

GVC embeddedness and innovation performance – an analysis across 28 European countries

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Abstract

Purpose – This study has the following aims. First, it tries to clarify the relationship between global value chain (GVC) participation and innovation performance. To date, research generated mixed results. Secondly, it explores a novel way of investigating GVC participation by focusing on the sectoral level in which organizations operate using the concept of GVC embeddedness, which has not been investigated to date.

Design/methodology/approach – Data from two sources are combined. The European Company Survey of 2019 provides data about the innovation performance of organizations. These data include measures about production and process. At the sectoral level, these company-level data are combined with data from the Trade in Value Added from the Organization for Economic Cooperation and Development. In total, more than 20,000 companies were investigated, which operate in 15 sectors in 28 countries. This three-level structure is analysed using multilevel ordered probit analyses.

Findings – The results show that forward participation and backward participation at the sectoral level are positively related to product innovation and process innovation. The probability of not being engaged in innovation is reduced through GVC embeddedness. And, the probability of generating incremental and radical innovations (both regarding products and processes) increases if GVC participating at the sectoral level is higher.

Originality/value – This study is the first to relate sectoral GVC embeddedness to the innovation performance of organizations.

Keywords GVC embeddedness, Forward participation, Backward participation, Innovation performance, Organizational governance

Paper type Research paper

Introduction

Global value chains (GVCs) consist of linkages between organizations adding value to a good or service while operating in different countries (Gereffi *et al.*, 2021). These links are, for example, established through outsourcing of (previously internalized) production processes or via collaboration with suppliers and buyers in other countries (Contractor *et al.*, 2010). GVC participation is examined at different levels, such as nations, sectors and organizations (Antras and Chor, 2022), each reflecting their position within the global economy. This article combines the sectoral and the organizational level. In accordance with Hu *et al.* (2022), the term GVC embeddedness is used to refer to this concept. In the current study, GVC embeddedness reflects the openness of the sector in relation to global production flows. As such, this study employs a “meso-level” approach by including the sectoral level, which is situated between micro-analysis of specific organizations and workplaces and macro-analysis of national economies (Ponte *et al.*, 2019). Regarding the impact of GVCs, two recent



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reviews of GVC research (Kano *et al.*, 2020; McWilliam *et al.*, 2020) discuss theoretical and empirical research, emphasizing the need for investigating the link between GVCs and the innovation performance of organizations.

While it has been proposed that GVC participation and innovation performance are related to each other, empirical research into this area remained surprisingly scarce (Elshaarawy and Ezzat, 2022). As Elshaarawy and Ezzat (2022) note, the literature connecting GVC participation and organizational innovation to date is largely theoretical. The only exceptions of empirical investigations of innovation that they mention are Dang and Dang (2020) and Tajoli and Felice (2018). An additional literature search does generate some other examples, such as Turkina and Van Assche (2018), who investigate the link between GVC participation in a number of economic clusters (e.g. Aerospace, Biomed and IT) and innovation and Lema *et al.* (2019) and Yang *et al.* (2020), who both investigate the link between GVCs and innovation performance in developing countries. Other studies investigated related topics such as the use of technology and knowledge diffusion (e.g. Brancati *et al.*, 2021), but these do not address the topic of innovation performance. In that sense, Van Assche's (2017) remark of the field's situation still applies: "A question that has hitherto received surprisingly little scholarly attention, however, is how the globalization of value chains affects a firm's innovation capabilities" (p. 739). Hence, understanding the relationship between GVC participation and innovation performance requires additional empirical research.

The need to investigate the link between GVCs and innovation performance is further stressed, as it is also debated whether there is a positive or a negative link between GVCs and the innovation performance of organizations as well as how these relationships are explained. The literature mainly emphasizes positive effects of GVCs, and empirical results also point in that direction (Van Assche, 2017; Elshaarawy and Ezzat, 2022). Offshoring and outsourcing of activities imply that organizations can use their remaining resources to innovate and that organizations gain by upgrading their technology and knowledge via external linkages (Bardhan and Jaffee, 2005; Phene and Almeida, 2008; Pietrobelli and Rabellotti, 2011). While others have countered these arguments stating that GVC participation constrains the innovation performance of organizations due to a weakened financial position of organizations or production processes becoming dispersed and fractionalized (Steinberg *et al.*, 2017; Ambos *et al.*, 2021; Baum *et al.*, 2022; Elshaarawy and Ezzat, 2022), the gains seem to outweigh these restrictions.

The question that the present study therefore aims to answer is how the GVC participation of an organization's sector of operation relates to its innovation performance. This study is positioned as follows in the GVC research domain. The study distinguishes itself from studies that remain at the macro level and that generated insights into (trends) in GVCs, GVC governance and outcomes such as inequality and innovation at the national level (e.g. Tajoli and Felice, 2018). In addition, it goes beyond the focus on a specific sector (e.g. Turkina and Van Assche, 2018) as it includes several sectors in a single analysis. And, finally, it investigates these sectors and organizations across several countries.

Theoretically, the present study integrates insights derived from GVC research with organizational theories of innovation performance. Empirically, it does so by combining Trade in Added Value (TiVA) data at the sectoral level, which are available from the OECD, with company-level data collected by the European Company Survey (ECS) 2019. These data allowed to include data about 15 sectors in 28 European countries. To get a good understanding of how GVCs relate to innovation performance, backward and forward participation in GVCs are investigated (OECD, 2021).

Theory and hypotheses

It is commonly believed that there is a link between GVC participation and the innovativeness of organizations. Combining insights from GVC research with theories of innovation

performance sheds a light on these diverging outcomes. McWilliam *et al.*'s (2020) shows that research explaining how GVC participation affects the innovation performance of organizations relies on theories of internal organization such as the resource based view (RBV), the knowledge-based view (KBV) and the Dynamic Capabilities Approach (DCA), as well as theories of inter-organizational relationships such as the relational view (RV), the transaction cost approach (TCA) and network theories (Crossan and Apaydin, 2010; Bai *et al.*, 2020; Szambelan *et al.*, 2020). Theoretically, these approaches differ. RBV emphasises the role of resources in explaining innovation, whereas the KBV argues that knowledge is the main resource and the DCA implies that it is not so much the resources *per se* that matter but the way in which organizations are capable to recombine them. RV, TCA and network theories focus much more on how organizations get access to resources, namely by building relations (the relational view and networks) or via formal control (TCA). While these approaches differ, they also complement each other in several respects, for example, by emphasizing that innovation performance requires that organizations have unique resources, develop, access and apply knowledge and are capable of seizing opportunities. All these mechanisms rely on internal organization or are structured via external ties. Hence, the relationship between GVC participation and innovative performance can be explained with theoretical frameworks based on resources, knowledge and capabilities of organizations.

GVC embeddedness is conceptualized as the external environment of organizations, which is of vital importance here for several reasons. First, characteristics of the external environment define the need for having unique resources, knowledge and capabilities (Pandza and Thorpe, 2009; Fawcett *et al.*, 2011). Secondly, the external environment provides opportunities to access, develop and exchange them (Mol, 2001; Holmqvist, 2003; Ruiz-Ortega *et al.*, 2023). Based on the assumption that GVCs constitute a core part of the environment in which organizations operate, the connection between organizations and their environment can be more direct (if they participate directly in a GVC) or indirect (if the organization belongs to a sector with a high incidence of GVC participation). In other words, organizations may be affected by GVCs directly as well as indirectly, as GVCs affect the wider environment in which organizations operate.

The sector in which organizations operate is a particular important point of reference compared to the more general level of the country (Ciani and Gregori, 2022). In several studies, the sectoral level received attention. In these studies, the direct and indirect effects of sectors are examined by taking into account the structure of the sector and the dynamics taking place within sectors. These studies provide explanations of sectoral differences regarding innovation performance (Wakelin, 2001). Innovations are believed to diffuse within sectors (Cai *et al.*, 2022). Kitsos *et al.* (2023) argue that regional embeddedness can create positive externalities for all organizations belonging to the same region. Similarly, organizations can gain from the innovation performance of other organizations in the sector (Moreira *et al.*, 2018). Thus, the sector to which organizations belong may provide important resources and opportunities for learning. Nevertheless, to date, this assumption has not been tested by combining the sectoral level (the environment of organizations) to the organizational level (the unit where innovations take place). To conduct such an analysis, available data about the sectoral level are combined with organizational level data. What is novel here is that the sectoral level constitutes an environment or context in which the organizations operate and are hence interpreted in terms of sectoral embeddedness.

The relationship between GVC embeddedness and innovation performance

Whereas prior research into GVC participation and innovation performance generated some mixed outcomes (Ambos *et al.*, 2021), there is more evidence for a positive relationship than a negative relationship. The main reason for this is that those who emphasise the negative side of

GVCs focus on the extremes. They do so by arguing that production processes become too dispersed that organizations become more focused on efficiency instead of innovation or that innovation processes become too complex or interdependent (Yamin, 2011; Narula, 2014; Steinberg *et al.*, 2017; Ambos *et al.*, 2021). Nevertheless, these seem to be exceptional cases. Whereas the development of resources, knowledge and capabilities and the management of external resources may require additional attention, it is assumed here that on average organizations are capable of handling these complexities. A positive relationship between GVC embeddedness and innovation is explained along several lines of argumentation. One of the main arguments is that GVC participation leads to increased competition, which translated into increasing the need for innovation (Schmitz, 2005). In addition to that, research shows that especially backward participation (making use of foreign inputs) can have a positive impact on innovation since foreign knowledge is incorporated in the processes of organizations (Eissa and Zaki, 2023), which may serve as a form of social capital, which in turn contributes to the innovation performance of organizations (Inkinen *et al.*, 2015). More generally, the existence of GVCs means that production processes are dispersed across countries, which in turn allows for the exchange of knowledge between organizations operating in different countries (Tajoli and Felice, 2018). Furthermore, GVCs can put pressure on participants to increase their standards to fulfil demand (OECD, 2013). GVCs may therefore also spur learning and technological upgrading (Schmitz and Knorringer, 2000; Sampath and Vallejo, 2018). Research into the impact of offshoring on innovation performance also shows that organizations can gain in that way (Nieto and Rodriguez, 2011; Thakur-Wernz and Wernz, 2022). Having said that, along with opportunities to acquire improved technologies and know-how, GVC participation can also help companies to enhance their trade networks (Ernst and Kim, 2002; Gereffi, 2014; Ndubuisi and Owusu, 2021; Reddy *et al.*, 2021). This means that organizations participating in GVCs develop their resources, knowledge and capabilities internally to deal with their external environment or that they develop external relationships in such a way that mutual learning and information sharing are enabled.

These arguments are integrated as follows. It is expected that the negative effects or hindrances apply to the organizations that have a low level of GVC participation and thus have yet to develop the necessary capabilities to participate and to reap the benefits from participation. The organizations on the other hand of the spectrum have developed these capabilities and are expected to generate more returns in terms of innovation performance.

- H1. There is a positive relationship between GVC embeddedness (sectoral level GVC participation) and the product and process innovation performance of organizations.

Data and analytic strategy

Data sources

Data from different sources are combined to investigate the link between GVCs and innovation performance of organizations.

Organizational level. To assess the outcomes at the organizational level, data from the European Company Survey (ECS; <https://www.eurofound.europa.eu/en/european-company-survey-2019>) are analysed. The ECS is a survey to gather data from companies with at least ten employees in 28 European countries (EU member states and the UK). Interviewees are the managers who are responsible for the human resources in those companies. One of the aims of the ECS is to provide insights into the practices of these establishments in a harmonized manner. The fourth round was collected in 2019. The 2019 edition of the ECS contains information about 21,869 establishments in 28 European countries (27 EU member states and the UK) in total. The analyses for product innovation are conducted on a dataset with 21,744 companies and the analyses of process innovation include 21,646 establishments. To make

sure that a large share of the organizations is included in the analyses, for the independent categorical variables, the categories “missing” or “not applicable” are also presented.

Sectoral level: GVC embeddedness. The company data are combined with data from the TiVA dataset provided by the OECD (<https://www.oecd.org/sti/ind/measuring-trade-in-value-added.htm>), which contains information about a large number of GVC participation indicators (OECD, 2021). The TiVA indicators are available for different levels of analysis (e.g. sector and country) and for different years. For the present analyses, the data at the sectoral level for the 28 ECS-countries are of interest. The ECS contains information about the sector in which an establishment operates. The following 15 sectors are included (Table 1).

Measures

Innovation performance. The questions measuring innovation performance are:

- (1) Since 2016, has this establishment introduced any new or significantly changed products or services? [*Product innovation*]
- (2) Since 2016, has this establishment introduced any new or significantly changed processes, either for producing goods or supplying services? [*Process innovation*]

The answer categories of the two questions are the same. Respondents could choose between “no”, “yes, new to the organization” and “yes, new to the market”. In this paper, these response categories are labelled “no innovation”, “incremental innovation” and “radical innovation”. As such, they reflect an ordering in the level of innovativeness. Nevertheless, since the distances between the categories are unknown, they are treated as an ordinal scale and analysed accordingly.

GVC embeddedness: forward and backward participation at the sectoral level. As explained in the theoretical section, this study aims at understanding the link between GVC participation at the sectoral level. By combining this information with organizational level data, it is possible to interpret this as the extent to which an organization is embedded in a GVC. The TiVA-data at the sectoral level have been used in other studies (see, for example, Anzolin and Benassi, 2024). However, the studies have not combined these sectoral-level data with company-level data.

Sector	NACE (ECS)	STAN (TiVA)	%
Mining and quarrying	B	D05T09	0.4
Manufacturing	C	D10T33	25.6
Electricity, gas, steam and air conditioning supply	D	D35	0.9
Water supply; sewerage, waste management and remediation activities	E	D36T39	1.6
Construction	F	D41T43	10.3
Wholesale and retail trade; repair of motor vehicles	G	D45T47	20.8
Transportation and storage	H	D49T53	6.2
Accommodation and food service activities	I	D55T56	6.0
Information and communication	J	D58T63	4.1
Financial and insurance activities	K	D64T66	2.1
Real estate activities	L	D68	1.4
Professional, scientific and technical activities	M	D69T75	6.8
Administrative and support services activities	N	D77T82	3.9
Arts, entertainment and recreation	R	D90T93	3.3
Other service activities	S	D94T96	6.6

Source(s): Table by authors

Table 1.
Sectors included in the
analyses

Several GVC indicators are included in the analyses. Backward participation (*exgr_fvash*) indicates that the sector is mainly a buyer of external inputs. Forward participation (*exgr_dvaafcsh*) indicates whether the sector is a seller. Domestic added value (*exgr_dvaafcsh*) is also included as an indicator of how much the sector adds to exports via domestic inputs. The natural logarithms of these GVC indicators are added to the models. Using these transformations is often applied in research investigating GVC participation (Hu *et al.*, 2021). Since some sectors have a score of 0, the logarithms are calculated after a 1 is added to the raw score.

Knowledge-intensive work practices. To measure the knowledge-intensity of the companies, a variable measuring knowledge-intensive work practices (KIWPs) is constructed. Based on DCA and organizational learning theories, Koster (2022) developed this construct spanning the ability to adapt to changing circumstances, to enhance learning and the use of technology. With the ECS, these aspects can be measured with the following six items:

- (1) For how many employees in this establishment does their job include finding solutions to unfamiliar problems they are confronted with? Your best estimate is good enough. [*Unfamiliar problems*].
- (2) For how many employees in this establishment does their job include independently organising their own time and scheduling their own tasks? Your best estimate is good enough. [*Scheduling*].
- (3) How many employees in this establishment are in jobs that require continuous training? Your best estimate is good enough. [*Continuous training*].
- (4) In 2018, how many employees in this establishment participated in training sessions on the establishment premises or at other locations during paid working time? Your best estimate is good enough. [*Participation in training*].
- (5) In 2018, how many employees in this establishment have received on-the-job training or other forms of direct instruction in the workplace from more experienced colleagues? Your best estimate is good enough. [*On-the-job training*].
- (6) How many employees in this establishment use personal computers or laptops to carry out their daily tasks? Your best estimate is good enough. [*Computers*].

For each of these questions, respondents indicate on a seven-point scale to how many of the employees it applies. The categories of these items are as follows: none at all, less than 20%, 20–39%, 40–59%, 60–79%, 80–99% and all.

A reliability analysis of these items resulted in a Cronbach's alpha of 0.71. Therefore, it is concluded that the items can be combined into a single scale. This scale is created by adding the scores on the items. These scores are divided by 6. Hence the final scale also runs from 1 to 7.

Digitalization. Three variables are included to measure the level of digitalization of the establishments. Each of these variables was measured with a 0 indicating that these technologies are not present and a 1 that they are.

- (1) The variable *robots* is measured with the question “Robots are programmable machines that are capable of carrying out a complex series of actions automatically, which may include the interaction with people. Does this establishment use robots?”.
- (2) The variable *DA production* is measured with the question “Does this establishment use data analytics (Data analytics refers to the use of digital tools for analysing data collected at this establishment or from other sources) to improve the processes of production or service delivery?”.

- (3) The variable *DA monitoring* is measured with the question “Does this establishment use data analytics to monitor employee performance?”.

These dummy variables are separately added to the analyses. Exploratory factor analyses did not yield an underlying dimension of these variables. Hence, they indicate different aspects of digitalization of the company.

Organizational size. The variable *organizational size* is measured by asking the question “Approximately how many people work in this establishment?”. This variable has three categories, namely 10–49, 50–249 and 250 and more. The descriptive statistics of the data are presented in [Table 2](#).

Analyses

The theoretical framework developed in this paper relies on the notion that organizations are embedded in a context – the sector to which they belong – and the structure and dynamics taking place within these sectors – due to how they are placed within a GVC – is expected to affect the innovation performance of organizations. To investigate this, a dataset is constructed in which characteristics of sectors are linked with characteristics of organizations. Moreover, the empirical data are available for 28 countries. Finally, the dependent variables investigated in this study have three levels, namely 0, 1 and 2, which stand for no innovation, incremental innovation and radical innovation. Hence, the dataset consists of three levels (organizations nested in sectors, which are nested in countries), and the responses are ordered categories. To fully take advantage of the information at hand, a multilevel ordered probit analysis is performed with STATA version 18 (using MEOPROBIT). The probit model uses the independent variables to predict a latent variable based on the ordered responses ([Liddell and Kruschke, 2018](#)). To simplify the interpretation, the outcomes of the multilevel probit analysis are used to calculate marginal effects. These marginal effects show the probability of a change in the dependent variable

	Min/Max	Mean	S.D.	Percentage
Backward participation	0/67.21	25.82	12.43	
Forward participation	0/17.54	7.57	4.94	
<i>Product innovation</i>				
No	0/1			65
Incremental (new to the organization)	0/1			19
Radical (new to the market)	0/1			16
<i>Process innovation</i>				
No	0/1			67
Incremental (new to the organization)	0/1			25
Radical (new to the market)	0/1			9
KIWPs	1/7	3.60	1.16	
Robots				18.0
DA processes				49.8
DA monitoring				31.8
<i>Size</i>				
Small (10–49)	0/1			62.4
Medium (50–249)	0/1			27.3
Large (250+)	0/1			10.3

Source(s): European Company Survey (ECS), Table by authors

Table 2.
Descriptive statistics

with a change in one unit of the independent variable, given that all other variables are set to their mean value. The parameters in the tables can therefore be interpreted as the probability of the occurrence of the three possible outcomes (e.g. no innovation, incremental innovation and radical innovation). Because forward and backward participation are correlated (the correlation coefficient is 0.39 at the sectoral level), they are added separately to the models.

Results

Tables 3–6 present the results of the multilevel probit analyses for the two dependent variables (product innovation and process innovation).

Tables 3 and 5 show that product innovation is explained by backward participation and forward participation at the sectoral level. First, an increase in backward participation reduces the probability that organizations in the sectors are not innovative with 6.2% (the predicted probability is 0.062; $p < 0.001$) and forward participation of the sector reduces this probability with 1.8% ($p < 0.001$). The probabilities that organizations are engaged in incremental innovations increase with 2.3 and 0.7% for a unit increase in backward participation and forward participation, respectively. And, finally, the probability of radical innovations increases with 3.6% (backward participation) and 1.1% (forward participation); the level of GVC participation at the sectoral level increases with 1 unit.

Tables 4 and 6 show the results for process innovation. Backward participation and forward participation at the sectoral level also explain these kinds of innovation. A unit increase in backward participation at the sectoral level reduces the probability that organizations in the sectors are not innovative with 5.3% and a unit increase in forward participation of the sector reduces this probability with 0.9%. The probability of incremental innovations increases with 3 and 0.7% for a unit increase in backward participation and forward participation at the sectoral level, respectively. And, finally, the probability of radical innovations increases with 2.3% (for backward participation) and 0.4% (forward participation); the level of GVC participation at the sectoral level increases with 1 unit.

	No innovation			Incremental innovation			Radical innovation		
	Predicted probability	s.e.	<i>p</i>	Predicted probability	s.e.	<i>p</i>	Predicted probability	s.e.	<i>p</i>
Backward participation	−0.062	0.014	0.000	0.023	0.001	0.000	0.039	0.009	0.000
Knowledge-intensive work practices	−0.055	0.003	0.000	0.021	0.001	0.000	0.034	0.002	0.000
<i>Organization size</i>									
Medium	−0.019	0.007	0.008	0.007	0.003	0.008	0.012	0.005	0.009
Large	−0.040	0.011	0.000	0.015	0.004	0.000	0.025	0.007	0.000
Robots	−0.082	0.010	0.000	0.031	0.004	0.000	0.051	0.006	0.000
DA production	−0.108	0.007	0.000	0.041	0.003	0.000	0.067	0.005	0.000
DA monitoring	−0.035	0.007	0.000	0.013	0.003	0.000	0.022	0.005	0.000
Wald χ^2	1085.300 ($p = 0.000$)								

Table 3.
Predicted probabilities for product innovation and backward participation

Note(s): 18,854 organizations in 15 sectors in 28 countries
Source(s): European Company Survey (ECS), Table by authors

	No innovation			Incremental innovation			Radical innovation		
	Predicted probability	s.e.	<i>p</i>	Predicted probability	s.e.	<i>p</i>	Predicted probability	s.e.	<i>p</i>
Backward participation	−0.053	0.013	0.000	0.030	0.007	0.000	0.023	0.006	0.000
Knowledge-intensive work practices	−0.054	0.003	0.000	0.030	0.002	0.000	0.024	0.002	0.000
<i>Organization size</i>									
Medium	−0.028	0.007	0.000	0.016	0.004	0.000	0.012	0.003	0.000
Large	−0.042	0.011	0.000	0.023	0.006	0.000	0.019	0.005	0.000
Robots	−0.127	0.010	0.000	0.071	0.005	0.000	0.060	0.005	0.000
DA	−0.120	0.007	0.000	0.067	0.004	0.000	0.053	0.004	0.000
production DA	−0.062	0.007	0.000	0.035	0.004	0.000	0.027	0.003	0.000
monitoring	1441.910 (<i>p</i> = 0.000)								
Wald χ^2									

Note(s): 18,811 organizations in 15 sectors in 28 countries

Source(s): European Company Survey (ECS), Table by authors

Table 4.
Predicted probabilities
for process innovation
and backward
participation

	No innovation			Incremental innovation			Radical innovation		
	Predicted probability	s.e.	<i>p</i>	Predicted probability	s.e.	<i>p</i>	Predicted probability	s.e.	<i>p</i>
Forward participation	−0.018	0.003	0.000	0.007	0.001	0.000	0.011	0.002	0.000
Knowledge-intensive work practices	−0.054	0.003	0.000	0.020	0.001	0.000	0.034	0.002	0.000
<i>Organization size</i>									
Medium	−0.018	0.007	0.011	0.007	0.003	0.011	0.011	0.005	0.012
Large	−0.038	0.011	0.006	0.014	0.004	0.000	0.024	0.007	0.000
Robots	−0.084	0.010	0.000	0.031	0.004	0.000	0.053	0.006	0.000
DA	−0.108	0.007	0.000	0.040	0.003	0.000	0.068	0.005	0.000
production DA	−0.036	0.007	0.000	0.013	0.003	0.000	0.022	0.004	0.000
monitoring	1130.870 (<i>p</i> = 0.000)								
Wald χ^2									

Note(s): 19,069 organizations in 15 sectors in 28 countries

Source(s): European Company Survey (ECS), Table by authors

Table 5.
Predicted probabilities
for product innovation
and forward
participation

Overall, no negative results were found regarding the relationship between GVC embeddedness and the innovativeness of organizations. Instead, [hypothesis 1](#) is fully supported. Both backward and forward participation at the sectoral level are associated with higher levels of innovativeness in organizations. There are some notable differences across the findings. First, the outcomes are stronger for backward participation than for forward participation. Secondly, the outcomes show that backward participation at the sectoral level

Table 6.
Predicted probabilities
for process innovation
and forward
participation

	No innovation			Incremental innovation			Radical innovation		
	Predicted probability	s.e.	<i>p</i>	Predicted probability	s.e.	<i>p</i>	Predicted probability	s.e.	<i>p</i>
Forward participation	−0.009	0.003	0.000	0.005	0.002	0.000	0.004	0.001	0.000
Knowledge-intensive work practices	−0.052	0.003	0.000	0.029	0.002	0.000	0.023	0.002	0.000
<i>Organization size</i>									
Medium	−0.028	0.007	0.000	0.015	0.004	0.000	0.012	0.004	0.000
Large	−0.041	0.011	0.000	0.023	0.006	0.000	0.019	0.005	0.000
Robots	−0.129	0.010	0.000	0.072	0.005	0.000	0.057	0.005	0.000
DA	−0.120	0.007	0.000	0.067	0.004	0.000	0.053	0.004	0.000
production DA	−0.062	0.007	0.000	0.035	0.004	0.000	0.028	0.003	0.000
monitoring									
Wald χ^2	1466.880 (<i>p</i> = 0.000)								
Note(s): 19,024 organizations in 15 sectors in 28 countries									
Source(s): European Company Survey (ECS), Table by authors									

is more strongly related to radical product innovations, while in the case of process innovation, backward participation seems to lead to more incremental innovations.

Finally, it is worth noting that the control variables contribute to a further understanding of the innovativeness of organizations. Knowledge-intensive work practices have a profound impact in that regard. Knowledge-intensive organizations are far more likely to be innovative. The absence of innovations reduces with more than 5% for each unit increase in these practices (which amount to a difference of 35% from the lowest to the highest level of knowledge intensity). Digitalization also plays a major role. Organizations that do not use digital tools are almost 10% more likely to refrain from innovations. The outcomes for incremental and radical innovation are somewhere in the range of a 1 and 7% increase in innovativeness per 1 unit change (since these are dummy variables, this is the difference between applying these tools or not applying them). Finally, organizational size matters. The largest companies are the most innovative, both with regard to incremental and radical innovations.

Conclusion and discussion

Conclusion

This paper sets out to answer the question whether the innovation performance of organizations is related to GVC participation at the sectoral level, that is, GVC embeddedness. This question is addressed using the ECS (2019) in combination with sectoral-level data about backward participation, forward participation and domestic added value. The analyses lead to the following insights and conclusions.

Theoretical contributions and implications

First, GVC embeddedness at the sectoral level is associated with higher levels of innovation performance of organizations. These associations were found for product and process innovation in relation to both backward and forward participation. What the research shows

is that these globalized external ties particularly matter for production and process innovation and reach organizations via the sector in which they operate. Clearly, the findings are in line with what may be expected from theories emphasizing the resource, knowledge and capability advantages that GVC may provide. This also means that no evidence was found for the opposite view that GVCs are a hindrance because they lead to fragmentation, complexity and increasing, which undermine the development of resources and routines. This means that overall, GVC embeddedness and innovation performance of organizations are positively related. Of course, this is not to say that there may be organizations going against this general trend, experiencing negative outcomes of innovation performance. That other studies have found some of the negative outcomes of GVCs adds to this argumentation. While we do see that on average GVC embeddedness goes along with the ability to maintain and develop resources, information and capabilities, this does not have to hold for every organization under all circumstances. Instead, we may expect these negative outcomes to appear under specific circumstances, which were not investigated here.

Secondly, the research shows that the sectoral level matters for the innovation performance of organizations. In part, this is due to the direct relations that these organizations have, but it also underscores that organizations are indirectly affected by the GVC participation of their sector. This can be understood as a form of GVC embeddedness in which learning and the transfer of knowledge take place through the GVC channels – between the organizations that are connected globally – as well as the diffusion of information across organizations in the same sector, even if not all of them are participating in the GVC.

Practical implications

For managers and consultants, this research offers several practical insights. Organizations aiming to increase their innovation performance – by developing new products and services and new forms of organizing – are advised to explore the possibilities of connecting to GVCs. This research suggests that particular attention should be geared towards managing the relationships with other organizations. Via these GVC relationships they may get access to new resources and learn from their GVC-partners. And by investing in these relations and by managing them carefully, they may benefit the most from them. This research also points to another way of improving the innovation performance of organizations, namely by partnering with other organizations that already participate in a GVC. Instead of tapping into a GVC themselves, they may access resources, information and capabilities indirectly via these partners. One of the main benefits of this approach is that it is associated with less risk and may therefore be an attractive option for many organizations, in particular for smaller organizations and those with fewer resources.

Limitations and future research

The study has several restrictions that should be considered. To begin with, the dataset did not contain direct measures of GVC participation at the organizational level. While the research shows that the sectoral level matters, future research should complement the present study by including more fine-grained measures of GVC participation at the organizational and the sectoral level. Having such data allows for deeper understanding of the dynamics and exchanges taking place between organizations, both within and outside the sector. In addition to that, the theoretical mechanisms that were used to develop the theoretical framework are not tested directly. The present research suggests that resources, knowledge and capabilities are developed and maintained as a result of GVC participation. But as the theoretical mechanisms could not be tested directly, this also remains a matter of interpretation. Future research would gain by making these mechanisms explicit and

investigating them empirically. Such research should also pay attention to the condition under which GVC embeddedness and innovation performance occur.

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