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Exploring potential drivers of innovation-related activities in Poland: evidence from Polish business clusters

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Abstract

Research background: Innovations are introduced by competitive companies. One of the most common methods, increasingly used by companies, is organizing clusters or cluster initiatives operating within a specialized sector, competing with each other, exploiting the potential of cooperation and its impact on creating new business ideas. However, these efforts could be unviable due to the lack of an effective leader of the group. One should underline a crucial role of the leader in such an organized network, since the leader makes improvements and takes initiatives for all the network and its partners. These concepts prompt us to undertake the research on the role of clusters' characteristics on enhancing willingness to innovate in general. This study aims to point out the main characteristics of clusters and to investigate their impact on companies' innovativeness. The main problem to address is the magnitude of specific effects that might boost introducing new solutions in firms' networks.
Purpose of the article: The purpose of this study is to investigate the impact of factors describing cluster environment (characteristics like cooperation within clusters and beyond them, incentives of a leader, and localization factors) that might affect the innovativeness of companies.
Methods: The authors collected data using questionnaire. This type of primary source enables the authors to construct a model consisting of latent variables such as incentives of coordinator of cluster or cluster initiative, cooperation of firms with local authorities, cooperation between

entrepreneurs, or localization. The results are subject to the Structural Equation Modelling (SEM) analysis.

Findings & value added: The conducted analysis leads to several findings. Firstly, incentives provided by the cluster coordinator enable companies to increase the willingness to introduce innovations in general. Secondly, however, the influence of other cluster characteristics on the propensity to innovate for firms functioning within specific Polish business clusters is scant. These findings point to the fact that actions leading to assign the official coordinator of a cluster need to be done, as it should result in better flow of knowledge, more symmetric information among companies within cluster, and more productive and innovative way of functioning firms in general. Regarding innovation clusters (and regional innovation systems), these actions need to be supported by forming policy on regional level, because effective clusters would induce more competitive regional economy in long-term scenario.

Introduction

The global economy, as well as an unstable business environment, affects the need for sophisticated strategic actions aimed at introducing innovations and sustaining a long-term competitive position.

One of the most popular methods, increasingly used by companies, is organising cluster groups operating within a specialised sector, competing with each other, exploiting the potential of cooperation and its impact on creating new business ideas.

The way the companies are organised in a more or less formalised network in which business entities cooperate and compete simultaneously, creates a specific business environment that has an influence on the capabilities and scope of introduced innovations. Additional benefits due to cluster cooperation and constant competition support the possibilities of reallocation of enterprises' resources towards the process of implementing innovations (Baptista & Swann, 1998; Baptista, 2000).

Moreover, the leader plays a crucial role in such an organised network, on account of the fact that the leader makes improvements and takes initiatives for all the network and its partners. Leadership in the network is often based on partnership. It is up to the participants to regulate the network, so the nature of leadership is rather heterarchical (Müller-Seitz, 2014). Leaders who try to set goals precisely encounter different perceptions, which can cause conflicts and misunderstandings. The challenge for the leaders of heterarchical networks is to ensure the proper representation of the interests of the involved partners (Sullivan *et al*., 2012). Therefore, the scope of formalisation of a cluster, the method of identifying an effective leader (among participants of the network or from outside of the network) and also the leader's involvement in common network activities may have an impact on the cluster's ability to implement innovations.

However, the link between innovation efforts and firms' performance (also functioning within clusters), is often treated as a 'black box' (Rosenberg, 1982). Supplementing this relationship with other dimensions — network and leadership — is not well discovered in literature yet, especially for Emerging Europe countries (EECs). There is only one known study provided by Elenkov *et al*. (2005) suggesting that effective leadership can influence both product-market and administrative innovations, however, the emphasis here was put on managerial perspective and the empirical evidence is blurred between developed and emerging countries. Other known studies focus usually on two of three/four earlier mentioned dimensions.

Thus, the authors of this paper decide to address and fill the research gap and enrich current state-of-art by implementing study using primary data (from original questionnaire) regarding members of different clusters and cluster initiatives (with different level of technological sophistication) functioning in Poland, one of the Emerging Europe countries (EECs), and taking into account the role of leadership among companies within clusters with different levels of technological sophistication.

The aim of this study is to point out the main characteristics of clusters and to investigate their impact on company innovativeness. The main problem to discover is the magnitude of specific effects that might boost introducing new solutions in firms' networks. The study has been developed among companies cooperating and competing within the five Polish business clusters: the boiler sector, the wine sector, the tourism sector, the clothing sector and the building sector. The selection of clusters is justified by taking into account different type of sectors representing the Polish economy, and including both "Key National Clusters" (representation of small amount of clusters, with the most significant impact for Polish economy as grouping the most productive companies') and local industrial clusters and cluster initiatives (vast majority of the population).

A questionnaire was used (with primary data provided), with which the authors attempted to measure latent variables, such as incentives of coordinator, cooperation or localisation. The results were subject to the Partial Least Squares-Structural Equation Modelling (PLS-SEM) analysis. The analysis revealed the crucial role of coordinator of cluster (or cluster initiative) in boosting the willingness to innovate, however, with scarce evidence provided by other factors.

The paper is organized as follows. Section 2 presents the notion of innovation, concepts of clusters and effects of cooperation, and hypotheses development. Section 3 describes the methodology, questionnaire and dataset. Section 4 presents the results of the study. Section 5 describes discus-

sion on results. Section 6 consists of conclusions, policy implications and limitations.

Literature review

The role of innovations

The concept of innovation derives from 1930s and is connected with the publications by Schumpeter (1951), who considered innovations in the economic and technological context. The author emphasized the distinction between innovations and inventions. In the history of mankind inventions appear relatively often, but do not become innovations automatically. One key factor is essential in the process of introducing innovation — a personal factor in the form of an innovative entrepreneur (Schumpeter, 1951). Moreover, the Schumpeterian theory involves introducing completely new products or incrementally improving existing ones, implementing a new production method, introducing a new sales method, applying a new way of organizing production, using new raw materials and/or semi-finished products and the opening of new markets. On the basis of Schumpeter's theory, Oslo Manual (OECD, 2005) divides innovations into four types: product, process, organizational and marketing innovations. The Schumpeter's theory was a starting point for further analyses of innovations affecting the growth of global economy (Grossman & Helpman, 1993) and endogenous relationship between innovation and growth (Aghion *et al.,* 1998).

In the literature, one can find many types of innovations. In terms of creativity of the applied idea, Niosi (2012) distinguishes creative and imitative innovations. Creative innovations are defined as entirely new actions and solutions which were not previously implemented. Thus, imitative innovations are the result of non-original changes that are based on imitation and dissemination of the existing solutions which may bring noticeable benefits. In terms of the radicality of the introduced idea, Garcia and Calantone (2002) differentiate radical and incremental innovations. Radical innovations are pioneer and breakthrough, but appear rarely in the economy. According to Mensch (1979), breakthrough innovations that open new markets in the industry appear every 30 years and repeat in a cyclical manner. On the other hand, incremental innovations include smaller, typically modernization changes. Innovative improvements play a dominant role in the economy (Marquis & Myers, 1969). More recent publications focus on role of innovation in ecologic context, defining eco-innovations for facing

challenges for environment and meeting sustainable development criteria (Silvestre & Ţîrcă, 2019; Mazzoni, 2020).

Regarding empirical studies, a specific role of innovations deriving from different types of companies, networks and systems need to be addressed. Helfat *et al.* (2007) argue that propensity to innovate of specific company reflects 'dynamic capabilities' that lead to its financial success. What is more, innovations are often perceived as an additional source of benefits from customer or value added (Nobre *et al.,* 2011) and often reshape positively the employment in specific sectors (Bogliacino & Pianta, 2010; Evangelista & Vezzani, 2011). As a result, innovations are often associated with firms' growth (Varis & Littunen, 2010) and formulating policy of encouraging entrepreneurs to work on novel ideas would lead to the growth of economy at industrial, regional and national level (Grossman & Helpman, 1993).

The systemic nature of the current innovation processes is also considered. The whole process of creating innovation is based on cooperation between a large group of entities, so it has the hallmarks of systemic, not always individual, actions. Numerous approaches to the typology of innovation systems can be found in the literature. The most popular typology of innovation systems considers national innovation systems (Lundvall, 1992; Fagerberg & Srholec, 2008), regional innovation systems (Asheim *et al.*, 2003; Cooke, *et al.,* 1997, 2010, sectoral and technological innovation systems (Carlsson & Stankiewicz, 1991; Malerba, 2002; Njøs & Jakobsen, 2016) and innovation clusters (Porter, 1998A; Engel, 2015; Cheng *et al.,* 2017; Pucci *et al.,* 2017; Pan *et al.*, 2018).

Clusters' concept and effects of cooperation

The modern concept of industrial clusters derives from the early 1990s and is strictly connected with the publications written by Porter (1990, 1998). The primal definition developed by Porter (1998) states that "Clusters are geographic concentrations of interconnected companies, specialized suppliers, and service providers, firms in related industries, and associated institutions (e.g. universities, standard agencies, and trade associations) in particular fields that compete but also cooperate".

The literature on the internal effects of cooperation within the clusters has its beginnings in a research conducted by Marshall at the end of the 19th century, in which he established correlations between the location of companies and their economic efficiency (Marshall, 1890). In the following years, Marshall's idea was developed and completed by many scholars. They focused on the relation between geographical agglomeration and

achieving economies of scale. Weber (1909) explains individual decisions of the producers regarding the location. They are motivated by minimization of production and delivery costs within a concentrated group of producers. Modern-day researchers (Rodriges-Clare, 1996), and (Ciccione & Matsuyama, 1996) have conceived models explaining that the presence of the benefits of Marshall's concept, combined with achieving economies of scale, lead to multiplying (maintaining) optimal production conditions, and prohibiting an underdevelopment trap. Krugman (1991) points out that knowledge spillovers and external financial factors have a great influence on the presence of benefits of Marshall's concept. Rosenthal and Strange (2003) add that knowledge spills over especially heavily in the high technology sectors.

Andersson *et al*. (2004) present three areas of positive influence of cooperation: greater innovativeness, greater productivity, and greater flexibility in business development. Baptista and Swann (1998) and Baptista (2000) specify that the strength of a cluster is correlated with the innovative activity of companies. Arrow (1962) and Audretsch and Feldman (1995) point out the role of the learning-by-doing process and a direct, face-to-face exchange of information. They also explain the importance of geographical proximity for the transfer of knowledge and innovation.

Regarding innovation clusters, there is a strong representation of papers describing cooperation for innovation in networks, sufficient knowledge management, and impacting firms' performance especially in developed countries (Bell, 2005; Darroch, 2005; Corral *et al*., 2019; Pucci *et al.*, 2020; Alberti *et al*., 2021) and China (Pan *et al*., 2018, Cheng *et al*., 2017; Chun-Liang *et al*., 2018). However, regarding clusters in EECs, the actual evidence is quite scarce. For instance, these studies reveal an important role of clusters in enhancing productivity of firms within (Stojčić *et al*., 2019) or show innovations as specific triggers for internationalization of companies with important role of cooperation (Jankowska & Götz, 2018) Moreover, existence of clusters with more sophisticated technological advance would lead to easier adaptation of new concepts, such as Internet of Things or Industry 4.0 (Götz & Jankowska, 2017).

However, many of these studies lack concepts regarding the role of cluster coordinator, leadership etc. and treating it with innovativeness, cooperation and network simultaneously altogether. We would like to address and fill this research gap regarding clusters with different level of technological sophistication in Poland and shed light on their characteristics affecting their innovativeness in general.

The role of cluster leader, cooperation, tradition of localization and innovativeness: hypotheses development

The nexus between efforts for innovation and firms' performance (also functioning within clusters), was historically treated as a 'black box' (Rosenberg, 1982). Many classic studies addressed this research gap in different ways, including empirical studies on innovation in different types of firms according to their size (Acs & Audretsch, 1988), types of proximity (Boschma, 2005) and co-existence of clusters (Bell, 2005).

Supplementing this link with the third dimension — network and leadership — is not well discovered in literature yet, especially for EECs. For instance, Elenkov *et al*. (2005) suggest that effective leadership can influence both product-market and administrative innovations, however, the emphasis was here put on managerial perspective. Kurzhals *et al.* (2020) provide systemic literature review on strategic leadership and innovation, however, the research is limited to technological scope of innovation only and stressing top-management perspective. Very interesting point of view is presented by Alberti *et al.* (2021) with focus on rotating leadership, rotating contribution and innovations (existing correlations is proven by the authors), however, their study account for high-technology sectors only (also in Pan *et al*.) and uses secondary data. They also argue that innovations are deeply rooted in clusters (with significant role of tradition of localization of cluster) and this argument is very vibrant for our paper as a starting point for our further analysis.

Regarding empirical studies, Chun-Liang *et al*. (2018) reveal the importance of collaboration in conducting innovation actions by members of clusters, in China however, their study is limited due to the only one cluster (and only six companies within) and no information on interaction between leader and members provided.

Apart from clusters, collaboration of private companies with other types of entities (i.e. not only by members of clusters, but with public institutions and local government) is often an important driver of innovation, as it reflects in term 'the triple helix' (or 'the triple helix model of innovation'). Triple helix addresses benefits of cooperation of universities, industries, and government, that could be seen in fostering development and enhancing innovativeness in general. Empirical evidence shows that the role of cooperation within the triple helix may be crucial factor boosting innovation-related activities, especially in high-technology sectors (e.g. nanotechnology, see Cheng *et al*., 2017; Necoechea-Mondragón *et al*., 2017). However, empirical evidence regarding this phenomenon with sectors (and clusters) with relatively lower level of technological sophistication (e.g. foot-

wear districts — see Boschma & Ter Wal, 2007, pp. 177–199) is rather scarce — the authors would like to address this issue in the paper and include the triple helix in further analysis.

In addition, analysis provided by Cheba (2015) on comparison of clusters among European countries and Japan points out that Japanese clusters have, in fact, a long tradition (French clusters also, i.e. Duranton *et al.* 2011) and it could potentially be a factor in their effectiveness regarding regional policy. So this factor — tradition of localization — would be included in further analysis as one of the drivers of potential innovativeness of clusters.

Hence, the conducted analysis of literature on the subject prompt us to undertake the research on the specification of clusters' and its impact on the innovativeness of companies functioning within clusters (or cluster initiatives). We would like to investigate to what extent the role of cluster leader, cooperation, and tradition of localization is important in boosting the level of innovativeness of specific companies within clusters. The following hypotheses were formulated:

H1: *The activities of the cluster coordinator boost the level of innovativeness of a company.*

H2: *Cooperation within the triple helix has a positive impact on the innovativeness of a company.*

H3: *Cooperation with competitors and establishing informal relations between companies leads to being more innovative.*

H4: *The tradition of localization and participation in cluster initiatives leads to a higher level of innovativeness of a company.*

Research methods

Investigation of the impact of cluster specification that might affect the innovativeness of a company is based on a statistical survey carried out in 2018, among Polish enterprises, representing five geographically concentrated industries that form functioning industrial clusters and cluster initiatives.

The selection of clusters included in the study is made as follows. Due to characteristics of Polish economy, the authors attempt to take into consideration different type of sectors among Polish entities. In Poland, clus-

ters derive mainly from manufacturing and services sector including both "Key National Clusters" (e.g. relatively small amount of clusters, with the most significant impact for Polish economy grouping the most productive companies') and local industrial clusters and cluster initiatives (vast majority of the population). They also operate in such a diversified environment, as they form not only in knowledge-intensive sectors, but also in more traditional ones. Thus, the sample of clusters used in the study is representative as it takes into account the heterogeneity of clusters and cluster initiatives in Poland. For instance, selected clusters differ significantly in terms of their scope and scale (e.g. numbers of SMEs involved varies between 18 and 300), level of formalisation (some of the clusters have a leader among companies within industry; others have a leading consulting company functioning outside the industry) and level of intensity of initiatives in cluster. Moreover, this study accounts for clusters from more traditional sectors (such as clothing industry, wine and tourism sector) and more technologically intense ones (e.g. construction and boiler sector).

The chosen entities are: Pleszew Boiler Cluster (boiler sector, functioning in the Wielkopolskie voivodeship, the Lubusz Wine and Honey Trail (wine sector, functioning in the Lubuskie voivodeship), Łeba — the Blue Land (tourism sector, functioning in the Pomorskie voivodeship), the Podlachia Lingerie Cluster (clothing sector, functioning in the Podlaskie voivodeship) and the Eastern Construction Cluster (construction sector, functioning in the Podlaskie voivodeship). The above-mentioned clusters' characteristics are shown in Table 1.

The PAPI and IDI methods were used while collecting the data. The survey consisted of numerous questions on a five-point Likert scale, where '1' means 'strongly disagree' and '5' means 'strongly agree' with a specific statement.

In the case of the boiler sector, 20 entities responded; in the case the wine sector the number of responses was 23; in the case of the tourism sector, 50 entities responded; in the case of the clothing sector the number of responses was 14, and in the case of the building sector 23 entities responded. Thus, the total number of observations is 130.

Due to the characteristics of variables used for the study — Likert scale variables — the Partial Least Squares (PLS) method was used with Structural Equation Modelling approach. This unique algorithm (hereinafter: PLS-SEM) enables estimating connections between individual explanatory variables and determining their impact on the explained variable simultaneously (Ringle *et al*., 2015). PLS-SEM is utilized in many scientific fields to check and verify interrelationships between selected variables, including human resources management (Sarstedt *et al.*, 2020), supply chain man-

agement (Kaufmann & Gaeckler, 2015), statistics (Pagès & Tenenhaus, 2001), and finance (Blanco-Oliver *et al*., 2016). The method is particularly recommended for non-parametric analyses due to relative robustness to data failure problems and specific data distributions (Cassel *et al.*, 1999; Sarstedt *et al.*, 2020), and the ability to effectively estimate the results for a relatively small sample (e.g. for 100–200 observations) (Reinartz *et al.*, 2009). Therefore, when analyzing the questionnaire data that are prepared in the Likert scale, it is strongly recommended to use the PLS-SEM algorithm.

Structural Equation Modelling technique is also strongly represented in studies devoted to knowledge management, innovations and clusters. For instance, Darroch (2005) and Corral de Zubielqui *et al.* (2019) highlight the importance of the relationship between knowledge management, innovativeness and performance of companies. However, the conducted studies are prepared for developed countries (New Zealand and Australia) and the authors underline the need to prepare an analysis in a different economic context. Pan *et al*. (2018) point out the need for improving technological learning ability of high tech clusters, as the study is devoted to the relationship between innovation network, learning and innovation performance. Regarding leadership and innovations, there is only one known study developing SEM algorithm looking at the topic of innovation-oriented leadership in a company provided by Stock *et al*. (2013) (however, the sample are firms outside clusters).

All in all, the combination of factors describing specification of clusters in our study and proposed SEM technique is quite unique, and aggregates many other theoretical and empirical point of views from literature.

The main dependent variable in the study is innovativeness (*innov*) described as propensity to introduce at least one new or improved product / service or innovation in any management area in the company in the last three years. The latent variables are divided into the four groups.

The first group (and the first latent variable) describes the cluster coordinator incentives made in order to be more innovative (influence of the coordinator's activities on boosting companies' innovativeness — *coord* and influence of the coordinator's activities on raising additional funds — *coordfunds*). The second and third group of variables (the second and third latent variable) are the variables defining cooperation. Cooperation covers a wide range of factors that can affect innovativeness, e.g. cooperation within triple helix — formal and informal relations — *coop3H*, cooperation with the local authorities — formal and informal relations — *coopgov*, cooperation with competitors — *coopcomp* and cooperation among cluster companies-informal relations — *cooprel*. The fourth latent variable de-

scribes the tradition of localization of the specific company — *tradloc* and participation in cluster initiatives — *cluster*. The influence of a specific indicator on latent variable is expected due to the concepts of modern clusters.

The first step of PLS analysis requires defining the measurement model and the structural model. The measurement model shows relationships between indicators and created constructs. These constructs in PLS-SEM algorithms are called latent variables. All the constructs need to be measured by explaining variables (indicators). Thus, all the indicators were divided into four groups. On the other hand, the structural model covers the interrelationships between constructs and shows latent scores for endogenous variables.

The next step of analysis of the measurement model requires finding the proper direction of interrelationship between indicators and created constructs (latent variables). According to Hair *et al*. (2014), PLS-SEM models can be divided into formative and reflective ones. Reflective models show consequences (relationships — one-headed arrows in a graph from latent variables to indicators) and formative models prove concrete cause (arrows from indicators to latent variables) (Sarstedt *et al*., 2014). The analyzed model is a formative one.

The following step of the analysis covers assessment of the chosen type of model. In the PLS-SEM, in the formative model, the measurement model should be assessed by (Hair *et al*., 2014):

1. Collinearity between indicators measured by the variance inflation factor (VIF should be lower than 3 – higher VIF implies higher level of collinearity);
2. Convergent validity (path coefficients for outer weights should be greater than 0.5);
3. Significance of path weights (T-Value>1.645) – PLS-SEM relies on bootstrapping procedure (as a rule of thumb for credible outcomes, the minimal number of subsamples should not be lower than 5000; the model is re-estimated for each subsample and the result shows the statistical significance of each predictor).

According to Sarstedt *et al*. (2014), if path coefficients are statistically significant, the indicator is retained. If the loading of indicator is higher than 0.5 but it is not statistically significant, then additional verification and explanation based on economic theory should be provided. If the path coefficient is non-significant, the indicator should be deleted from the measurement formative model.

The subsequent part of analysis includes defining interrelationships between latent variables in the structural model and assessing the strength of

relationships between variables. However, PLS-SEM does not include typical goodness-of-fit measures (Henseler & Sarstedt, 2013). Thus, the analysis covers statistical significance of indicators and path coefficients for the structural formative model.

The estimation is carried out with the SmartPLS 3 package using the Partial Least Squares algorithm and bootstrapping procedure (5000 subsamples) for 130 observations.

Results

Table 2. and Table 3. show the variance inflation factor (VIF) for outer and inner models. As a rule of thumb, VIF should be lower than 3. For all the indicators and models (inner and outer), the above-mentioned condition is fulfilled. This result means that multicollinearity of variables used in study is relatively low and the analysis can be further processed with this set of factors.

Secondly, convergent validity is checked. The final structural formative model includes the indicators presented in Figure 1. Some indicators in the measurement model whose outer weights are lower than 0.5 are retained due to the consistency with economic theory regarding cluster leader, cooperation within triple helix (and in general), and localization affecting innovativeness of specific company in general. Moreover, deleting variables in formative models can cause problems and interfere with the outcomes of significance tests because of the nature of the formative model. Indicators in formative models are unique and not interchangeable, thus, deleting them can enlarge negative effects (Hair *et al*., 2014). To have sufficiently estimated and non-biased results, the authors decide to include symmetric amount of factors determining every construct (latent variable). The result of the second step is obtaining factors important for further analysis of interrelationships between constructs.

Thirdly, the next part covers checking the relevance and significance of coefficients in the structural model. Figure 1. (the graph) and Table 4. show results of estimation, which indicate a level of interrelationship between a specific feature and innovativeness. The presented values are path coefficients for a specific variable and p-value (in brackets). Note: p-value describes a level of significance for indicators: $p<0.01$ (***), $p<0.05$ (**), $p<0.1$ (*). The bold lines represent the most significant relationships. Weights are standardized, values and differ from -1 (strong negative interrelationship) to +1 (strong positive interrelationship).

Path coefficient (see Table 5.), represents the direction of the interrelationship between the constructs (latent variables) and the endogenous variable. Furthermore, according to Cohen (1988), the values of f Square of 0.02, 0.15, and 0.35, respectively, represent small, medium, and large effects of the explaining latent variable on the explained variable. Effect size values of less than 0.02 indicate that there is no effect.

Taking into consideration the final model (Figure 1.), one major result can be observed. Incentives of the cluster coordinator lead to being more innovative. If we look at specific factors in inner model for latent variable 'Coordinator' we obtain a very important role of both incentives of coordinator of cluster in boosting innovative activities (*coord*) and raising additional funds (*coordfunds* — the most significant variable at $p<0.01$). If we look at the outer model, the effect of a positive impact of the cluster coordinator on introducing innovations is noticeable and statistically significant (p-level<0.05 [**]). It proves that successful cluster leadership may have a positive impact on introducing innovations in general (in line with Elenkov *et al*., 2005). Thus, the H1 hypothesis is statistically proved and accepted.

The effect of cooperation influencing introducing innovations in general is ambiguous. Firstly, regarding inner model for construct 'Coop_gov', cooperation with local authorities (*coopgov* — the most significant variable at $p<0.01$) has stronger impact on overall cooperation in construct 'Coop_gov' than cooperation within triple helix (*coop3h*). However, overall result of impact of earlier mentioned construct is not significant and we cannot adopt second hypothesis. Secondly, regarding inner model for construct 'Coop_ent', cooperation among competitors (*coopcomp*) is the most important factor with the highest value of loading (the most significant variable at $p<0.01$). However, mainly because of non-significance of second factor *cooprel*, the overall impact of cooperation (among different entrepreneurs — 'Coop_ent') on innovativeness of companies is not significant. Thus, the third hypothesis *H3* cannot be adopted.

Finally, taking into account the factors connected with Localization, participation in cluster activities (*cluster)* is the most important factor in this group, with positive sign and statistical significance (at $p<0.05$). In turn, tradition of localization has a negative factor loading. Overally, Localization is not significantly related to innovativeness of specific company, and the fourth hypothesis H4 cannot be adopted. Thus, the H2, H3 and H4 hypotheses are not supported.

Discussion

This paper primary focuses on the vital aspects of clusters, especially to what extent the specific characteristics of Polish clusters (e.g. activities of leader of the cluster, network, cooperation with other firms and within the triple helix, and localization factors) determine innovativeness of specific companies. Due to the multi-dimensional nature of clusters and cluster initiatives in Poland, the attention is devoted to various measures at the firm level. The obtained results only partially confirm adopted hypotheses.

In the case of activities of coordinator (or leader) of cluster or cluster initiative, results on innovation are viable and lead to confirm hypothesis *H1*. The positive and statistically significant impact of activities of leader of cluster on introducing new business ideas is revealed. This results are unique at firm-level apart from other studies and enriches the current level of knowledge on EECs. Obtained result is in line with Elenkov *et al.* (2005) that suggests influence of successful leadership on product and administrative innovations. However, the authors of current study would like to stress that this study does not consist of disaggregation of types of innovation introduced by company — it is possible limitation and could be improved in future works. Apart from clusters, the results are also in line with Stock *et al.* (2013) as they underline the important role of innovation-oriented leadership in a company with R&D cooperation practices.

Secondly, the impact of other factors possibly boosting innovativeness is not revealed, as we focus on specific constructs (latent variables).

Regarding cooperation with institutions, results differ significantly from Cheng *et al.* (2017) and Necoechea-Mondragón *et al.* (2017) indicating no statistically significant impact of that type of cooperation activities on innovativeness of specific company. This phenomenon would be explained by taking into account different types of clusters with different technological sophistication — other studies are focused mainly on high-technological sectors. It would be an important finding leading to the conclusion that cooperation with local authorities (leading to boosting level of innovativeness) is functioning effectively for more technologically advanced sectors and clusters (and cluster initiatives). Thus, sufficient policy for non-technology sectors and clusters should be addressed.

Taking into consideration cooperation with other competitors and companies (outside clusters) affecting the willingness to innovate in general, a significant relationship between these factors (constructs) is not revealed. These results differ significantly from Pouwels and Koster (2017) (they indicate a positive, significant relationship between inter-organizational cooperation and organizational innovations), however, their approach show

statistically significant results for one type of innovation only (organizational). Our results also vary in evidence given by Radicic *et al.* (2018), as they point out the importance of cooperation for innovation (four particular types) both for technological and non-technological sectors in EU regions. The results obtained by the authors of this study are somewhat puzzling in this regard, and should be deepened in the international context. One of the possible explanation for that matter would be the fact that cooperation for innovation of Polish enterprises functioning outside clusters is still on different trajectory (as one of members of EECs) than in countries with relatively longer and more innovation-oriented traditions (West European developed economies, Japan). The authors of this study would like to stress that we include more general level of innovativeness (without disaggregation for specific types), however, such differentiation would be good starting point for further analysis.

Lastly, the overall impact of localization on innovativeness of specific company is not revealed. The possible explanation of estimated results is as follows: the positive effect of cooperation within clusters (*clusters*) is throttled by negative effect of tradition of localization (*tradloc*) on innovativeness. The empirical evidence of positive effect of cooperation within clusters on innovativeness is revealed by many scholars (Chun-Liang *et al*., 2018; Alberti *et al*., 2021). However, the results differ significantly from studies for developed economies (United Kingdom and Italy — see Beaudry, & Breschi, 2003; France — see Duranton *et al.,* 2011; other European economies and Japan — see Cheba, 2015) in terms of tradition of localization. The explanation for this phenomenon would be based on the assumption, that companies in Poland functioning within traditional industries and characterized by relatively long industry experience are not innovation-oriented.

The research carried out by the authors enriches the assessment of the ability of implementing innovations by the members of clusters for the role of characteristics of network in stimulating innovative activities. The most important observation is the fact that the impact of the cluster coordinator on introducing innovations in general is revealed.

Conclusions

The paper provided a novel model examining interrelationships between clusters' characteristics (cooperation between firms and with local authorities, incentives of coordinator of cluster, and localization) and willingness to innovate of entrepreneurs of five Polish clusters using Structural Equa-

tion Modelling. Its main objective was to explore the potential drivers of innovativeness of specific company functioning within clusters among the earlier mentioned characteristics. The authors used primary data from questionnaire to conduct the study among the sample of Polish members of business clusters and cluster initiatives. The model comprises of unique set of variables describing clustering activities (for instance, incentives provided by leader of cluster, cooperation within and beyond clusters, cooperation within a triple helix, and tradition of localization) and goes beyond traditional view, often focused on high-technology sectors only (Pan *et al*., 2018; Alberti *et al*., 2021) as it takes into account the potential heterogeneity of clusters (selected clusters differs significantly in terms of scope and scale, level of formalization, and intensity of incentives within) with inclusion of both members of traditional and knowledge-intense sectors. This approach is novel for EECs and enriches current state-of-art.

In spite of the fact that empirical research was done for Poland, the contribution of the paper still consists of revealing a crucial role of cluster coordinator in increasing propensity to innovate. This result is in line with Elenkov *et al*. (2005) initially revealing that successful leadership implicates important boost in innovativeness for a company, especially with relatively higher level of technological sophistication. However, in this study direct finding is revealed that incentives provided by leader of specific cluster are important driver for innovation-related activities, both for technological and non-technological industries.

Taking into consideration the variety of models of innovations and the wide range of innovation systems, the role of cluster leader may have a crucial impact on innovativeness for different levels of data disaggregation. The coordinator of a network of firms' have two main tasks that are the key factors leading to effective cooperation within the network: the leader should weaken the pressure on causing conflicts that are determined by the realization of individual goals by partners and should combine common goals for the network. Revealing the role of the cluster leader in supporting the innovativeness of participants of a network of firms' is also reflected in the discussion of the range of cluster and participation of external entities in activities of the network. To extend research horizons in this regard, the authors suggest taking into account different types of leadership in specific organizations, psychological and behavioral aspects (Pieterse *et al*., 2009), and including empirical studies at team-level, similarly with Eisenbeiß and Boerner (2010).

However, according to the obtained results, only that factor creates a significant opportunity to enhance the level of innovativeness in a specific company functioning within cluster or cluster initiative in Poland.

Regarding other drivers that would potentially implicate the boosting innovativeness at firm-level, the authors initially assumed that cooperation with other institutions (mainly regarded as cooperation within the triple helix; or with local authorities only) would be important asset for further innovation-related activities. However, this importance of this direct relationship is not revealed, similarly with cooperation with other business entities, and tradition of localization. Mainly, the obtained results differ significantly from those in literature — Pouwels and Koster (2017) show a significant relationship between inter-organizational cooperation and organizational innovations; Radicic *et al.* (2018) point out importance of cooperation for innovation (four particular types) both for technological and non-technological sectors in EU regions; similarly, Cheng *et al.* (2017) for China and Necoechea-Mondragón *et al.* (2017) for Mexico. Moreover, the importance of localization factors influencing innovation activities is not revealed, as the authors attempted to prove. This results also differ significantly from recent studies regarding clustering activities and traditional localization boosting creation of new business ideas (Chun-Liang *et al*., 2018; Alberti *et al*., 2021 for clusters; Duranton *et al.,* 2011 for more traditional sectors in France).

On the basis of obtained results for non-significant relationships, the authors assume that these factors have something in common. One of the possible explanation for that matter would be the fact that cooperation for innovation of Polish enterprises functioning inside and outside clusters is still on different trajectory (Poland is a post-communist economy and one of members of EECs) than in countries with relatively longer and more innovation-oriented traditions (West European developed economies, Japan). Moreover, cooperation with local authorities (leading to boosting level of innovativeness on the basis of empirical finding of other authors) is functioning effectively for more technologically advanced sectors and clusters (and cluster initiatives). Thus, sufficient policy for non-technology sectors and clusters should be addressed.

Policy implications

The study is a real contribution to research and discussion on the shape of the cluster support policy, and points out needs of sophisticated actions especially made by authorities in the field of supporting cooperation of entities in clusters. The scale and scope of management as a part of the cluster support policy with the participation of many different organizations provokes constant discussion of its tasks. There is a constant need of improving policy for clusters in national, regional, sectoral and industrial con-

text in order to foster innovativeness and economic development for a country with characteristics like Poland. In the case of supporting clusters' innovative actions, a huge amount of government support need to be done to exhibit their real potential.

Numerous dilemmas are revealed in the foreground: which clusters should be supported by the policy regarding their technological sophistication, scale and scope of functioning, and level of formalization and to what extent (Benneworth & Charles, 2001); secondly, clusters combine various types of organizations with specific, both individual and common goals — to what extent the cluster support policy modifies the boundaries and influences the organizations that make up the cluster; furthermore, to what extent the realization of individual goals goes hand in hand with the implementation of common goals; thirdly, to what extent the coherence between the strategy and policy of the regions and the strategy of network entities can be preserved (MacNeill & Steiner, 2010). The answer to those questions is ambiguous to address the following recommendations. This study reveals the fact that actions made by a leader of cluster association could lead to more intense innovation-related activities, thus the crucial thing is to make a proper selection of the leader — a company from inside or outside the cluster — as an entity with sufficient competencies. The selection of this leader could be suggested by authorities, as the government stance should be as follows: local authorities should recommend companies with the highest potential regarding competitiveness, innovativeness, and ethical standards. Pointing out a concrete leader should imply in better flow of knowledge, more symmetric information among companies within cluster, and more productive and innovative way of functioning firms in general.

Moreover, there is a need of promoting more R&D-related cooperation (between different types of clusters and cluster initiatives, between entities functioning within cluster, and in terms of triple helix) to expand innovation activities. The authors underline a fact that there is a huge gap of this type of activities among studied clusters and it should be improved significantly to catch up developed economies. Regarding innovation clusters (and regional innovation systems), these actions need to be supported by forming policy on regional level, because effective clusters would induce more competitive regional economy in long-term scenario.

Limitations of the study and further research

The results of this study points out directions for further research. The study was limited due to the nature of collected data, cross-section analysis and focusing on clusters deriving from one specific economy — Poland.

Firstly, to extend research horizons regarding actions of leader of cluster or cluster initiative, the authors suggest taking into account different types of leadership in specific organizations, study additional behavioral aspects affecting current functioning of a company, and including empirical studies at team-level, however, in relation to economic activity of companies functioning within clusters.

Secondly, using panel data regarding networks' specification (utilization of comparable variables to this study) and time-lagged propensity to innovate could be more appropriate in terms of analyzing the clusters' potential, mainly because of dynamic character of cooperation within and beyond clusters Moreover, there is a need to address potential relationship between characteristics of networks' or clusters, innovativeness and firm performance, especially for the demarcation on technology and non-technology industries and clusters. Specification of every cluster would be a differentiating mediator of this relationship and would vary across sectors.

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Annex

Table 1. Characteristics of clusters' potential

Cluster	Scope and scale	Level of formalization	Initiatives (scope/level)
Pleszew Boiler Cluster	26 SMEs Localisation: Pleszew city and around Market orientation: local, regional and domestic	Association Leader: cluster company Leader activities: medium level	Medium
the Lubusz Wine and Honey Trail	30 SMEs Localisation: Lubuskie voivodeship, high concentration: Zielona Góra city and around Market orientation: local and regional	Association Leader: cluster company Leader activities: medium level	Medium
Łeba – the Blue Land	60 SMEs Localisation: Pomorskie voivodeship, Baltic city and around Market orientation: domestic and international	Association Leader: Local Tourism Agency Leader activities: medium level	Low
the Podlachia Lingerie Cluster	18 SMEs Localisation: Białystok city and around Market orientation: domestic and international	Association Leader: consulting company Leader activities: low level	Low
the Eastern Construction Cluster the Key National Custer	300 SMEs Localisation: 100 SMEs originally Białystok city and around; 40 SMEs originally construction sector) Market orientation: domestic and international	Association Leader: consulting company Leader activities: very high level	High

Table 2. Outer VIF values

Outer VIF Values	VIF
cluster	**1.002**
coop3h	**1.027**
coopcomp	**1.135**
coopgov	**1.027**
cooprel	**1.135**
coord	**1.128**
coordfunds	**1.128**
tradloc	**1.002**
innov	**1.000**

Source: own elaboration based on SmartPLS 3.

Table 3. Inner VIF values

Inner VIF Values	Innovations
Coop_ent	**1.007**
Coop_gov	**1.066**
Coordinator	**1.117**
Innovations	**-**
Localisation	**1.170**

Source: own elaboration based on SmartPLS 3.

Table 4. Statistical significance of interrelationships in a formative structural model

N=130	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
Coop_ent -> Innovations	-0.019	-0.021	0.115	0.162	**0.871**
Coop_gov -> Innovations	-0.156	-0.145	0.193	0.809	**0.419**
Coordinator -> Innovations	**0.252**	**0.246**	**0.128**	**1.973**	**0.049(**)**
Localisation -> Innovations	0.007	-0.042	0.104	0.070	**0.944**

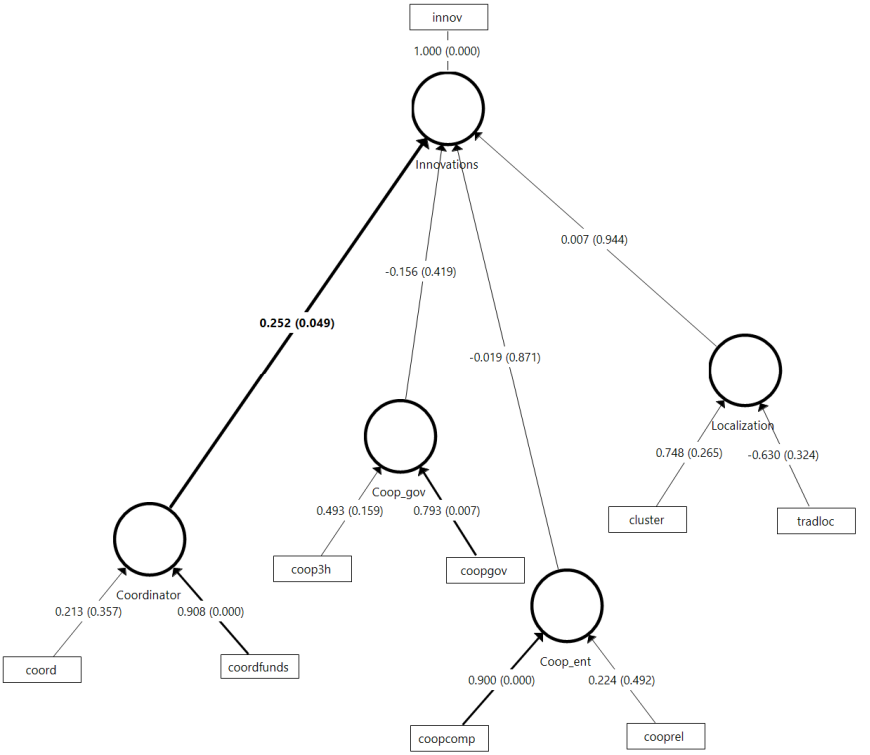
Source: own elaboration based on SmartPLS 3. Note: *** p<0.01, ** p<0.05, * p<0.1.

Table 5. Path coefficients and f Square – relations between variables and effect size on explained variable in formative model

N=130	Innovations (*path coefficient*)	Innovations (*f Square*)
Coop_ent	-0.019	0.017
Coop_gov	-0.156	0.091
Coordinator	**0.252 (**)**	**0.029**
Localisation	0.007	0.001

Source: own elaboration based on SmartPLS 3. Note: *** p<0.01, ** p<0.05, * p<0.1.

Figure 1. Path coefficients (p-values in brackets) graph of a structural formative model (result of bootstrapping procedure)



Source: own elaboration based on SmartPLS 3.