

# A cluster's internationalization as a catalyst for its innovation system's access to global markets

A cluster's  
internationalization  
process

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## Abstract

**Purpose** – The paper aims to illuminate the platform created by a cluster organization to facilitate its internationalization and thereby enhance its regional innovation system partners' competitiveness by providing access to global value chains and boosting innovativeness.

**Design/methodology/approach** – The study draws upon the interaction approach, focusing on the interaction process, interaction partners, relationship atmosphere, and relationship environment. A qualitative study was conducted at Future Position X, a Swedish cluster organization. A total of 58 interviews were conducted, including 48 face-to-face in-depth interviews between 2017 and 2019 with six key informants at FPX, representatives from 28 SMEs, ten members of regional innovation systems to which FPX belongs, and four process leaders of regional and local networks, in addition to online interviews with ten members of the regional innovation systems conducted via Microsoft Teams in March 2021. The time span of the study provides a longitudinal perspective.

**Findings** – The FPX cluster collaborates with actors in the quadruple helix, maintaining a mindset that has led to a number of new partner agreements in the global arena to secure the resources and expertise necessary for cluster activities, and thereby ensuring firms in FPX networks access to platforms for international expansion. Internationalization thus expands the cluster's knowledge base beyond the traditional environment of its member firms.

**Research limitations/implications** – Very few innovations arise from the isolated work of a lone genius. Instead, most innovation is achieved through complex, interactive, iterative and cumulative learning processes in which a variety of actors are involved. The FPX cluster organization's internationalization platform is therefore vital to the internationalization of its partners since cluster actors lack the time, resources, knowledge, experience, and networks required to break into international markets singlehandedly.

**Practical implications** – This study suggests that, for practitioners and researchers alike, the growing importance and relevance of the regional innovation system cannot be overemphasized. It also holds policy and societal implications in that FPX's global network helps regional SMEs to internationalize, in addition to inspiring international firms to establish operations in the Gävleborg region, thereby helping to strengthen the overall GIS environment. Internationalization also expands the FPX cluster's knowledge base beyond the traditional environment of its firms, an example of this being the construction start of a Microsoft data centre in the region in 2020.

**Social implications** – FPX is financed through taxation and grant funding. By initiating projects, creating relationships and building collaborations, FPX thus contributes to collaboration between business, academia and the public sector. FPX also contributes to knowledge development of new technology by creating meeting places and networks around digital issues, such as GIS, AI, the IoT and blockchain technology.

**Originality/value** – While earlier research has concentrated on endogenous gaps critical to cluster dynamics, comparatively little attention has been paid to exogenous gaps, i.e. linkages between regional clusters and innovation partners elsewhere in the world. This study showcases the richness of interactions in the cluster against the background of wider, global innovation interactions. Future research should examine other vital

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questions that remain unanswered, e.g. by measuring and exploring the extent to which regional innovation systems can contribute to long-term economic growth for society.

**Keywords** Cluster internationalization, Internationalization process, Formal and informal networks, Future position X (FPX), Digitalization, Small and medium-sized enterprises (SMEs)

**Paper type** Research paper

## Introduction

The first fruits of the research and theorization of national innovation systems (Freeman, 1995) began to appear in the late 1980s. Shortly thereafter, Lundvall published a chapter on “innovation as an interactive process” in Dosi (1988b). While the ideas of both Freeman (on networks) and Lundvall (on interactive learning) were path-breaking and useful for the current study, the relative generality of their concepts of national innovation systems and blind spots regarding regions are obvious weaknesses (Edquist, 2004; Tartaruga, 2020; González-López et al., 2019; Kumar et al., 2022), and the need for further research within firms and innovation support organizations, e.g. cluster organizations, has become increasingly clear.

Because market mechanisms seem insufficient for producing appropriate, fluid and rapid change in the development of a region (Fiore et al., 2011), the regional innovation system was developed as an instrument by which regional and national policymakers could encourage innovation (Pino and Ortega, 2018). In other words, regional innovation systems “can be thought of as the institutional infrastructure supporting innovation within the production structure of a region” (Asheim and Coenen, 2005, cited in Pino and Ortega, 2018, p. 2). Regional governance mechanisms, such as cluster initiatives, support knowledge creation and help to geographically embed the firm (Kramer et al., 2011; Spicka, 2022; Kumar et al., 2022).

Studies have shown that clusters add value both for the actors involved and to the economy, in the form of knowledge-building and the synergistic benefits accrued from collaboration, such as economies of scale, social relations and networks, information flows and building infrastructure (Porter, 1998; Sölvell, 2009; Kumar et al., 2022; Spicka, 2022; Singh et al., 2022). Cluster initiatives provide a natural setting for different stakeholders, including small- and medium-sized enterprises and multinational enterprises (SMEs and MNEs), to interact effectively with each other and with other institutions, to work together, and to learn (Osarenkhoe and Fjellström, 2017). Thus, the interactive learning process that occurs between cluster organizations and actors in this setting is congruent with the concept of open innovation as postulated by Chesbrough (2003) and Waluszewski et al. (2009), and with the assertion that “innovation is born out of reshuffling resources inside and outside of the firm and takes into consideration the mutual value creation of those (innovators) involved” (Osarenkhoe and Fjellström, 2021, p. 3).

### *Problematicization of the phenomenon and research gaps bridged in this study*

Few previous studies have addressed the internationalization of cluster organizations. Some studies have viewed clusters’ internationalization from the perspective of the tasks that cluster organizations perform and how the organizations are linked to their international partners (Jankowska and Główska, 2016; Schreier et al., 2019; Kumar et al., 2022; Spicka, 2022), while others have looked at the role cluster organizations play in the internationalization of new ventures (Ayakwah et al., 2019; Caputo et al., 2016; Singh et al., 2022).

### *Endogenous and exogenous gaps*

Most of the studies to date also focus on the positive effects of cluster activities with respect to collaboration and interaction: (1) between firms; (2) between firms and education and research; (3) between firms and capital; and (4) between firms and policy; collectively known as endogenous or internal gaps (Sölvell, 2009; Jankowska and Główska, 2016; Schreier et al., 2019; Spicka, 2022; Kumar et al., 2022). Much less attention has been given to the exogenous

gap (regarding the interaction of clusters with global innovation systems) limiting how firms interact with global markets and value chains.

Since previous studies have concentrated mainly on internal (endogenous) gaps that impede collaboration and mobility within clusters rather than external (exogenous) gaps vis-à-vis collaboration and interaction with global markets, our aim is to paint a rich picture of the cluster's interactions on the canvas of its wider, global innovation interactions by focusing on the global linkages between regional clusters and innovation partners elsewhere in the world. The study thereby contributes to the existing literature by illuminating exogenous gaps – between actors in the regional innovation system and global innovation systems – that are critical to cluster dynamics, thus responding to calls for more research on cross-border gaps that enable collaborations and interactions with global innovation systems (Tartaruga, 2020; Jankowska and Głowska, 2016; Kumar *et al.*, 2022). To this end, the exploratory nature of this study is guided by the following research question:

*RQ.* What role does a cluster organization's internationalization platform play in the internationalization of firms and other actors that make up the regional innovation system?

In other words, the study aims to highlight how the internationalization platform of one cluster organization is used to tap into its entire innovation system internationally and become integrated with other global innovation networks. This is particularly vital because previous studies (Jankowska and Głowska, 2016; Osarenkhoe and Fjellström, 2021) show that many cluster actors lack the time, resources, internal knowledge-sharing activities and innovative capability (Chatterjee *et al.*, 2022), experience and networks required to break into international markets on their own. Such a platform invariably therefore enables SMEs to overcome liabilities of size, resources, newness, and foreignness when attempting to enter foreign markets where they lack relevant prior network positions (Johanson and Vahlne, 2009; Spicka, 2022; Kumar *et al.*, 2022). Bridging this gap is of utmost importance because the rich picture of interactions (Pagani and Pardo, 2017; Coreynen *et al.*, 2017; Spicka, 2022; Kumar *et al.*, 2022) in cluster organizations is set against the background of wider, global innovation interactions. Furthermore, creation of an internationalization platform is crucial for cluster organizations today, as traditional industries, labour markets and the global economy as a whole face rapid and substantive change and disruption brought on by the effects of digitalization (North *et al.*, 2019; Vadana *et al.*, 2019). For companies, internationalization means opportunities for new business models, for everything from marketing and sales channels to logistics.

## Theoretical background

### *Interactive, iterative, and cumulative learning processes of innovation*

According to Srholec and Verspagen (2012), much of the innovation literature has been preoccupied with using a firm's R&D investment as an indicator for innovation, thus neglecting the fundamental issue of how firms and organizations actually innovate, since a focus on R&D investments captures only a simplistic, linear view of how innovation works. A less linear definition of innovation undertaken by some researchers postulates that innovation is a process that takes place in the interaction between the focal company or organization and its environment (Van de Ven *et al.*, 1999; Kline and Rosenberg, 1986; Baraldi and Waluszewski, 2005; Håkansson and Waluszewski, 2002). A subsequently emerging body of research on open innovation (Chesbrough, 2003) postulates, however, that the assets necessary for creating innovation might not necessarily collocate with those for commercializing innovations, and offers a new paradigm to explain why firms should externalize innovation (Chesbrough, 2006; West and Bogers, 2014; Bagherzadeh *et al.*, 2021). Del Vecchio *et al.* (2020) build on extant literature on how firms "can and should use external

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ideas as well as internal ones, and internal and external paths to market” (Chesbrough, 2003, cited in *ibid.*, p. 979) to make effective use of technological tools and facilitate competitiveness (Santoro *et al.*, 2018). They also illuminate how the innovation process unfolds and open innovation strategies (Prahalad and Hamel, 1990; Santoro *et al.*, 2019) are executed in ICT SMEs by managing internal and external knowledge flows to provide a deeper understanding of the family firm.

The open innovation literature has furthermore focused increasingly on the role of the users in innovation processes (von Hippel, 1988; Porter, 1990; Bogers *et al.*, 2018; Chesbrough, 2003; Enkel *et al.*, 2009; Bagherzadeh *et al.*, 2021). There remains, however, a need to broaden the scope and focus also on interactions between several actors in the wider network of innovation use, development and production in order to understand how the innovation process works (Håkansson and Waluszewski, 2007; Remneland Wikhamn and Styhre, 2019). This view rests on the seminal works of Van de Ven *et al.* (1999) who posit that there is a difference between achieving an invention and achieving an innovation.

Whereas an invention can be defined as a novel solution to a specific problem, developed by a single company in isolation or in collaboration with end-users, for an invention to become an innovation it must attain widespread use and become integrated into the organizational and physical structures needed for its utilization. Hence, the interface between the resources and the users that the producers of new technology bring to the collaboration is recognized as important (Van de Ven *et al.*, 1999; Waluszewski *et al.*, 2009; Kumar *et al.*, 2022). This way of defining innovation is consistent with Penrose’s seminal work (1959) that sees value creation as inherent in combining heterogeneous resources. The study of how resources are reshuffled and how the interfaces between resources become integrated is thus an established approach in interorganizational network studies of innovation (Mele *et al.*, 2010; Eklinder-Frick *et al.*, 2011; Spicka, 2022; Singh *et al.*, 2022).

#### *Innovation systems defined*

The concept of innovation systems is still emerging, and consensus has yet to be reached regarding its exact definition. One definition suggested is: “a set of components and the causal relations influencing the generation and utilization of innovations and the innovative performance” (Granstrand and Holgersson, 2019, p. 1). What the concept clearly does entail, however, is that the flow of technology and information between people, enterprises and institutions is key to the innovative process. Innovation systems encompass the interactions between actors needed to turn an idea into a process, product, or service in the market.

Against this backdrop, it seems that the popularity of the concept of the regional innovation system is closely related to the emergence of regionally identifiable nodes or clusters of industrial activity as well as a surge in regional innovation policies that deem the region the most appropriate level at which to sustain innovation-based learning economies (González-López *et al.*, 2019). Thus, current research on open innovation extends into a broad set of areas and domains, such as SMEs, new units of analysis, different high- and low-tech industries, non-profit organizations, and public policy (West and Boger, 2014). Moreover, some research regards the future of open innovation as one of processes that cannot be predicted with certainty (Cassiman and Valentini, 2016; Bagherzadeh *et al.*, 2021).

#### *Interaction between clusters actors*

In their book *No Business Is an Island: Making sense of the interactive business world*, Håkansson and Snehota (2017a) provide empirical insights into the often-hidden interactive aspects of the contemporary business world. This interactiveness is attributed to the fact that the interactive dimension is crucial for the development and growth of companies and economies. Enormous attention has been devoted to clusters (Porter, 1990; Ayakwah *et al.*, 2019; Osarenkhoe and Fjellström, 2017; Spicka, 2022; Kumar *et al.*, 2022) and cluster

initiatives (Sölvell, 2009). According to Morgulis-Yakushev and Sölvell (2017, p. 99), “a cluster is a combination of a geographical agglomeration (territorial definition) of related and supporting industries (sectoral definition), including firms that are both horizontally (competing) and vertically (buyer – supplier) related. In addition to firms, clusters include other organizations such as research institutes, educational institutions, capital providers and government organizations.” Hence, a cluster comprises several different types of actors. These actors, i.e. companies and other organizations in the cluster, are usually networked and connected, and interact in various ways, e.g. through resource and information mobility and sharing, which may include collaborative projects.

While clusters often possess great potential, the strength and depth of the ties between companies and other organizations within clusters can vary considerably and much of this potential may remain unfulfilled (Kumar *et al.*, 2022; Spicka, 2022; Pavelkova *et al.*, 2015; Morgulis-Yakushev and Sölvell, 2017; Jankowska and Główska, 2016; Sölvell and Lindqvist, 2011). Weak interaction isolates cluster members, creating gaps between different types of actors, though the strength of inter-actor ties can increase – through various types of “bridge-building” activities (Sölvell and Lindqvist, 2011). A lack of strong interactions between cluster actors can limit mobility and collaboration, as well as the dissemination of knowledge.

The 7 Cluster Gap Model developed by Morgulis-Yakushev and Sölvell (2017) describes these limitations as gaps that hinder interaction. The seven gaps include: (1) the *firm-to-firm gap* limiting interactions between firms in the cluster; (2) the *firm-to-research gap* limiting interactions between cluster firms and research organizations; and (3) the *firm-to-education gap*, which limits interactions between firms and education (primary, secondary, tertiary) organizations (human resources are built through the different levels of the education system and, in the case of universities, education and research are seen as one actor); (4) the *firm-to-capital gap* limiting interactions between firms and investors; (5) the *firm-to-public gap* limiting interactions between cluster firms and government and other public bodies that make and implement policy decisions about public infrastructure, regulations, cluster programs, etc.; (6) the *firm-to-other clusters gap*, which limits interactions between firms in one cluster with actors in sectors outside that cluster, in other words sector to sector interactions; and (7) the *firm-to-global gap* (the focus of the current paper) refers to a gap that hinders cluster firms’ global linkages, in other words, to global markets and value chains (ibid., p.101).

While most previous studies have focused on gaps 1–6 – regarded in this study as endogenous gaps, less attention has been paid to gap 7 – regarded here as an exogenous gap. Hence, it is this gap we aim to address here.

The interaction approach: interaction parties, relationship atmosphere, and the relationship environment:

Håkansson (1982) described an interaction model based on principles that he saw as neglected in earlier research. Håkansson’s model investigates interaction from the perspective of how it relates to the characteristics of the actors involved, how the actors perceive one another, and how their actions towards one another are shaped over time (Håkansson and Waluszewski, 2002). The model treats interaction as a process related to collective actions in a larger environment of connected actors and, when established as a way of viewing industrial exchanges, two assumptions were also made: that the exchanges are characterized by social exchanges between the parties involved, and that adaptations are made to the product/service involved (Håkansson and Waluszewski, 2002).

The interaction approach (Håkansson, 1982) was put forward by the Industrial Marketing and Purchasing (IMP) Group to challenge the then-prevailing microeconomic market view of business and industry. The interactive view focuses on interconnected relationships between interdependent actors or organizations (Håkansson *et al.*, 2009; Håkansson and Snehota, 2017b). As the existing economic and management research offered only limited explanations

of such business interactions (Håkansson and Snehota, 2017b), the core mission of IMP's approach has been to fully understand the characteristics, conduct and performance of the interactive business landscape (Håkansson *et al.*, 2009). The general starting point for the approach is that all organizations are embedded in relationships and consequently dependent on other organizations in different contexts (Håkansson and Snehota, 1995; Halinen and Törnroos, 1998; Singh *et al.*, 2022).

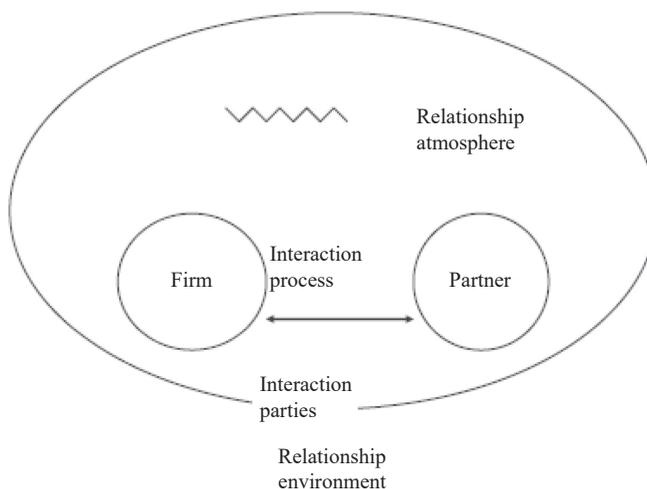
Based on this interpretation, the idea of interaction is developed (Ford and Håkansson, 2006) as the core process of the business landscape:

The idea that business interaction between individually significant companies is a primary characteristic of the business landscape is a basic observation in IMP studies. The implication of this observation is that it is not what happens within companies but what happens between them that constitutes the nature of business. (Håkansson *et al.*, 2009, p. 27)

Empirical IMP observations have led to the argument that actors, activities and resources are shaped and transformed by interaction and that "no business is an island" (Håkansson *et al.*, 2009; Håkansson and Snehota, 2017a).

As noted above and depicted in the model presented in Figure 1 below, the philosophy applied to relationships (by the IMP Group) was that of social exchange. The model rests on the assumption that interacting is beneficial and that relationships are reciprocal, long-term, and mutual, and contains four basic dimensions, each with a set of variables that can be used to analyse a relationship (see Figure 1). The model conceptualizes the four groups of variables, describing: the parties involved, the elements and processes of interaction, the environment in which the interaction takes place, and the atmosphere affecting and affected by the interaction. The suggestion is that researchers should investigate each group of variables and the interplay between them. Even when considering infrequent transactions, aspects such as previous interactions, purchases and associated relationships can influence the present relationship. And, although the interaction approach appears to focus on dyadic relationships, its principles could also be applied to multiple-party relationships.

*The four groups of variables that constitute the interaction model.* With reference to the four groups of variables depicted in Figure 1, analysis of the *relationship environment* refers to



**Figure 1.**  
The interaction  
approach

**Source(s):** Adapted from Håkansson (1982)

analysis of the environment affecting the relationship rather than a broader environmental analysis such as conducted when formulating general corporate strategy. It is, however, analogous to the political, social, technological, and economic analysis that forms a part of a general strategic environment analysis.

The *interaction process* refers to how the parties to the relationship interact. This interaction tends to be of two types: shorter-term episodic exchanges, such as single transactions; and series of exchanges that build into longer-term patterns of norms and expectations of the interacting parties (Caraça *et al.*, 2009; Mikhaylova, 2014).

Understanding the *interaction parties*, be they organizations or individuals, is also a central dimension of relationship analysis in the model. And the *relationship atmosphere* refers to the mood or tone that pervades an exchange, represented in the figure by the jagged line (∩∩∩∩). The atmosphere between individuals affects the relationship and is a mediator of it.

Understanding innovation in the context of the ever-changing industrial landscape has become cumbersome in the age of digitalization and necessitates serious challenges to traditional internationalization models (Cavusgil, 1980; Johanson and Vahlne, 1977, 1990, 2003). Despite the above-mentioned challenges, some basic outcomes of the traditional model – experiential learning (Forsgren, 2002; Johanson and Vahlne, 2003) and international networking (Mattsson and Johanson, 2006; Mort and Weerawardena, 2006) – may still maintain a crucial validity in the non-sequential internationalization process as well (Osarenkhoe, 2009). As a growing number of SMEs now operate on an international level (Osarenkhoe and Fjellström, 2021), it is important to understand how these enterprises, with their limited resources, handle current challenges. This led Ngoma *et al.* (2017) to investigate entrepreneurial orientation (innovativeness, proactiveness, and risk-taking) as a predictor of SME internationalization, establishing a significant relationship between entrepreneurial orientation and the internationalization of SMEs. Table 1 offers a summary of the theoretical overview.

## Methodology

Qualitative methods enable us to investigate the different forms of embeddedness in networks, as they provide the opportunity for close study of complex areas, especially when the outside natural setting is difficult to study (Doz, 2011). A qualitative case study approach was therefore chosen to gain a deeper understanding of the phenomenon under study and to observe its particular context (Yin, 2014). In addition to it being the most suitable approach for business network studies (Halinen and Törnroos, 2005), qualitative research also provides the benefit of presenting a broad perspective on the identified problem and is beneficial when interpreting empirical data collected at both the organizational and individual level (Koporcic and Törnroos, 2019).

### *Data collection*

The collection of data for the study took place at Future Position X (FPX). (See following section for more information about FPX.) The primary data consist of in-depth interviews with six key FPX managers and officials, and 14 “inwardly” and 14 “outwardly” internationalized member firms of the FPX cluster. Another source of data was data collected during roundtable talks, involving ten participants, held in conjunction with a visit from a group of international experts sent by Vinnova (Sweden’s innovation agency) to evaluate the first three years of FPX’s GeoLife Region initiative, where one co-author of the current paper took part in a session on the competitiveness of research and knowledge development and the other participated in workshops with FPX and SMEs on

Theoretical perspective	Authors	Highlights
<p><i>Innovation and learning</i> Innovation takes place in the interaction</p>	<p>Van de Ven <i>et al.</i> (1999), Baraldi and Waluszewski (2005), Håkansson and Waluszewski (2002), Spicka (2022), Chatterjee <i>et al.</i> (2022), Del Vecchio <i>et al.</i> (2020)</p>	<p>Innovation is a process that takes place in the interaction between the focal company or organization and its environment. Inter-firm competition</p>
<p><i>Cluster initiatives</i> Offer a setting for different stakeholders, including companies, to interact effectively with each other and with other institutions, to work together, and to learn</p>	<p>Sölvell (2009), Morgulis-Yakushev and Sölvell (2017), Osarenkhoe and Fjellström (2017), Osarenkhoe and Fjellström (2021), Kumar <i>et al.</i> (2022), Spicka (2022)</p>	<p>“Innovation is born out of reshuffling resources inside and outside of the firm and takes into consideration the mutual value creation of those (innovators) involved” Osarenkhoe and Fjellström (2021) (p.3) A hub for developing innovation capabilities</p>
<p><i>Cluster interactions</i> The firm-to-global gap addresses the linkages of actors inside clusters to global markets and value chains, i.e. the gap between cluster firms and global markets and value chains</p>	<p>Pavelkova <i>et al.</i> (2015), Morgulis-Yakushev and Sölvell (2017), Jankowska and Główka (2016), Sölvell and Lindqvist (2011), Singh <i>et al.</i> (2022)</p>	<p>Whereas a lack of interactions between cluster actors can limit mobility, collaboration, and the dissemination of knowledge, strong interactions can support these activities</p>
<p><i>Interaction approach</i></p> <ul style="list-style-type: none"> <li>- Relationship environment</li> <li>- Interaction process</li> <li>- Interaction parties</li> <li>- Relationship atmosphere</li> </ul>	<p>Håkansson (1982), Håkansson <i>et al.</i> (2009), Håkansson and Snehota (2017b), Caraça <i>et al.</i> (2009), Mikhaylova (2014), Kumar <i>et al.</i> (2022), Spicka (2022), Chatterjee <i>et al.</i> (2022), Del Vecchio <i>et al.</i> (2020)</p>	<p>Interaction’s shape and contribute to activities and resource-sharing between actors. Industry cluster a resource orchestration lens</p>

**Table 1.**  
Summary of perspectives

internationalization. A second round of talks was also held (2-h sessions on two occasions) with four process leaders of cluster initiatives and regional and local networks. The responses to questions asked at these events led us to a better understanding of the research question and the variables that constitute the interaction approach (Håkansson, 1982; Håkansson and Snehota, 2017a, b). A third round of interviews was then conducted with ten members of the regional innovation systems to which FPX belongs. These interviews took place online via Microsoft Teams’ video conferencing platform. The interviews and group sessions were structured in accordance with the parts of the interaction approach presented above in the section on theoretical background and Figure 1.

In summary, a total of 58 interviews were conducted for this study – 48 face-to-face in-depth interviews between 2017 and 2019, and 10 online interviews via Microsoft Teams in March 2021. This reflects a longitudinal data collection format rather than a “snapshot” of a specific point in time. The respondents included 6 key informants at FPX, representatives of 28 SMEs (FPX cluster firms), 10 members from the regional innovation systems FPX belongs to, and 4 process leaders from regional and local networks. The interviews were recorded and transcribed, and the interview settings encouraged a free flow of viewpoints on the topic of discussion, which revolved around the research questions, where the participants had the opportunity to talk freely with other participants.

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### *Other methodological considerations*

Using an interactive focus as a guide, the objective of this study has been to shed light on the platform created by a cluster organization to facilitate its internationalization and thereby enhance the competitiveness of the cluster's regional innovation system partners and their ability to gain access to global value chains, and thereby boost innovativeness. Hence, we examine here how one Swedish cluster organization, Future Position X, uses its internationalization platform to tap into its entire innovation system internationally, and how this system becomes integrated with other global innovation networks. The theoretical and methodological point of departure taken for this study is the IMP network approach (Håkansson *et al.*, 2009), using the interactive approach as our analytical tool (Håkansson and Johanson, 1992; Håkansson and Snehota, 2017a, b) – a fruitful approach for dealing with complexity when analysing relationships at the dyadic and network levels, with a focus on the interaction process, the interaction parties/partners, the relationship atmosphere, and the relationship environment. According to the interactive perspective, studying the business world requires observing and describing the phenomena under study empirically, and involves the interplay of this empirical research and conceptual development (Håkansson and Snehota, 2017b), where in-depth case study methodology is preferred (Baraldi *et al.*, 2020).

### *Analysis of the data*

The study data were analysed in three steps (Miles and Huberman, 1994). In the first step, data reduction, the collected data were reduced by selection and exclusion (i.e. filtering). For the audio- and video-taped interview material, the analysis process began during transcription of the recordings. In the second step, data display, the data were organized in order to compress the information and identify main themes. The themes extracted included the focus, objectives, activities and organization of clusters and networks, which provided insight into the main features of the cluster initiatives, regional networks, and local networks in the region looked at. The third step, the drawing and verification of conclusions, was to reflect on and form an understanding of the data selected and displayed in the earlier steps. The three steps overlap often occur simultaneously throughout the study.

In addition to the Miles and Huberman (1994) approach, Hayes' (2000) method was used to perform a thematic analysis of the data from the interviews. Here, the four variables of the interaction approach were used as a guide to create four themes/categories. An inductive approach was used, meaning that themes and conclusions were drawn from observations made of the interview responses. Themes involve recurring patterns in one or more of the interviewees' answers. Identifying themes enables the researcher to generalize regarding approaches, events and thoughts commonly mentioned in the respondents' answers to questions (Hayes, 2000). The responses in the recorded interviews were compiled and categorized to reflect how they corresponded to the research questions, following which the different themes that emerged from the responses were further analysed and used to create prototype themes (Hayes, 2000). The prototype themes also underwent further analysis to arrive at final themes (Hayes, 2000), and the final themes then used to structure the presentation and discussion of the findings.

### **Presentation of findings**

It is worth noting that, to facilitate consistency between the theoretical framework depicted in the interaction model presented in Figure 1, we use the four dimensions of the interaction framework (see Figure 1, above) in presentation and discussion of the findings below – namely: the interaction process, the interaction parties or partners, the relationship atmosphere, and the relationship environment. A summary is provided in Table 2.

*Interaction process/Relationship environment*

Future Position X is a non-profit organization and award-winning cluster situated in Gävle, Sweden. Founded in 2006, the FPX cluster received the EU's Management Excellence Gold Award in 2013–2015 and again in 2016–2020, with FPX's managing director, Johan Bång, receiving the European Cluster Manager of the Year for 2010. In 2020, FPX was also named a Digital Innovation Hub by the EU. FPX is a member organization that works to promote growth through better health and well-being in the smart, sustainable, and vibrant city of Gävle. By creating relationships and collaborations, FPX helps to create new cross-sectoral connections between business, academia and the public sector. FPX also contributes to knowledge development of new technology by creating meeting places and networks for issues such as blockchain technology, the internet of things (IoT) and artificial intelligence (AI). FPX is financed by its member companies, Region Gävleborg, and the European Regional Development Fund. It is also behind the GeoLife Region innovation and research program, a profit growth initiative funded by Vinnova. FPX has thus become Europe's leading cluster for increased and skilled innovative use of geographic information technology. This mainly involves developing position-based services, media, and solutions for smart cities and green societies of the future.

The interaction process variable addresses how FPX and other parties to a relationship interact. In its quest to bridge the external (exogenous) gaps vis-à-vis collaboration and interaction with global markets, FPX's main focus has been securing global links and intensified interaction with regional clusters and innovation partners elsewhere in the world

Empirical themes	Empirical findings	Theoretical link
<i>Interaction process/ Relationship environment</i>	<ul style="list-style-type: none"> <li>• Lack of an international network and collaboration strategy</li> <li>• Establishing international links with similar clusters</li> <li>• Information exchange patterns; two-way communication exchanges; and long-term institutionalization</li> <li>• Inter-firm competitive rivalry and collaboration in clusters (Singh <i>et al.</i>, 2022)</li> <li>• Cluster through a resource orchestration lens (Kumar <i>et al.</i>, 2022)</li> </ul>	<p>Lone clusters lack the knowledge and resources required to support the internationalization process, i.e. a sequential learning process (Osarenkhoe and Fjellström, 2021; Johanson and Vahlne, 2009)</p> <p>The role of the hub-firm in developing innovation capabilities (Kumar <i>et al.</i>, 2022)</p> <p>Inter-firm competitive rivalry and collaboration in clusters (Singh <i>et al.</i>, 2022)</p> <p>Innovation ecosystems (Spicka, 2022)</p>
<i>Interaction parties or partners</i>	<ul style="list-style-type: none"> <li>• Internationalization strategies and research relationships</li> <li>• Internationalization platform</li> <li>• Cross-sectoral and cross-border organizational network model</li> <li>• Complementarity-based nature of cooperation strategy and its impact on collective strategies for value generation among actors</li> </ul>	<p>Knowledge and innovation happens in interactions among various stakeholders (Baraldi and Waluszewski, 2005; Håkansson and Waluszewski, 2002; Singh <i>et al.</i>, 2022; Spicka, 2022; Kumar <i>et al.</i>, 2022; Chatterjee <i>et al.</i>, 2022; Del Vecchio <i>et al.</i>, 2020)</p>
<i>Relationship atmosphere</i>	<ul style="list-style-type: none"> <li>• Broaden its network and partnerships</li> <li>• New knowledge and new business opportunities</li> <li>• Greater access to internationalization and growth capital</li> </ul>	<p>Strong interactions among clusters and their stakeholders bring opportunities in the network (Pavelkova <i>et al.</i>, 2015; Morgulis-Yakushev and Sölvell, 2017; Jankowska and Głowska, 2016; Sölvell and Lindqvist, 2011; Singh <i>et al.</i>, 2022; Spicka, 2022; Kumar <i>et al.</i>, 2022)</p>

**Table 2.**  
Empirical findings  
with theories

(see below). The GeoLife Region Initiative launched in 2013 has led to the Gävleborg region becoming internationally recognized for its implementation of geo-technologies in the advancement of health and well-being, and Europe's Geographic Information Systems (GIS) capital. According to one respondent, FPX's interaction process in the longer term involves: information exchange patterns; two-way communication exchanges; and long-term institutionalization.

To begin with, FPX lacked an international network and collaboration strategy and, hence, started the internationalization process by developing links with similar clusters in: 1) Norway, Denmark, Finland and the Baltic States; 2) France, Germany, Italy and Austria; 3) China, Chile, Ukraine, UK, USA and Russia, followed by other countries. Thereafter, it developed links to other clusters with core competencies in different areas of technology, including: 4) Gävle's "sister city" – Zhuhai City; 5) the Changfeng Alliance in Beijing (in China's Silicon Valley); and 6) the Hubei Association for Science and Technology.

The main reason FPX considered expanding into an international market was to maintain its leading position in technology development. FPX had to identify future market needs in order to respond appropriately to transformation processes, and to strengthen its global market position. To do this, FPX began by establishing international links with similar clusters in its Nordic neighbours, in the Baltic, and in Europe. As noted, FPX learned that to position itself at the forefront of innovation, it had to combine its core competencies with those of other, often very different areas of technology. To this end, it established relationships with several of the biggest geospatial technology global hotspots and then began to build relationships with other hotspots with complementary knowledge, such as: the mobile and new media industry (in Malmö); the digital media and gaming industry (in China); the health industry (in Beijing and Australia); and the sports industry (in Åre, Barcelona and Melbourne). This has enabled FPX to work with cross-cluster international innovation and, importantly, supports the "innovation to bridge the gaps" strategy. FPX's internationalization strategy dates back to 2005 and, as of 2012, its stated vision for spin-offs from its innovation system is that they be "born global", with a focus on China, the largest economy in the world.

In its pursuit to become established in China, FPX encouraged its domestic hub, the City of Gävle (an actor in FPX's innovation system), to sister with Zhuhai City in Guangdong, southern China – the "factory floor" and fastest growing region in the world. Founded in 1446, Gävle itself – a livable city and major port in Sweden – is, as noted, known as Europe's GIS capital, and GIS technology is the flagship of FPX.

#### *Interaction parties or partners*

FPX is owned by *Lantmäteriet* (the Swedish mapping and land registration authority), Gävleborg County Council, the University of Gävle, the City of Gävle and other public actors and collaborates with actors in the quadruple helix, including researchers, innovators, entrepreneurs, governments, municipal organizations, citizens, and other stakeholders involved in implementation of R&D projects, and monitoring and evaluation, in both the private- and the public sector. One of FPX's integral interaction partners is Business Sweden, an organization jointly owned by the Swedish government and the Swedish business sector. Business Sweden's mandate and mission is to help international companies gain access to the Swedish market and to help domestic ones use Business Sweden as a platform for international expansion. Business Sweden, at home and via its 44 offices across Europe, the Americas, the Middle East, Africa, and Asia-Pacific, has helped to create access for FPX where access is hard to get. Other interaction parties from the business sector include more than 200 companies that participate in the projects and activities of the FPX cluster. In the research and academic setting, FPX works closely with universities in Sweden, Denmark,

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Norway, Australia, China, and other countries, as well as local educational platforms in the region. The FPX network now has its own offices in more than 15 countries, established through internationalization strategies and research relationships. These connections can be used to advantage to help companies with new markets and new suppliers, or to gain access to new knowledge and research.

To address the area of entrepreneurship and commercialization, FPX developed an internationalization platform – the GeoLife Region Initiative – to ensure the support and activation of projects. FPX’s plan was to use its cross-sectoral and cross-border organizational network model to reach more international players, and thereby create a broader network and partnerships to attract new projects, knowledge, and business opportunities. The aim of creating FPX’s international innovation platform has been to create access to internationalization and growth capital for the companies in the cluster’s network.

#### *Relationship atmosphere*

As noted, via the GeoLife Region Initiative, FPX developed an internationalization platform to ensure the support and activation of projects. And, also as noted, the plan was to use its cross-sectoral and cross-border network to appeal to international players and broaden its network and partnerships in an aim to attract new projects, new knowledge, and new business opportunities, as well as to provide cluster firms with greater access to internationalization and growth capital. It is against this background that the rich picture of FPX interactions emerges – on the canvas of wider, global innovation interactions.

Another FPX project of note was TRIIP (The Regional Innovation Internationalization Project, which concluded in 2019) – a project aimed at innovators and entrepreneurs with ideas, products and/or services with development- and internationalization potential. The project targeted micro-enterprises in the Swedish regions of Gävleborg, Dalarna and Värmland, creating opportunities for these businesses to become involved in developing new methods to succeed internationally. Below are some success stories resulting from the TRIIP project.

*Success stories.* Tevsjö Destilleri, a mill and spirits distillery, participated in TRIIP and received support from business coaches to develop an internationalization plan that included a market analysis, product evaluation, and translation for processing the Chinese market. In May 2018, Tevsjö took part in a group trip organized by TRIIP to attend the SIAL Exhibition in Shanghai.

Zava Tec, an innovative O-ring maker, took part in TRIIP and received support from business coaches to refine its marketing strategy for internationalization. This led to two trips to promote their products at trade fairs and company visits. Zava Tec made use of TRIIP-sponsored travel to attend the Paper Con paper and packaging trade fair in Charlotte, North Carolina, USA, where it met and signed with a new customer, Wisconsin Rapids, and a new retailer.

InCoax, a broadband company, joined the TRIIP project in 2016, where it participated in workshops and received business-coach support with a business model, promotion and networking. This led to a trip to China where InCoax met investors, and telecom and real estate companies. In 2020, InCoax launched four new products on the market. The new products are based on new technology and represent further development of previous InCoax products.

### **Discussion of findings**

#### *Interaction process and relationship environment*

The main reason for FPX going international was to maintain and strengthen its position at the forefront of technology development. FPX achieved this by identifying upcoming market

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needs and responding accordingly. This is in line with firm behaviour described by [Ayakwah et al. \(2019\)](#). Our findings also show how FPX leverages its internationalization platform to tap into the entire FPX innovation system internationally and the platform becomes integrated with other global innovation networks, a form of international matchmaking and capitalization, securing more links for the companies in the FPX cluster. This also supports the argument that innovation is an interactive process that is rarely limited to the bounds of a single organization or firm ([Windrum et al., 2016](#); [Chesbrough, 2003](#); [Bogers et al., 2018](#)). Thus, FPX's innovation process can be considered a socially embedded process where the user's perspective is often in focus ([Dosi, 1988a](#); [Von Hippel, 2001](#); [Remneland Wikhamn and Styhre, 2019](#); [Kumar et al., 2022](#)). FPX combined its own core competencies with those of other, different areas of technology. This is in line with the interaction approach of the IMP Group ([Håkansson, 1982](#); [Håkansson and Snehota, 2017a](#)).

In effect, leveraging the entire global innovation system also provides more international links for start-ups and the regional innovation system. The concept of the innovation system stresses that the flow of technology and information between people, enterprises and institutions is key to the innovative process ([Pino and Ortega, 2018](#); [Asheim and Coenen, 2005](#); [Kumar et al., 2022](#)), as the system contains the interactions needed to turn an idea into a marketable process, product, or service ([Lundvall, 1985](#); [Håkansson and Snehota, 2017a](#)). In other words – a network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies ([Freeman, 1995](#)).

The findings of the current study also show that FPX's initial internationalization strategy followed a sequential process, which is in line with [Johanson and Vahlne \(1977, 1990\)](#) and [Schreier et al. \(2019\)](#). That is, FPX started with markets in countries with low psychic distance from the home country. This observation on the behaviour of the cluster in this study is also in line with Johanson and Wiedersheim-Paul's observation (1975) – that firms tend to make incremental decisions about their engagements in international markets and operations abroad. It is obvious from the current findings that FPX's internationalization patterns demonstrate a gradual process and hence its internationalization decisions fall within the general theoretical framework, maintaining the validity of the basic assumption of the sequential or gradual internationalization model (*ibid.*; [Osarenkhoe, 2009](#)). FPX combined the interplay of experiential learning and commitment that drove its earlier internationalization process with a similar experiential learning and commitment mechanism focused on business network relationships ([Johanson and Vahlne, 2003](#)), allowing it to enter markets with high psychic distance.

### *Interaction parties*

Our findings show that FPX collaborates with actors in the quadruple helix, innovators, entrepreneurs, companies, organizations, business, politicians, researchers, students, and the public. A common denominator among these actors is that they all want to be a part of novel innovations, companies, products, and services in smart, sustainable, and viable cities and communities of the future. This includes stakeholders implementing projects in research and development, and monitoring and evaluation, in both the private- and the public sector. We attribute this to the fact that FPX's innovation platform is used by companies and organizations looking for innovation support or new models for interacting with users, clients or markets. FPX helps these firms and organizations to find ways forward. Intense interactions ([Sölvell, 2009](#); [Sölvell and Lindqvist, 2011](#); [Ayakwah et al., 2019](#); [Schreier et al., 2019](#); [Tartaruga, 2020](#); [Spicka, 2022](#); [Singh et al., 2022](#)) occur through, among other encounters, meetings between companies, organizations, researchers and users who stimulate and advance FPX's activities.

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FPX's global mindset, which led to several new partner agreements to secure the resources and expertise necessary for the activities of these partners, ensuring access to investment capital and platforms for the international expansion of the firms in FPX networks, is in line with the salient features of entrepreneurial orientation and internationalization of SMEs (innovativeness, proactiveness and risk-taking) described in studies by Ngoma *et al.* (2017) and Schreier *et al.* (2019; Singh *et al.*, 2022).

Combining FPX's own core competencies with very different technology areas demonstrates that, when undergoing internationalization, being active in networks facilitates the identification of opportunities and can, in addition, govern a firm or organization's choice of entry modes and entry nodes (Schreier *et al.*, 2019; Galkina and Chetty, 2015). FPX's establishment in several of the biggest global geospatial technology hotspots is in line with Schreier *et al.* (2019), who suggest that participation in informal networks can increase an organization's knowledge about opportunities in foreign markets, as well as generate experience-based learning, trust and loyalty. As FPX works with cross-cluster international innovation, its strategy can thus be seen as a gap-bridging one.

#### *Relationship atmosphere*

According to the findings presented above, FPX contributes to collaboration between business, academia, and the public sector – by initiating projects, creating relationships, intensifying interactions to bridge the endogenous gaps (Sölvell, 2009; Sölvell and Lindqvist, 2011; Jankowska and Główska, 2016; Schreier *et al.*, 2019; Kumar *et al.*, 2022; Singh *et al.*, 2022) mentioned in the introduction of this study, and building collaborations. FPX also contributes to knowledge development for new technology by creating meeting places and networks around digital issues such as GIS, AI, IoT and blockchain technology. The FPX innovation platform and Gävle Innovation Arena can be used to digitally model societies, thereby solidifying FPX's position as a major player in the work to strengthen both society and companies through more sustainable growth (Tartaruga, 2020; Schreier *et al.*, 2019).

The findings also show how FPX leverages its internationalization platform to tap into its entire innovation system – domestically and internationally. This provides more international links for the regional innovation system and start-ups (Asheim and Coenen, 2005; Pino and Ortega, 2018; Kumar *et al.*, 2022). As noted above, the concept of the innovation system stresses the flow of technology and information between people, enterprises, and institutions as being key to the innovative process (Håkansson, 1982; Håkansson and Snehota, 2017a), containing interactions needed to turn innovative ideas into new products and technologies.

FPX's ability to leverage significant actors in its network, for example, Business Sweden, and Sweden's foreign minister and ambassadors, made the internationalization process less cumbersome and less resource-consuming. Business Sweden's role in facilitating access to the Swedish market for FPX foreign networks cannot be overemphasized. Moreover, domestic actors in FPX's network utilize the Swedish market as a platform created by FPX and Business Sweden for international expansion.

Business Sweden clients range from start-ups and SMEs to multinational companies, and its services cater to all of these segments. Through its relationship to Business Sweden, FPX has been able to tap into Business Sweden's holistic approach of hands-on support and strategic and practical expertise, and into its capability to create access – both at home and abroad through Business Sweden offices around the globe – to public- and private-sector actors in these markets. This enabled FPX to navigate regional business structures to expand business and unlock growth for its member firms.

## Concluding remarks

This study examined how the internationalization platform of a cluster organization is used to tap into the cluster's entire innovation system internationally and becomes integrated with other global innovation networks. More specifically, the study illuminates the platform created by FPX to facilitate internationalization in order to enhance its competitiveness and that of the firms and other partners in the regional innovation system and gain access to global value chains and contribute to greater innovativeness and competitiveness. Creating such a platform invariably enables SMEs to overcome liabilities of size, resources, newness and foreignness when attempting to enter foreign markets where they lack relevant prior network positions (Johanson and Vahlne, 2009; Kumar *et al.*, 2022).

As mentioned above, the concept of innovation systems has been widely used in innovation studies, often with different qualifiers such as *national* innovation systems (Freeman, 1987; Lundvall, 1992) or *sectoral* innovation systems (Kumar *et al.*, 2022; Spicka, 2022; Singh *et al.*, 2022). Although the concept of the innovation system is still emerging, some define it as "a set of components and the causal relations influencing the generation and utilization of innovations and the innovative performance" (Granstrand and Holgersson, 2019, p. 1). Innovation is thus often the result of the interactions of an ecology of actors (Granstrand and Holgersson, 2019; Spicka, 2022), and consequently, the interaction approach as operationalized in different parts of the current study is a valuable way to analyse relationships at the dyadic-network level. We have done this by focusing on the interaction process, interaction partners, relationship atmosphere, and relationship environment (Håkansson, 1982; Håkansson *et al.*, 2009; Håkansson and Snehota, 2017b; Singh *et al.*, 2022), allowing us to capture the interconnected relationships between interdependent actors and organizations.

Despite a lack of consensus on exactly what an innovation system is, our findings unveil two basic assumptions that characterize the innovation process that can be used as a starting point for modern innovation studies. The first assumption has to do with the innovative nature of the innovation process (Dosi, 1988a; Cassiman and Valentini, 2016; Bogers *et al.*, 2018; Kumar *et al.*, 2022). Very few innovations arise as a result of the isolated work of an individual genius. Instead, most innovation comes about through complex, interactive, iterative and cumulative learning processes involving a variety of actors (individuals as well as organizations) involved in different ways (Edquist, 1997). As a result, the innovation process is also considered a socially embedded process, where the user's perspective is often in focus (Von Hippel, 2001).

Another perspective that has had a major impact in recent years is the "open innovation" perspective (Santoro *et al.*, 2019; Chesbrough, 2003; Bagherzadeh *et al.*, 2021). Innovation is thus an interactive process – a process rarely limited to the bounds of a single organization or firm (Windrum *et al.*, 2016; Chatterjee *et al.*, 2022). And, since innovation is an interactive learning process, relationships and interactions between different actors in the innovation chain play a pivotal role. It is almost impossible today for an individual firm to develop and accommodate all of the necessary expertise internally, within the organization (Prahalad and Hamel, 1990). Instead, firms and other organizations rely on various forms of collaboration with external actors, other firms and organizations (e.g. universities). This naturally varies from industry to industry, but the trend towards open innovation has become stronger in tandem with the emergence of what is sometimes called the "knowledge-based" or "learning" economy.

The second basic assumption about the nature of the innovation process is that the problem chain that leads to innovation is neither linear/straightforward nor sequential but is permeated by a number of overlapping feedback loops and unpredictable leaps (Chatterjee *et al.*, 2022; Kline and Rosenberg, 1986). The embryo of an innovation (or radical renewal process) is far from always spawned in a company's development department and then

passed on to other units. Instead, the development department is, in many cases, integrated into all parts of the process chain. With this view of interactivity as a basic starting point, the innovation literature often identifies three main parts of the innovation process: 1) the production of knowledge (exploration), 2) the development of this knowledge to create functional systems, and 3) the matching of these functional systems to market needs and demand (Pavitt, 2005). In practice, the three components are seldomly organized in a linear fashion. In most cases, there is significant overlap. For analytical purposes, however, one can make a point of keeping the sub-processes separate, not least since they provide a clear picture of the different competencies that fulfil different functions throughout the innovation process.

### **Implications of this study**

The importance and relevance of the regional innovation system, for practitioners and researchers alike, highlighted in this study cannot be overemphasized. As stated earlier in the paper, the regional innovation system can be thought of as “the institutional infrastructure supporting innovation within the production structure of a region” (Asheim and Coenen, 2005, cited in Pino and Ortega, 2018, p. 2). Regional governance mechanisms, such as cluster initiatives, the setting studied here, support knowledge creation and help to geographically embed cluster firms.

#### *Societal implications*

Future Position X creates relationships and builds collaborations through initiating projects that strengthen collaborations between business, academia, and the public sector. It also contributes to knowledge development of new technology by creating meeting places and networks around technological development such as GIS, AI, IoT and blockchain technology. The “Gävle Innovation Arena” platform is used to digitally model societies. Hence, FPX’s work helps to strengthen both society and companies through sustainable growth.

Another implication for society is that FPX’s global network helps regional SMEs to internationalize. This, in turn, encourages international firms to establish operations in the Gävleborg region, helping to strengthen the GIS environment in the home region. In addition, internationalization expands the FPX cluster’s knowledge base beyond the traditional environment of local firms. For example, in 2020, Microsoft began construction on a data centre in the region. Having partnered with Swedish state-owned energy company Vattenfall to track the consumption of renewable energy in Microsoft’s Swedish data centres using Vattenfall’s 24/7 matching solution, the centre is among the most sustainable of its kind to date. Microsoft Cloud delivered from these centres will enable Swedish businesses to empower employees, engage customers, transform products, and optimize operations through connected experiences supported by advanced data privacy and security. Upcoming plans also include a skilling initiative for up to 150,000 local inhabitants.

#### *Managerial implications*

The ontological view (what is the nature of reality?) and epistemological view (what can be known?) upon which this study is based rest on understanding triadic relations as an interactive learning process that occurs in the interaction between actors as postulated by the concept of open innovation and that “innovation is born out of reshuffling resources inside and outside of the firm and takes into consideration the mutual value creation of those (innovators) involved” (Osarenkhoe and Fjellström, 2021, p. 3). This triadic logic rests in turn on the assumption that the methods of the strategy and its central questions stem from a

definition of business strategy as concerned with matching a firm's internal capabilities to its external environment (Penrose, 1959; Prahalad and Hamel, 1990; Hunt and Lambe, 2000).

A second managerial implication relates to the fact that a majority of cluster participants tend to be SMEs, firms that are often short on the time, resources, knowledge, experience and networks required to break into international markets. For these firms, collaborative development environments like the FPX internationalization platform become even more important, reinforcing the need for clusters and firms to develop how they manage interactive innovation processes. In addition, "going international" can be vital for clusters in emerging industries, with digital era-induced transformation processes in these value chains generating a need for clusters to incorporate a global mindset in their internationalization strategy.

#### *Theoretical implications and avenues for future research*

This study shows that the core dimensions of the regional innovation system, of which cluster organizations are important actors, are to be found in interacting organizations and institutions that mediate this interaction to promote the flow of knowledge and innovation processes. It is therefore of utmost importance that future studies seek to develop a deeper understanding of the actors that operate at the regional level. A clear definition of the specific critical actors is needed, along with a clarification of the dispositions that can be categorized as regional innovation systems (Kumar *et al.*, 2022; Spicka, 2022). Moreover, what are the roles and behaviours of these actors – the governments, firms, universities, and civil society – that play a part in developing the regional innovation system? These points are in line with Pino and Ortega's (2018) call for more research on regional innovation systems. The current study responded to calls by Håkansson and Waluszewski (2007) and Eklund and Waluszewski (2015) to broaden the focus of network's configuration by incorporating interactions between other actors in the wider network of innovation development, production and use in our quest to better understand how the innovation process works. In the study of innovation processes, the open innovation literature has moreover focused mainly on the role of the users. Furthermore, previous studies have largely concentrated on internal (endogenous) gaps that impede collaboration and mobility within clusters rather than external (exogenous) gaps vis-à-vis collaboration and interaction with global markets. The focus of this study has been global links, between regional clusters and innovation partners elsewhere in the world. The rich picture of intra-cluster interactions can and should be set on the canvas of wider, global innovation interactions (Kumar *et al.*, 2022; Spicka, 2022).

As in open innovation environments (Chesbrough, 2003; Enkel *et al.*, 2009; Cassiman and Valentini, 2016; Del Vecchio *et al.*, 2020), firms that belong to cluster initiatives make use not only of external sources for innovation and external paths to the market but also of internal knowledge that flows via external paths to the market. In contrast to outside-in knowledge flow, it is unfortunate that inside-out open innovation (Prahalad and Hamel, 1990; Bogers *et al.*, 2018; Remneland Wikhamn and Styhre, 2019), where organizations allow un-utilized ideas to leave the organization, has been less explored. Leaving inside-out processes less well understood. This study has made an effort to bridge this gap.

In response to the call in the literature for closer study of inside-out innovation (*ibid.*), future studies should include efforts to measure the extent to which regional innovation systems contribute to long-term economic growth for society. Once the role of regional innovation systems has been clearly established or defined, the main task will then be to investigate how to instil an innovation system in a region, an essential issue for policy-makers. Thus, vital questions remain to be answered.

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