequent product innovation performance as significantly influenced by a firm's efforts to integrate newly accessed knowledge via organizational innovation(s).

3.1. Learning-by-exporting and the moderating role of organizational innovation

Organizations can grow, evolve and develop over time, whereby decision makers need to carefully and consistently manage organizational design. It is known that when growth occurs in international business activities, including exporting, firms must simultaneously adapt to host market differences, whilst still strategizing to maintain internal coordination (see also Prahalad & Doz, 1987; Tan, Su, Mahoney, & Kor, 2020; Volberda, Van Den Bosch, & Mihalache, 2014). Since

Table 1
Selected LBE Studies with innovation outcomes.

Reference	Research setting	Key variables	Key findings
Salomon & Jin (2010)	1744 Spanish manufacturing firms between 1990–1997	Dependent variable (DV): Count of patent applications to proxy innovative productivity Independent variable (IV): Export status (dichotomous) and Export volume calculated as the natural log of total export sales. R&D expenditure to identify and compare technologically leading to lagging firms.	Exporting increases innovative productivity for both technologically leading and lagging firms, whereby the former, <i>ex post</i> exporting, file for more patents.
Monreal-Pérez et al. (2012)	4142 observations of an annual average of 1767 Spanish manufacturing firms between 2001–2008.	DV: Product and Process innovation (measured as dichotomous variable) IV: Previous export propensity (categorical variable of whether a firm has exported during the considered period or not)	Firms do not experience any learning-by-exporting (LBE) effects – neither in terms of subsequent product nor process innovations.
Love & Ganotakis (2013)	412 UK-based high-technology SMEs between 2001–2004.	DV: Proportion of total sales accounted for by new-to-market products IV: Export status	High-tech SMEs, following exporting, were found to innovate subsequently, but exporting did not make them more innovation intensive. Innovation-intensive firms were found to have different patterns for entry to, and exit from, export markets.
Golovko & Valentini (2014)	19,737 firm-year observations of Spanish manufacturing firms between 1990 and 2002.	DVs: Product and process innovation measured as dichotomous variables IV: Export status measured as dichotomous variable Firm size: large versus small-medium sized firms based on industry median size	Export status is positively associated with firm innovation output, whereby large firms show increased process innovation outputs following entry into export markets. In turn, small and medium-sized firms engage in product innovation prior to exporting.
D'Angelo et al. (2020)	880 Italian manufacturing firms between 2004–2007	DV: Dichotomous variable of product innovation IVs: Export propensity; export intensity (percentage of sales from exporting);	Absorptive capacity and foreign collaborations facilitate LBE when firms experience a rapid increase in export breadth, whereby the same

(continued on next page)

Table 1 (continued)

Reference	Research setting	Key variables	Key findings
		number of export market locations	does not apply for export depth.
		Absorptive capacity measured as the level of R&D over volume of sales	
		Foreign collaborations measured as a dichotomous variable	
Freixanet et al. (2021)	663 Spanish manufacturing firms between 2007 –2014.	DVs: Product and process innovation measured as dichotomous variables IVs: Export propensity and export intensity Family firm measured as dichotomous variable Technological leadership measured as categorical variable (see page 221 for details)	Family firms are found to be more likely to convert new knowledge from exporting into product innovations and are also more efficient in this respect compared to non-family firms. But family firms have a smaller LBE effect when it comes to process innovation.
Golovko et al. (2023)	2711 Spanish manufacturing firms between 2007 –2013.	DV: Marketing innovation IV: Propensity to start exporting Marketing capabilities leader and technological capabilities leader; for details see page 620	Focusing on a new learning outcome of LBE, the authors find that exporting is associated with more marketing innovations, whereby this learning effect is stronger for firms with leading marketing capabilities but is independent from firm's technological leadership status.

Note: Selected empirical LBE studies, with innovation outcomes, focused on firm-specific factors and moderators; for a comprehensive review on LBE, see Freixanet & Federo, 2023.

firms' organizational designs are characterized by routines, organizational evolution is contingent on changes to existing routines to ensure 'fit' between the firm's increasingly international external environment and its internal practices and routines (Nelson & Winter, 1982). In this regard, exporting firms can 'evolve' by strategically altering some of their routines to effectively capture and integrate knowledge acquired through exporting. This is important, as new knowledge derived from exporting may be serendipitous, and without changes to routines and practices, part of this new knowledge acquired may become lost or dismissed, and learning may, in fact, not occur. Whilst exporters enjoy clear information advantages and learning opportunities in export markets, mere knowledge access (e.g., of market or technical knowledge) is distinct from the enactment of such knowledge (Saka-Helmhout, 2010) which is embodied in the clear impact of acquired knowledge on the focal firm's internal routines.

Compared to merely accessing knowledge in foreign export markets, enacting it by implementing changes to extant organizational routines is, in fact, less straightforward. This is because firms tend to be path-dependent in their behavior and many are subject to organizational inertia (e.g., see Shimizu & Hitt, 2005). Yet, firm managers and key

decision-makers can play an active role in driving changes to routines by implementing *organizational innovation*, which pertains to new organizational methods in the firm's business practices, workplace organization and/or external relations (OECD/Eurostat, 2005). The initiative to engage in organizational innovation usually originates at the highest level of management and becomes diffused throughout the organization (Birkinshaw, Hamel, & Mol, 2008). Given that firms differ, some managers may recognize more rapidly the potential to make internal changes and deviate from the organizational status quo by adopting organizational innovation(s), following exposure to export markets. In contrast, other firms and their managers may leave their existing routines unchanged, amidst greater involvement in export markets; this could be due to deliberate choice or inertia (Criscuolo & Narula, 2007). Also, as highlighted by the attention-based view (ABV) of the firm (Ocasio, 1997; 2011), firm managers possess selective focus of attention, whereby some managers may pay greater attention to the learning opportunities available in export markets, than others. Taken together, not all exporters adopt organizational innovation(s), despite greater exposure to export markets, but, we argue, there will be a benefit to those who do.

Organizational innovation is important for the realization of LBE effects because it provides a structural and administrative mechanism for firms to access, integrate and store, foreign (market or technological) knowledge. For example, organizational innovation, such as the adoption of a new IT system, may target and improve the ease with which organizational members can communicate with stakeholders abroad (including sales agents), thereby fostering international knowledge access. In turn, the subsequent integration, and storage, of this knowledge may be realized through the establishment of centralized data banks within the system, allowing these individuals to share their knowledge with other relevant organizational members. Other structural changes may reduce internal bureaucratic barriers and enable organizational actors to effectively communicate novel ideas to peers or top decision makers. Ultimately, organizational innovation is important for the realization of effective product innovations amongst exporters because it allows them to develop unique and targeted working practices to integrate new knowledge and adopt associated technologies or processes (Khosravi, Newton, & Rezvani, 2019). Our first hypothesis states that:

H1. The positive relationship between a firm's export intensity and its subsequent product innovation performance is strengthened when firms engage in organizational innovation.

3.2. Learning-by-exporting and the extent of organizational innovation

Further, the adoption of organizational innovation(s) entails specific strategic complexities and opportunities for managers, which – we argue - have implications for LBE. As such, exporters may not only differ in terms of *whether* they adopt organizational innovation(s), or not, but also *to what extent* they do so, as there are different 'types' of organizational innovation. Building on the Oslo Manual (OECD/Eurostat, 2005), we distinguish between three, non-mutually exclusive ways in which firms adopt organizational innovation: (1) firms may adopt *new business practices*, which can relate to knowledge management or supply chain management, and new IT systems; (2) firms may adopt new methods for *workplace organization and decision making*, such as changing the composition of departments/teams through job rotations and decentralization; and (3) firms may strategically change the way they interact with *external stakeholders*, thereby adopting organizational innovations targeted at partnerships, outsourcing and sub-contracting. As the quest for organizational innovations tends to originate at the highest level of management and trickles down the organization (Birkinshaw et al., 2008), managers need to carefully evaluate the causes and benefits associated with each type.

We specifically argue that (1) all three organizational innovation types are conducive to LBE, and that (2) there are important complementarities between different organizational innovation types. Through

an organizational learning lens, engaging in multiple organizational innovation initiatives concurrently embodies greater commitment to enacting the knowledge acquired through exporting, or other relevant experiences, thereby aiding LBE (Saka-Helmhout, 2010). In this regard, we expect exporters to differ, with some managers paying more attention to the learning opportunities abroad and subsequently showing commitment by inducing relevant organizational innovations to act upon those. In line also with ABV (Ocasio, 1997; 2011), export markets offer different types of stimuli, whereby managers will selectively pay attention to a limited sub-set of such stimuli, while ignoring others. Thus, depending on their managers' perceived learning opportunities abroad, some exporters will engage in multiple types of organizational innovation concurrently. Greater commitment to internal change and knowledge enactment (Saka-Helmhout, 2010), through multiple and different organizational innovation initiatives implemented at the same time, may help firms to access, integrate and store relevant knowledge from export markets more effectively, thereby enhancing LBE effects.

Moreover, building on a behavioral theory of the firm, of which organizational learning is one of the four "relational concepts" (Gavetti et al., 2012), firms are in a "quasi-resolution of conflict", meaning that – at a given point in time – they experience different, possibly conflicting, organizational goals (Cyert & March, 1963). In the context of LBE, there may, indeed, be discrepancies between different organizational units, such as the technical staff (engineers and/or scientists in the R&D department) responsible for product innovations and Sales & Marketing staff. Organizational innovation efforts targeted at aligning these organizational units, we propose, are particularly conducive to LBE, as by definition, LBE involves the accession and absorption of new market as well as technological knowledge.

For instance, targeted job rotations can encourage individuals (e.g., in the Sales department) to share their knowledge and insights, generated in the export markets, with members of other organizational units (e.g., engineers in the R&D department) to discuss new business opportunities, including product enhancement and/or new product development. Parallel to this, firms may adopt new IT systems to help with knowledge transfer across organizational units and the sharing of foreign accessed knowledge. Also, the engagement in collaborative agreements with foreign partners has previously been found to support firms' abilities to LBE (D'Angelo et al., 2020). Thus, organizational innovation aimed at adopting new methods of engaging with external stakeholders can further improve knowledge flows from new and emerging networks by establishing improved methods of cooperation with partners, leading to better acquisition and absorption of new knowledge.

Finally, by adopting organizational innovations concurrently, firms may also evolve and further enhance organizational flexibility at multiple organizational levels (Le Bas, Mothe, & Nguyen-Thi, 2015). Indeed, pertaining to the entire social system of an organization (Damanpour & Evan, 1984), multiple organizational innovations may go hand in hand, eventually reinforcing one another, and altering the make-up of the firm. A firm can adopt a new firm-wide IT system to streamline administrative processes or increase interactions with customers or foreign sales agents; such efforts, may (eventually) affect the firm's structure at the department/team-level by encouraging decentralization and flatter decision-making hierarchies (c.f. Nell, Foss, Klein, & Schmitt, 2021). Hence, while some organizational innovation initiatives in isolation may seem comparatively incremental or even minor, in conjunction with other organizational innovation initiatives, they can significantly support LBE. In sum, multiple and different organizational innovation types (i.e., *new business practices, workplace organization and decision making, external stakeholder interaction*) can be complementary, triggering knowledge enactment and eventually LBE. In line with our conceptual model depicted in Fig. 1, we hypothesize the following:

H2a. The positive relationship between a firm's export intensity and its subsequent product innovation performance is strengthened by each

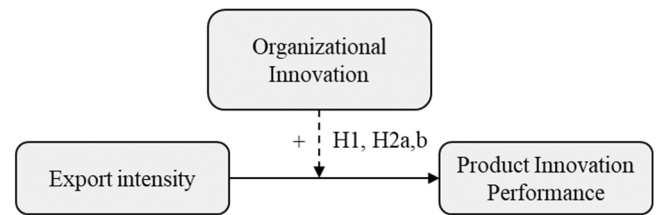


Fig. 1. Conceptual Model.

organizational innovation type.

H2b. The positive relationship between a firm's export intensity and its subsequent product innovation performance is strongest with the adoption of multiple organizational innovation types concurrently.

4. Data and methods

4.1. The sample

The data are drawn from the Mannheim Innovation Panel (MIP, 2024), which provides information on the innovation behavior of German firms since 1993. Conducted by the Centre for European Economic Research (in German: Leibniz-Zentrum für Europäische Wirtschaftsforschung, ZEW) in collaboration with the Institute for Applied Social Science Research and the Fraunhofer Institute of System and Innovation Research, the MIP is designed as a panel survey. The survey is usually filled out by the CEO or R&D manager of a sampled firm, who provides detailed information on general firm characteristics, such as firm size and revenues, as well as detailed information on the firm's innovation activities (Piening & Salge, 2015). Acknowledged to be of high quality and with details regarding the methodology used to collect this data publicly available (see Eurostat, 2009; Klingebiel & Rammer, 2014; Peters & Rammer, 2013), the MIP is the German contribution to the European Community Innovation Survey (CIS). The CIS has been used in influential management and international business (IB) studies (e.g., Laursen & Salter, 2006; Leiponen & Helfat, 2010; Piening, Salge, & Schäfer, 2016; Rammer & Schubert, 2018; Schubert, Baier, & Rammer, 2018), gaining increased recognition. The CIS is regarded as the most substantial effort for collecting cross-national innovation data at the firm-level and it is guided by the Oslo Manual, which offers guidelines for collecting and analyzing innovation data (OECD/Eurostat, 2005). CIS questions are designed to minimize the potential for common method bias, making it difficult for respondents to have clear associations between different fields of the survey; hence, common method bias is not likely to be present in CIS data (see also Klingebiel & Rammer, 2014; Leiponen & Helfat, 2010; Love, Roper, & Vahter, 2014).

We deem Germany as an appropriate and interesting empirical context for two main reasons. First, despite Germany's longstanding and prominent presence in world trade, there are surprisingly few studies on the learning potential of German firms in export markets (see some notable exceptions, such as Fryges & Wagner, 2010). We seek to fill this gap and offer insights into the LBE opportunities amongst German exporters, thereby complementing extant studies focused on other major European markets, such as the UK and Spain which have dominated the LBE literature thus far (e.g., Gkypali et al., 2021; Golovko et al. 2022; 2023; Love & Ganotakis, 2013; Monreal-Pérez, Aragón-Sánchez, & Sánchez-Marín, 2012). Second and relatedly, Germany is the ideal research setting for our study as the country is home to the so-called *Mittelstand* firms which, as medium-sized, privately-owned manufacturing firms, are often regarded as the 'backbone' of the German economy, consistently contributing to the country's export success (Pahnke, Welter, & Audretsch, 2023). Consequently, we conduct a firm-level statistical analysis based on the 2013, 2015 and 2017 survey waves of the MIP, whereby each survey covers a three-year reference period. This time span has been chosen because the three chosen waves

are the most recent consecutive survey waves which included questions specifically concerning different organizational innovation types (see also OECD/Eurostat, 2018).

We arrived at our final sample as follows. We initially combined the three separate waves of 2013, 2015 and 2017 in STATA, which resulted in an unbalanced sample. On average, there were 1.5 cross-sectional observations per firm in the initial dataset, reflecting the opening and closing of some firms, as well as non-responses in individual survey waves. For our statistical analysis, which - as detailed below - allows for firm-specific fixed effects based on an unbalanced panel, we then restricted our sample to only include firms which were present in at least two consecutive survey waves; this reduced the number of observations from 11,013 observations (full sample) to 3578 observations (restricted sample), whereby the average number of cross-sectional observations increased to 2.4 per firm. Following methodological conventions (e.g., Love et al., 2014), we compared the mean values of the key variables used in our statistical analysis between our restricted sample and the initial full sample and found no statistically significant differences. Furthermore, the dataset includes both innovating and non-innovating firms, which has important implications for the statistical analysis. According to the MIP, non-innovators are firms which did not offer any new or improved products/services within the last three years and did not introduce any new or improved processes; notably, non-innovators can choose not to answer the innovation-related questions in the survey, including many of our key variables. Hence, firms which for the whole duration of our studied period (surveys 2013, 2015 and 2017) labelled themselves as 'non-innovators' were removed from the sample. This leaves us with what we term as 'potential product innovators', in line with previous studies (see Laursen & Salter, 2006; Leiponen & Helfat, 2010). Moreover, given our focus on manufacturing firms, we removed service sector firms from the final sample, as these are likely to differ in their exporting activities (see also Love & Mansury, 2009). Finally, we removed observations for which the number of employees - an important control variable - was noted as '0' (which resulted in a further thirteen observations being removed). Our econometric analysis is based on a sub-sample of the MIP, consisting of 1489 manufacturing firms. The sample reflects Germany's famous medium-sized *Mittelstand* firms (Pahnke & Welter, 2019); on average, sampled firms had around 104 employees (medium size) and derived more than two-thirds of total revenues from key products (i.e., firms characterized by niche focus and narrow product portfolios).

4.2. Measures

4.2.1. Dependent variable

In line with previous LBE studies (e.g., D'Angelo et al., 2020; Xie & Li, 2018), our dependent variable proxies a firm's ability to introduce new or significantly improved products; here, measured as the *proportion of total turnover derived from new or clearly improved products (%)* (INNSUC) during the three-year reference period. The variable gives an overall indication of how important innovative products are to the focal firm; notably, a product counts as a product innovation i.e., a new or significantly improved product, if it is new to the adopting enterprise. This variable not only reflects a firm's competence in developing and introducing innovative products, but also its commercial success (Love et al., 2014), making it a well-established measure of innovation performance in the literature (see also Laursen & Salter, 2006; Leiponen & Helfat, 2010). In the MIP (see also Piening & Salge, 2015) this variable is measured on an ordinal scale, consisting of nine classes ([0]=0%, [1] 0 to < 5%, [2] 5 to < 10%, [3] 10 to < 15%, [4] 15 to < 20%, [5] 20 to < 30%, [6] 30 to < 50%, [7] 50 to < 75%, [8] 75 to 100%). To give cardinal meaning to our analysis, we take the absolute mean of each category which equates to values of 0%, 2.5%, 7.5%, 12.5%, 17.5%, 25.0%, 40.0%, 62.5% and 87.5%.

4.2.2. Independent variable

Our main explanatory variable reflects a firm's level of export intensity, i.e., the extent to which firm revenues are derived from exports; as discussed later, the independent variable is lagged in the analysis to reduce the risks of endogeneity. Export intensity is measured as the *turnover from international sales divided by total turnover* over the respective three-year reference period. In the MIP, values have been assigned an upper limit of "0.85", i.e., 85% export intensity, to avoid firms from being identifiable based on their high export intensity; hence, a firm which originally reported to have an export intensity of, say, 90% has been assigned a value of "0.85" in the dataset instead; this approach is not of concern as the censoring of the variable applies to less than 5% of the observations included. Overall, our measure of export intensity (see also D'Angelo et al., 2020; Love & Ganotakis, 2013), allows researchers to empirically examine LBE effects.

4.2.3. Moderating variables

We measure the extent to which the relationship between export intensity and subsequent product innovation performance is moderated by a firm's adoption of organizational innovation(s). We use the MIP's three 'types' of organizational innovation which were introduced throughout the three-year reference period, namely: (1) "new business practices for organizing procedures" (e.g., supply chain management or knowledge management) (*OI1 Business practices*); (2) "new methods of organizing work responsibilities and decision making" (e.g., teamwork or decentralization) (*OI2 Work organization*); and (3) "new methods of organizing external relations with external stakeholders" (e.g., partnerships or sub-contracting) (*OI3 External links*). To measure whether a firm engaged in organizational innovation throughout the three-year reference period, we coded a dummy variable (*OI dummy*), whereby a value of "1" indicates that a firm did adopt any one of these types of organizational innovation initiatives, and a value of "0" indicates otherwise. Moreover, in line with previous studies (e.g., Mol & Birkinshaw, 2009), the extent to which a firm engaged in organizational innovation is measured using a count variable (*OI extent*) (with values between "0" and "3"), whereby a value of "0" indicates that a firm did not engage in any of the three types of organizational innovation measured; a value of "1" indicates that a firm adopted any one of the three types; a value of "2" indicates that the firm adopted two different organizational innovation initiatives, while a value of "3" indicates that the firm adopted all three types of organizational innovation initiatives concurrently, with the latter reflecting the highest commitment to internal change and evolution through organizational innovation.

4.2.4. Control variables

We include several control variables. First, we include R&D intensity, measured as the total R&D expenditure as a share of total turnover. We also control for whether a firm actively carried out innovation activities in a given time period, or not. Moreover, considering the link between firm size and innovation (Nieto & Santamaría, 2010), we control for firm size which is measured as the log of the total number of full-time employees. In line with previous studies, we control for labor productivity, measured as a firm's turnover divided by its number of employees (e.g., Sui & Baum, 2014). In our models, we control for the proportion of all employees with a university degree (or equivalent), as this may further reflect a firm's level of absorptive capacity and the workforce's ability to effectively drive innovation outputs based on externally accessed knowledge (Leiponen, 2005; Love et al., 2014).

Moreover, given that previous studies have highlighted the importance of export market destination for accessing new knowledge for innovatory purposes (e.g., Xie & Li, 2018), we also control for a firm's international orientation which is coded as a dummy variable, indicating whether a firm operated beyond European markets, i.e., globally, ("1") or not, i.e., regionally ("0"). In a similar vein, we account for firms' home location, distinguishing between firms which are located in West Germany ("0") and those located in East Germany ("1"); despite the

unification over thirty years ago, discrepancies in innovation persist, as firms from the East are still catching up (c.f. [Piening & Salge, 2015](#)). Finally, we include time and industry dummies, as they are highly relevant for our empirical modelling, as per below. In particular, the role of industry and the associated technological intensities are relevant for LBE ([Salomon & Jin, 2010](#)), whereby our sample comprises of firms from overall thirteen different industries which we include as control variables.

4.3. Model estimation

We empirically examine whether and how a firm's exporting intensity - as a means to knowledge and learning inputs - affects its subsequent innovation performance. In line with previous works ([Griliches, 1979](#); [Love et al., 2014](#)), we estimate four forms of the innovation production function; whereby $INNSUC_{it}$ is the innovation performance predictor (for firm i at survey wave t) and FC_{it} is a vector of firm characteristics, which are likely to influence innovation performance, and which are included as control variables. Let E_{it-1} represent a firm's (i) export intensity at wave $t - 1$. After adding time effects (τ_t), firm-specific fixed effects (π_i) and idiosyncratic errors (ϵ_{it}), the innovation production function can be written as:

$$INNSUC_{it} = \delta_0 + \delta_1 E_{it-1} + \delta_2 FC_{it} + \tau_t + \pi_i + \epsilon_{it} \quad (1)$$

To test how organizational innovation moderators (OI) enable LBE, we formally include the respective interaction term, which extends our innovation production function to:

$$INNSUC_{it} = \delta_0 + \delta_1 E_{it-1} + \delta_2 FC_{it} + \delta_3 OI_{it} + \delta_4 (E_{it-1} \times OI_{it}) + \tau_t + \pi_i + \epsilon_{it} \quad (2)$$

Our dependent variable ($INNSUC_{it}$), representing the proportion of total turnover derived from new or clearly improved products (%), is (double) censored between 0 (0%) and 8 (87.5%). Accordingly, we apply a Tobit analysis (see also [Laursen & Salter, 2006](#)). In implementing our Tobit analysis, we follow the recommendations by [Amore and Murtinu \(2019\)](#) with regards to (1) accounting for selection versus censoring bias and (2) dealing with the Tobit residuals' distribution. First, 39% of our dependent variable are zeros, whereby we can assume that the reported zeros are, indeed, 'true' zeros, meaning that the firms in our sample of 'potential product innovators' could have sold new or clearly improved products; the MIP reports missing values as "." and not as zeros, giving us further confidence that the zeros are not driven by missing data, but by the fact that innovative firms did not derive any turnover from new or clearly improved products (despite their potential to do so). We conclude that the zeros are, indeed, true zeros and not imputed values to missing data, suggesting no selection bias concerning these zeros and hence, a Tobit model is deemed appropriate (see also [Amore & Murtinu, 2019](#): 341). Second, the assumption of the residuals being normally distributed is not satisfied in our case due to observed skewness. Following previous studies (e.g., [Amore & Murtinu, 2019](#); [Laursen & Salter, 2006](#)), we apply a logarithmic transformation to our dependent variable $INNSUC$, leading to a new latent variable which we label $INNSUC_LN$, whereby $INNSUC_LN = \ln(1 + INNSUC)$. Finally, to mitigate potential heteroscedasticity and serial correlation issues arising from incorrect model specification, we follow again [Amore & Murtinu \(2019\)](#) and include time, location (East versus West Germany) and industry dummies in our modelling.

While it has been argued that exporters can learn from exporting (LBE hypothesis), more innovative firms are also likely to enter the export market (self-selection hypothesis) ([Monreal-Pérez et al. 2012](#)). This may cause concerns of simultaneous endogeneity within our model, which we addressed. First, since we couple three waves of the MIP data, we introduce time-lags for our explanatory variable (export intensity), which is a widely adopted approach to manage potential endogeneity ([D'Angelo et al., 2020](#); [Panicker, Mitra, & Upadhyayula, 2019](#);

[Pinera-Salmerón, Sanz-Valle, & Jiménez- Jiménez, 2023](#); [Xie & Li, 2018](#)). Second, we adopt the Mundlak approach by adding the time averages of our time-varying covariates as additional explanatory variables to account for firm-specific effects (c.f. [Mundlak, 1978](#); [Wooldridge, 2019](#)). Indeed, the 'ideal' estimation approach would enable us to account for any unobserved heterogeneity i.e., firm-specific, unobserved factors of firm innovation output which are constant over time; and to test our hypotheses focusing on within-firm effects ([Love et al., 2014](#): 1711). As Tobit models in panel settings cannot be estimated using fixed-effect specifications, due to incidental parameter problems (c.f. [Amore & Murtinu, 2019](#)), applying the Mundlak approach (which can be interpreted as a quasi-fixed effects estimator) is a viable method for addressing endogeneity.

5. Results

[Table 2](#) and [Table 3](#) below illustrate the descriptive statistics and correlations for our variables respectively. As shown in [Table 2](#), firms in our sample derived, on average, ca. 15% of their turnover from new or clearly improved products. In terms of organizational innovations, *OI1 Business practices* (relating to new business practices) was the most widely adopted form of organizational innovation amongst our sample (30.4%), followed by *OI2 Work organization* (28.5%) and *OI3 External links* (15.2%). Notably also, the individual variance inflation factors (VIFs) are depicted in [Table 2](#), whereby we ran two tests with (1) the individual organizational innovation measures and (2) the coded *OI dummy* and *OI extent* variables; in the former case, the average VIF was 1.43 and in the latter case, the average VIF was 2.03, well below the threshold of an average VIF of six and individual VIF of ten (e.g., [O'Brien, 2007](#)), suggesting no collinearity problems with our estimations.

Our results from the Tobit regression are presented in [Table 4](#). In showing the results for our key explanatory and control variables, Model 1 includes only the control variables and Model 2 estimates the base relationship between lagged export intensity (L.EXPINT) and product innovation performance ($INNSUC_LN$), which resembles LBE. The other models in the table, i.e., Models 3–8, also estimate the relationship between export intensity and product innovation performance but taking different levels and types of organizational innovation as moderators into account.¹ Notable amongst our controls is the significant and positive effect of firm size on product innovation performance.

Interestingly, lagged export intensity is not significantly associated with greater product innovation performance (β : 0.241; p -value: 0.506). While the coefficient is positive, we find no significant empirical support for a LBE effect, which suggests that German exporters, on the whole, may not so straightforwardly learn from exporting. In Model 3, and in line with H1, the interaction term between lagged export intensity and organizational innovation is positive and significant (β : 0.395; p -value: 0.035), suggesting that exporting firms which amended their internal routines through organizational innovation exhibited greater product innovation performance, compared to exporters which did not adopt any organizational innovation. Empirical results suggest that, whether or not managers implement organizational innovation, significantly contributes to firm heterogeneity with respect to LBE. Given the lack of empirical support for general LBE effects, we argue that organizational innovation is a powerful mechanism for firms to learn from exporting, distinguishing between those exporters which strategically embed new knowledge and those which may not do so.

Next, in Models 4–7, we delve deeper into how specifically organizational innovation types facilitate LBE. As Model 4 shows, the interaction term between lagged export intensity and *OI1 Business practices* is

¹ Due to space restrictions, we excluded the results pertaining to the time averages of the time-varying covariates, the different time and industry dummies as well as their interactions, but they are available upon request.

Table 2
Descriptive Statistics.

Variables	Mean	S.D.	VIF	Variables	Mean	S.D.	VIF
1 Product innovation	15.86	21.308	-	8 OI2 Work organization	0.285	0.451	1.39
2 (lagged) Export intensity	0.219	0.272	1.81	9 OI3 External links	0.152	0.359	1.15
3 R&D intensity	0.017	0.035	1.51	10 OI dummy	0.431	0.495	4.30
4 Firm size	3.668	1.463	1.40	11 OI extent	0.728	0.960	4.27
5 Labor productivity	0.266	0.168	1.31	12 Staff education	2.892	2.197	1.45
6 Geographical focus	0.536	0.499	1.81	13 Active innovator	0.803	0.398	1.32
7 OI1 Business practices	0.304	0.460	1.42	14 East Germany	0.316	0.465	1.16

Source: Mannheim Innovation Panel (MIP), ZEW, Mannheim, Germany; waves 2013-2017 of the survey are included. N = 1489 (same for Table 2 below)

Table 3
Correlations Table.

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1 Product innovation	1.000													
2 (lagged) Export intensity	0.215	1.000												
3 R&D intensity	0.380	0.271	1.000											
4 Firm size	0.008	0.368	0.028	1.000										
5 Labor productivity	0.004	0.365	-0.074	0.291	1.000									
6 Geographical focus	0.163	0.596	0.260	0.424	0.257	1.000								
7 OI1 Business practices	0.205	0.170	0.170	0.244	0.107	0.162	1.000							
8 OI2 Work organization	0.174	0.114	0.088	0.171	0.026	0.110	0.481	1.000						
9 OI3 External links	0.093	0.034	0.112	0.045	0.027	0.085	0.273	0.308	1.000					
10 OI dummy	0.224	0.177	0.161	0.211	0.087	0.178	0.749	0.710	0.499	1.000				
11 OI extent	0.213	0.146	0.164	0.212	0.073	0.160	0.799	0.807	0.652	0.873	1.000			
12 Staff education	0.283	0.254	0.455	0.036	0.135	0.331	0.147	0.104	0.094	0.145	0.154	1.000		
13 Active innovator	0.516	0.2802	0.357	0.248	0.092	0.318	0.230	0.220	0.162	0.286	0.273	0.271	1.000	
14 East Germany	0.062	-0.168	0.145	-0.119	-0.239	-0.095	-0.026	-0.01	-0.050	-0.055	-0.031	0.183	-0.029	1.000

positive and highly significant (*beta*: 0.538; *p-value*: 0.005). In contrast, and against our expectations, the interaction term between lagged export intensity and *OI2 Work organization* in Model 5 is not significant (*beta*: 0.226; *p-value*: 0.247), and neither is the interaction term between lagged export intensity and *OI3 External links* in Model 6 (*beta*: -0.235; *p-value*: 0.355). The full model (Model 7), testing H2a, reiterates these results. We therefore find only partial support for H2a in that some organizational innovation types are, in fact, more conducive to LBE than others, whereby it is particularly the introduction of new business practices which enables LBE.

Finally, Model 8 shows the results for whether engaging in multiple organizational innovation efforts simultaneously enhances LBE effects (H2b). Interestingly, we find only some support for H2b, in that firms which adopted at least two different organizational innovation efforts concurrently experienced greater LBE effects (*beta*: 0.566; *p-value*: 0.024) than those which only adopted one type of organizational innovation in isolation (*beta*: 0.306; *p-value*: 0.193); this finding supports the notion that there are, indeed, important complementary effects between different types of organizational innovation. However, firms which adopted all three different types of organizational innovations in the studied period, did not experience stronger LBE than firms which adopted none or only one type of organizational innovation. One explanation may be that organizational innovation facilitates knowledge, but engaging in too many different forms of organizational innovation at once may, in fact, not favor LBE. A firm's daily operations may, at least in the short run, become disrupted due to staff members having to adjust their behaviours or be retrained, for instance. Hence, we find partial support for H2b, concluding that it is not only about greater levels of commitment to organizational innovation, but also about being strategic as to which type(s) of organizational effort to implement, which reiterates the importance of our findings concerning H2a.

5.1. Further analysis and robustness tests

As a first robustness test, we explore the possibility that exporting may have a direct effect on the adoption of organizational innovation, which in turn could suggest a mediating rather than moderating effect of organizational innovation on the relationship between exporting and product innovation. We ran probit regressions of both *OI dummy* and *OI1 Business practices* (the key organizational innovation variable) on lagged export intensity and the control variables discussed above. In all cases, the coefficient on lagged exporting was statistically insignificant, indicating that exporting does not have a direct effect on the adoption of organizational innovation, and lending further support to our interpretation of a moderating rather than a mediating relationship.² Additionally, we ran some further robustness checks due to the nature of our variables. First, we recoded all observations where export intensity was (or was capped at) 0.85 to 1.0 to see whether our results change, when we include 'high-intensity' exporters; our findings do not change here and hence are robust. Second, regarding the nature of our dependent variable, we took account of the large width of the last two categories by recoding the relevant observations to both the upper and lower limits of both categories. Again, our results do not change, further providing support for H1.

Further, our analysis revealed that (1) particularly organizational innovation pertaining to new business practices facilitates LBE and that (2) there are complementarities from adopting two different organizational innovation types. To test for robustness, we coded an additional set of dummy variables based on the variables *OI1 Business practices*, *OI2 Work organization* and *OI3 External links* to further test the effects of different combinations of them. For instance, the new variable *OI12* indicates those firms which, during the studied period, adopted both *OI1 Business practices* and *OI2 Work organization* concurrently (but not *OI3*

² Results available upon request.

Table 4
Results from the Tobit regression.

	Model 1	Model 2	Model 3	Model 4
(lagged) Export intensity		0.241 (0.362) [0.506]	0.023 (0.376) [0.952]	-0.003 (0.368) [0.992]
OI dummy × (lagged) Export intensity			0.395 * * (0.188) [0.035]	
OI dummy			-0.073 (0.095) [0.441]	
OI1 Business practices × (lagged) Export intensity				0.538 * * * (0.192) [0.005]
OI1 Business practices				-0.143 (0.104) [0.171]
R&D intensity	2.388 * (1.245) [0.055]	1.374 (1.493) [0.357]	1.411 (1.484) [0.342]	1.316 (1.475) [0.373]
Firm size	0.113 (0.130) [0.386]	0.319 * (0.178) [0.073]	0.299 * (0.178) [0.092]	0.287 (0.176) [0.104]
Labor productivity	0.040 (0.445) [0.929]	0.346 (0.602) [0.566]	0.308 (0.599) [0.606]	0.303 (0.593) [0.609]
Geographical focus	-0.097 (0.112) [0.387]	-0.206 (0.137) [0.132]	-0.219 (0.136) [0.106]	-0.191 (0.135) [0.158]
OI extent (#1) ^a	0.054 (0.068) [0.433]	0.055 (0.077) [0.474]		
OI extent (#2)	-0.011 (0.083) [0.892]	-0.002 (0.093) [0.985]		
OI extent (#3)	-0.033 (0.126) [0.796]	-0.033 (0.145) [0.820]		
Staff education	0.043 (0.027) [0.114]	0.004 (0.032) [0.894]	0.006 (0.031) [0.846]	0.005 (0.031) [0.865]
Active innovator	1.836 * * * (0.075) [0.000]	2.521 * * * (0.094) [0.000]	2.525 * * * (0.094) [0.000]	2.519 * * * (0.093) [0.000]
East Germany	0.028 (0.063) [0.656]	0.102 * (0.061) [0.092]	0.108 * (0.061) [0.076]	0.106 * (0.061) [0.082]
OI2 Work organization				0.069 (0.087) [0.430]
OI3 External links				-0.146 (0.100) [0.144]
Constant	-37.688 (92.587) [0.684]	166.908 (108.197) [0.123]	163.060 (107.799) [0.130]	172.609 (106.977) [0.107]
Observations	1998	932	932	932
Number of firm_ID	1207	759	759	759

	Model 5	Model 6	Model 7	Model 8
(lagged) Export intensity	0.139 (0.368) [0.705]	0.265 (0.363) [0.466]	0.022 (0.370) [0.953]	0.042 (0.376) [0.911]
OI2 Work organization × (lagged) Export intensity			0.065 (0.221) [0.247]	
OI2 Work organization	-0.003 (0.104) [0.975]	0.063 (0.088) [0.470]	0.053 (0.108) [0.627]	
OI3 External links × (lagged) Export intensity		-0.235	-0.431	

Table 4 (continued)

		(0.254) [0.355]	(0.266) [0.106]	
OI3 External links	-0.148 (0.101) [0.143]	-0.089 (0.120) [0.455]	-0.037 (0.121) [0.758]	
OI1 Business practices × (lagged) Export intensity			0.582 * * * (0.214) [0.006]	
OI1 Business practices	0.019 (0.087) [0.824]	0.020 (0.087) [0.817]	-0.159 (0.108) [0.141]	
OI extent (#1) × (lagged) Export intensity				0.306 (0.235) [0.193]
OI extent (#2) × (lagged) Export intensity				0.566 * * * (0.250) [0.024]
OI extent (#3) × (lagged) Export intensity				0.157 (0.364) [0.666]
OI extent (#1) ^a				-0.025 (0.103) [0.811]
OI extent (#2)				-0.143 (0.113) [0.206]
OI extent (#3)				-0.055 (0.191) [0.773]
R&D intensity	1.263 (1.484) [0.395]	1.188 (1.488) [0.425]	1.213 (1.476) [0.411]	1.416 (1.485) [0.340]
Firm size	0.296 * (0.177) [0.096]	0.306 * (0.178) [0.085]	0.296 * (0.176) [0.094]	0.297 * (0.178) [0.095]
Labor productivity	0.355 (0.597) [0.552]	0.354 (0.598) [0.554]	0.285 (0.593) [0.631]	0.274 (0.599) [0.647]
Geographical focus	-0.188 (0.136) [0.167]	-0.186 (0.136) [0.171]	-0.183 (0.135) [0.175]	-0.204 (0.136) [0.134]
Staff education	0.003 (0.031) [0.911]	0.004 (0.031) [0.900]	0.006 (0.031) [0.851]	0.005 (0.031) [0.885]
Active innovator	2.520 * * * (0.094) [0.000]	2.513 * * * (0.094) [0.000]	2.514 * * * (0.093) [0.000]	2.523 * * * (0.093) [0.000]
East Germany	0.102 * (0.061) [0.095]	0.102 * (0.061) [0.092]	0.109 * (0.061) [0.073]	0.104 * (0.061) [0.086]
Constant	171.062 (107.544) [0.112]	176.565 (107.801) [0.101]	180.197 * (106.991) [0.092]	173.291 (107.845) [0.108]
Observations	932	932	932	932
Number of firm_ID	759	759	759	759

Note: Estimation of Tobit regression with Mundlak specification (time averages available upon request). Standard errors are presented in parentheses; p-values in square brackets. Source: Mannheim Innovation Panel (MIP), ZEW, Mannheim, Germany; waves 2013-2017. ^a The three different organizational innovation efforts, as measured by the MIP, refer to: new business practices for organizing procedures; new methods of organizing work responsibilities and decision making; new methods of organizing external relations with external stakeholders.

External links); the same logic applies to the variables OI13 and OI23. We then interacted these combination dummies with our main explanatory variable (lagged export intensity) and re-ran our estimations. The results are depicted in [Table 5](#), whereby Model 4 represents the full model with all three interaction terms. The results confirm our initial findings of (1) the important role of *OI1 Business practices* and (2) complementarities

Table 5
Combinations of different organizational innovation types.

	Model 1	Model 2	Model 3	Model 4
(lagged) Export intensity	0.055 (0.364) [0.881]	0.264 (0.363) [0.467]	0.300 (0.364) [0.409]	0.141 (0.364) [0.698]
OI12 × (lagged) Export intensity	0.625 * ** (0.223) [0.005]			0.929 * ** (0.251) [0.000]
OI12	-0.167 (0.120) [0.163]			-0.219 * (0.128) [0.086]
OI13 × (lagged) Export intensity		-0.125 (0.311) [0.687]		0.286 (0.498) [0.566]
OI13		-0.073 (0.151) [0.627]		-0.068 (0.187) [0.716]
OI23 × (lagged) Export intensity			-0.446 (0.302) [0.140]	-1.290 * ** (0.483) [0.008]
OI23			-0.009 (0.151) [0.951]	0.164 (0.185) [0.376]
R&D intensity	1.416 (1.473) [0.337]	1.314 (1.494) [0.379]	1.227 (1.490) [0.410]	1.323 (1.481) [0.372]
Firm size	0.310 * (0.176) [0.079]	0.301 * (0.178) [0.090]	0.315 * (0.178) [0.076]	0.332 * (0.176) [0.059]
Labor productivity	0.350 (0.594) [0.556]	0.340 (0.600) [0.571]	0.327 (0.600) [0.586]	0.315 (0.594) [0.596]
Geographical focus	-0.185 (0.135) [0.171]	-0.187 (0.136) [0.170]	-0.196 (0.136) [0.151]	-0.183 (0.135) [0.175]
Staff education	0.003 (0.031) [0.935]	0.005 (0.031) [0.865]	0.006 (0.031) [0.856]	0.003 (0.031) [0.930]
Active innovator	2.529 * ** (0.092) [0.000]	2.516 * ** (0.094) [0.000]	2.520 * ** (0.094) [0.000]	2.509 * ** (0.092) [0.000]
East Germany	0.104 * (0.061) [0.086]	0.104 * (0.061) [0.085]	0.100 * (0.060) [0.097]	0.097 (0.060) [0.109]
OI3 External links	-0.154 (0.100) [0.124]			
OI2 Work organization		0.061 (0.084) [0.466]		
OI1 Business practices			0.044 (0.084) [0.602]	
Constant	163.414 (107.137) [0.127]	172.938 (108.012) [0.109]	177.144 (107.907) [0.101]	172.271 (107.122) [0.108]
Observations	932	932	932	932

Note: Estimation of Tobit regression with Mundlak specification (time averages available upon request). Standard errors in parentheses; p-values in square brackets. Source: Mannheim Innovation Panel, ZEW, Mannheim, Germany; 2013-2017.

between two different types of organizational innovation, overall suggesting that our main results are robust.³

As per the additional analysis in Table 5, complementarities tend to

³ Firm size was mostly significant and positive across our models. As another test, we estimated our models for firms above and below the median firm size (38 employees) separately, whereby the results stayed significant for those above the median, further confirming the importance of firm size which we control for across all models.

arise from adopting *OI1 Business practices* (i.e., new business practices for organizing procedures) and *OI2 Work organization* (i.e., new methods of organizing work responsibilities and decision making) concurrently. With both of these organizational innovation types being internal to the firm, they help streamline administrative procedures and routines at multiple organizational levels. In contrast, as shown in *Model 4*, adopting *OI2 Work organization* and *OI3 External links* in conjunction impedes, rather than supports, LBE. We attribute this finding to the diverging foci of these two types of organizational innovation, as well as the required time and effort to institutionalize them. Organizational innovation to external links is subject to negotiation and commitment between the focal firm and its partners. It therefore takes time and, when implemented in parallel with changes to the organization of work, managerial attention may become spread thinly, as new methods of organizing work responsibilities require retraining and other changes for employees. Hence, adopting the appropriate combinations of organizational innovation is an important strategic decision which can markedly affect firms' ability to benefit from LBE.

Finally, we address the timing of exporting and organizational innovation in LBE. As per Eq. (2) above, the estimations of Tables 3 and 4 assume that organizational innovation occurs after exporting and permits the effects of previous exporting activity to be reflected in product innovation performance. The time lag between exporting and organizational innovation reflects the decision-making processes involved, as managers need time to implement organizational innovations. However, it is possible that some LBE effects may be the result of strategic investments made by firms *before* exporting e.g., a 'learning-to-export' effect. In other words, learning investments during the pre-export phase may be reflected in improved performance subsequently. Learning-to-export effects arise where firms strategically invest in the development of enhanced products or services and/or delivery capabilities to generate positive productivity or innovation effects before entering (new) export markets (Eliasson, Hanson, & Lindvert, 2012; Gkypali et al., 2021). We performed robustness checks to show that LBE effects are not the result of organizational innovations made contemporaneously with or before the relevant exporting activity from which learning effects are inferred. We re-estimated Eq. 2 with versions in which a) organizational innovation occurs simultaneously with exporting; and b) organizational innovation precedes exporting – we found no statistically significant interactions.⁴

6. Discussion and contributions

We examined the *learning-by-exporting* (LBE) effect, i.e., the effective absorption and conversion of knowledge acquired from exporting that enhances innovation performance (Freixanet & Federo, 2023; Silva et al., 2012). Building on previous research which suggests that exporters differ in their learning and subsequent innovation capabilities (Salomon & Jin, 2010; Vendrell-Herrero et al., 2022; Xie & Li, 2018), we uncover the organizational routine-based mechanisms that strengthen LBE and offer a nuanced understanding of the assumed learning effects. Our study makes important theoretical contributions and offers practical implications for managers interested in how to best capture valuable knowledge from exporting activities.

Our contributions are as follows. First, this study contributes to the notion that LBE is highly idiosyncratic to firms and contexts (e.g., Freixanet & Federo, 2023; Love & Ganotakis, 2013; Monreal-Pérez et al., 2012). International engagement remains an important source of learning for exporters, but the effects are much more nuanced. In general, we find no significant support for a LBE effect amongst our sample of German, mid-sized manufacturing firms. In line with some recent works (e.g., Freixanet & Federo, 2023; Vendrell-Herrero et al., 2022), our findings contribute to the notion that firms from developed home

⁴ These results are available upon request.

markets may experience relatively weak LBE effects. Firms from more developed markets may, at least initially, identify little relevant knowledge in export markets, as (particularly technological) knowledge discrepancies between their home market and foreign locations may be limited. In this vein, particularly German customers have been found to be highly demanding in their technical requirements, thereby possibly diverging managerial attention from learning opportunities in export markets (Roper & Love, 2002). Even where exporters are able to serve technically demanding clients abroad, they face a persistent liability of foreignness and lack of embeddedness, which may impede the benefits from any significant knowledge spillovers. Previous research suggests that these disadvantages are especially pronounced when the host country industry is at the technological frontier (Schmidt & Sofka, 2009). Our study contributes to the notion that, in some contexts, LBE requires more than being an exporter and that not all firms, in fact, learn by exporting (see also Love & Ganotakis, 2013).

Second, we uncovered an important mechanism which allows *some* German exporters to, indeed, learn by exporting. Specifically, we considered that (1) firms are heterogenous in how they learn from their experiences abroad and that (2) organizations are not static but may change and evolve internally by adopting organizational innovation(s) (see also Surdu, Greve, & Benito, 2021). In this vein, we shift attention to the strategic role of organizational innovation. Importantly, our findings suggest that LBE effects are determined by *whether* a firm upgrades its internal routines through organizational innovation, as export intensity increases, and also *to what extent* the firm does so. Specifically, as we found in our further analysis, adopting multiple and different organizational innovation efforts pertaining to (1) *new business practices* (i.e., new business practices for organizing procedures) and (2) *workplace organization* (i.e., new methods of organizing work responsibilities and decision making) enables firms to become better equipped for accessing, integrating, and storing knowledge available in export markets. Together, we expect these efforts to streamline administrative procedures at multiple organizational levels and to help align cross-unit organizational goals. In contrast, we found that adopting *workplace organization* and *external links* in conjunction may impede, rather than support, LBE which we attribute to the diverging foci of these two types of organizational innovations (with one being internally focused and the other externally focused), as well as the required time and effort to institutionalize them. Further, our findings caution managers not only to be strategic as to which types of organizational innovation to focus on, but also on how many of such efforts to engage in concurrently. While implementing one type of organizational innovation may lead to only subtle and less significant change for LBE, engaging in too many organizational innovation efforts concurrently may risk poor financial and managerial attention allocation to each new routine. Hence, the strategic role of organizational innovation is nuanced.

Third and relatedly, we offer insights into, and unpack, the mechanisms through which firms can circumvent potential trade-offs between innovation and internationalization which have previously been documented in the literature (e.g., Bahl et al., 2021; Juergensen, Narula, & Surdu, 2022; Kriz & Welch, 2018). As argued by the behavioral theory of the firm (Cyert & March, 1963; Gavetti et al., 2012), firms are constantly in a “quasi-resolution of conflict”, meaning that they experience different, possibly conflicting, organizational goals which tend to be addressed through coalitions and temporary compromises. When export intensity increases, requiring financial and managerial resources, firms’ organizational goals and resources may therefore (temporarily) shift towards generating those foreign sales. In turn, innovation-related objectives may be compromised or delayed, leading to a potential trade-off between exporting activities and innovation-related activities; for example, managers may focus less on new innovations targeting the home market, and instead favor efforts to build the needed infrastructure to expand sales abroad, e.g., by hiring local sales agents, and vice versa (see also Roper & Love, 2002). We would argue that organizational innovation, specifically to extant business practices, may support

firms in overcoming any such goal-related conflicts and to generate clear synergies between their increased exporting and innovation activities.

Based on our findings, we highlight two key practical takeaways for managers. First, our findings suggest that LBE is not automatic, but rather requires managers to strategically induce changes to extant firm routines, via organizational innovation, to effectively harness knowledge from export markets. In this regard, we highlight as an important pre-requisite for LBE, that managers need to view their export markets not merely as an additional sales outlet for their firms’ current products, but as sources of vital market and/or technological knowledge to improve extant (or develop new) products. This mindset is important, as learning opportunities in export markets can arise serendipitously rather than in a more planned manner. Second and relatedly, our study encourages managers to be aware of the learning opportunities which arise from making (even seemingly small) changes to extant firm routines and procedures through organizational innovation. For instance, adopting a new IT system which entails internal organizational members, as well as external, foreign sales agents can support the effective dissemination and storage of new knowledge accessed in export markets. Having clear practices and procedures in place to capture relevant knowledge from foreign stakeholders can help make sense of relevant knowledge and turn it into commercial capabilities. Importantly, our findings highlight that, to maximize LBE effects, managers may wish to be strategic as to which type of organizational innovation to prioritize at a given moment in time and to focus on those practices which best align cross-unit communication and goals.

7. Limitations and future research directions

There are several limitations which constitute opportunities for future research. First, although we study the types of organizational innovation our sample firms engage in, we did not delve deeper into the ‘radicalness’ of change associated with organizational innovation. This, we propose, presents valuable opportunities for future research. Second, a limitation arises from the nature of our independent variable, which has been capped at 85%. Despite our previous robustness test in this regard, we acknowledge here that the operationalization of our independent variable can have a potential effect on whether we are indeed able to observe LBE effects. Moreover, also due to the nature of our dataset, we were unable to control for firm age and firms’ previous export experience, both of which may be relevant for LBE (e.g., see Love, Roper, & Zhou, 2016; Sui, Baum, & Li, 2023). Regarding the role of age, future LBE studies can explore whether younger firms may, perhaps, find it easier to engage in organizational innovation and reap the benefits from LBE due to their “learning advantages of newness” (Autio, Sapienza, & Almeida, 2000). Similarly, while we were able to control for whether firms operated only within Europe (as their home region), or beyond, i.e., operated globally, our dataset does not include any information on export market destination. Future research could explore whether, and how, export market destination affects the role played by organizational innovation in the context of LBE; these studies can build on existing works on LBE and export market destination, such as Xie and Li (2018).

In addition, studying the role of organizational innovation would be interesting to consider in a cross-country sample. Specifically, we deem research which compares the importance of organizational innovation amongst firms from more developed markets with that of firms from less developed, or emerging, markets as particularly fruitful. Following Vendrell-Herrero et al. (2022), we acknowledge that organizational innovation may become less important for firms from less developed home-markets, but this warrants further empirical investigation. Finally, while we have concentrated on the role of organizational innovation as a moderator in terms of LBE effects, we have not explored the potentially close relationship between process innovation, organizational innovation and LBE. It may be, for example, that firms need to fine tune their organisation of production to accommodate export

market needs through process innovations, which then may or may not lead to new product innovation. Overall, cultivating the ability to learn from activities in trade becomes particularly important for firms, in view of prevalent global trends such as protectionism and anti-globalization rhetoric which increasingly fracture the global economy into blocks and, importantly, discourage cross-bloc investments (see also Buckley, 2022). As our study suggests, learning from less 'obvious' international activities, such as exporting, is likely to require strategically induced organizational innovation, which welcomes research in other contexts, such as firms in the United Kingdom (U.K.), following the country's departure from the European Union (EU) and the associated trade impediments.

Data availability

Data will be made available on request.

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