

Exploring the Governance of Entrepreneurial Ecosystems for Productive High Growth

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Abstract

This paper aims to empirically identify the characteristics and governance types of regional entrepreneurial ecosystems (EEs) associated with productive high-growth entrepreneurship (PHGE). We developed a unique database comprised of public statistics on high-growth enterprises and regional EEs in Poland over the course of 2011–2018. The Hierarchical Clustering on Principal Components and a taxonomic analysis were used to identify how different types of EE governance relate to varying levels of high-growth enterprises' performance. We have identified and described the relationships between PHGE

and diverse clusters of EE governance and evolution stages toward developed structures. Two clusters proved similarly effective in generating PHGE and they represent alternative EE governance solutions as well as the most advanced evolutionary phases. The proposed conceptualizations of productive high-growth entrepreneurship and EE governance types advance the understanding and measurement of these phenomena. The profiling and configurational approach adopted in this research reflects the heterogeneity of EE governance types and outcomes and can be further replicated in other research settings.

Key words: entrepreneurial ecosystems; high-growth enterprises; governance; productive entrepreneurship

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Entrepreneurial ecosystems (EEs) are broadly considered the relationships and interactions among industrial, social, and institutional conditions in specific territorial units to generate productive entrepreneurship [Stam, 2015; Mason, Brown, 2014; Isenberg, 2021]. The growing research on EEs is mostly concerned with the identification of combinations of agency and other systemic components in a particular territory vis-à-vis differentiated outcomes [Wurth et al., 2021]. Still, the EE concept features important research gaps in terms of conceptualizations and measurements that might impede further academic advancements and effective territorial development policy.

First, the idea of EEs is under-developed regarding the nature of this phenomenon as a governance structure rather than just a configuration of actors and factors [Colombo et al., 2019; Colombelli et al., 2019; Cho et al., 2021]. Governance represents a regulatory, institutional structure that affects the performance and dynamics of territorial units [Markusen, 1996; Williamson, 2005]. Therefore, recognizing types of governance and their outcomes is critical for theory and policy. Second, a research gap exists regarding the conceptualization and measurement of productive entrepreneurship [Wurth et al., 2021; Torres, Godinho, 2021]. Productive entrepreneurship is predominantly defined as high-growth enterprises (HGEs). This approach focuses on the role of company size dynamics in macroeconomic indicators [Birch et al., 1995; Coad, 2009; Acs et al., 2008; OECD, 2007, 2021; Gancarczyk, 2019]. However, the microeconomic efficiency of HGEs and the expansion-performance relationship for sustainable enterprise development are underscored [Coad et al., 2020; Mogos et al., 2015; Steffens et al., 2009]. Consequently, the third, aggregate research gap refers to how productive high-growth entrepreneurship is affected by the EE governance [Colombo et al., 2019; Brown et al., 2017; Capozza et al., 2018].

Against the above underexplored areas, *the aim of this paper is to empirically identify the characteristics and governance types of regional entrepreneurial ecosystems associated with productive high-growth entrepreneurship.* We adopt multidimensional exploratory techniques of the Hierarchical Clustering on Principal Components and taxonomic analysis to identify how various types of EE governance are associated with differing levels of enterprise performance. As research material, a unique database was compiled from public statistics during the period 2011-2018 on Polish regional EEs and high-growth enterprises.

The study provides theoretical and policy-relevant contributions. It advances the literature on EEs by conceptualizing productive high-growth entrepreneurship in relation to EEs as outcome-oriented governance structures. Moreover, it contributes both to EE research and policy by empirically identifying how various types of EE governance contribute to productive high growth of enterprises. Correspondingly, the paper adds to the studies and policy on entrepreneurial growth by revealing how the growth performance nexus is conditioned

by the regional context. This research is also valuable for profiling and as a configurational approach to the understanding of different EE governance types. The applied approach captures the heterogeneity of regional environments in generating economic outcomes.

Conceptualizing Productive High-Growth Entrepreneurship

From their inception, EE research and policy have been oriented toward productive entrepreneurship that contributes to economic output or capacity to increase this output [Baumol, 1996; OECD, 2010; Dominiak et al., 2016]. So defined, productive entrepreneurship is predominantly captured as HGEs and unicorns that profoundly contribute to employment, value added, and innovation [Birch, 1995; Acs et al., 2008; OECD, 2007, 2021]. Currently, one of the critical challenges in boosting EE studies is to clarify and specify the expected impacts from EEs and related measures [Wurth et al., 2021, Torres, Godinho, 2021].

The present understanding of HGEs as productive entrepreneurship is often reduced to considerable and rapid size increases that ensure the referred macroeconomic outputs [OECD, 2007, 2021]. This approach ignores the importance of sustainability through microeconomic efficiency (e.g., profitability), which allows for the survival and continuing growth of enterprises [Mogos et al., 2015; Garnsey et al., 2006; Steffens et al., 2009; Coad, 2009; Zbierowski, 2012; Bolek, 2018]. HGEs' intense investment in innovation and new markets induces low liquidity and solvency and thus raises concerns regarding performance and survival [OECD, 2021; Oliveira, Fortunato, 2006]. The focus on the efficiency of growth is also justified from a policy point of view since profitable growth alleviates the threat of failed public support. Correspondingly, theoretical approaches to firm expansion point to the difference between growth as size increases (measured by revenue, employment, asset value or value-added dynamics) and efficiency (measured by profitability dynamics) [Achtenhagen et al., 2010; Marris, 1964].

Despite the above arguments, both the prevalent stream of research on HGEs and the current EE literature either miss the difference between size and performance measures or focus on size increases only, leaving performance issues underexplored [Coad et al., 2020; Achtenhagen et al., 2010; Davidsson et al., 2009; Steffens et al. 2009; Wurth et al., 2021]. Therefore, we clarify the concept of output from EEs as *productive high-growth entrepreneurship* that combines considerable size increases with efficiency, to ensure sustainability, i.e., survival and continuous expansion. Consequently, this paper also proposes a more fined-grained approach to the measures of productive entrepreneurship toward sustainability outcomes. The proposed approach reflects efficient expansion through growth performance measures, integrating size increase variables (e.g., sales, employment) and efficiency variables (e.g., profitability, liquidity).

Regional EEs as Outcome-Oriented Governance Structures

Entrepreneurial ecosystems emerged as a concept and policy drawing upon the importance of the territorial context for enterprise development. EEs represent sets of outcome-oriented and interrelated actors and factors from the business, social, and public spheres in the multi-scalar context of regional, country, and international conditions [Stam, 2017; Stam, Spigel, 2016; Brown, Mason, 2017; Bruns et al., 2017]. Territorial units demonstrate unique combinations of the above characteristics, therefore, “one size fits all” solutions do not apply for the purpose of research and policy [Mason, Brown, 2014; Brown, Mawson, 2019; Capozza et al., 2018]. Moreover, differing EEs might raise divergent outcomes in terms of productive entrepreneurship [Brown, Mason, 2017; Wurth et al., 2021].

Territorial heterogeneity and complexity favor qualitative case studies as a research method, but this limits the opportunity to generalize the results. To overcome difficulties in generalizing, the governance concept can be adopted as a higher-order construct. This enables a theoretical synthesis to reveal the common rules that pertain to the types of regional EEs representing distinct governance structures and related outputs [Colombo et al., 2019; Colombelli et al., 2019].

Governance is considered institutional modes (structures) or sets of rules that regulate the functioning of a particular economic system and thus affect its efficiency and change [Williamson, 2005; Markusen, 1996; Colombo et al., 2019; Colombelli et al., 2019]. However, EE-specific governance remains a nascent theme with few conceptual papers and a lack of empirical evidence, in particular, a quantitative one. We advance this research by synthesizing differentiated EE governance based on the literature in innovation systems and clusters [Markusen, 1996; Guerrieri, Pietrobelli, 2004; Brown, Mason, 2017; Stam, 2015]. This literature suggests that different types of governance might determine investment and economic stability, upgrading, innovation, and the evolution of EEs to generate PHGE. Below, these outputs are systemized depending upon the type of governance and according to sets of governance discriminating criteria.

EE Governance according to Central Tenants

EEs are governance structures centered around key or central tenants that set out the rules for investment decisions and economic stability [Colombelli et al., 2019]. These tenants differ in size and ownership and can comprise SMEs, large enterprises (LEs), foreign direct investors (FDIs), and public investors [Mason, Brown, 2014; Isenberg, 2021]. An *SME-dominated EE* benefits from predominantly local ownership of businesses. Rather than by external investors, investment decisions are controlled internally, which stabilizes the regional economy [Markusen, 1996; Malizia, Motoyama, 2019]. Most high-growers are young SMEs, however,

growth and profitability of small firms are irregular and discontinuous [Brown, Mason, 2017; Coad, 2009]. Moreover, SMEs have limited potential to access international markets and technologies [Felzenstein et al., 2015; Brown, Mawson, 2015]. The discontinuity of SME expansion and their limited capacity to compete internationally might negatively affect the prospects for resilience and sustainable profitability [Felzenstein et al., 2015].

Ecosystems centered around large enterprises with local ownership enable major investment decisions to be determined within the region. LEs demonstrate more predictable and persistent growth than small firms thus ensuring a more stable expansion of SME sub-contractors [Brown, Mason, 2017; Coad, 2009]. Large firms are sources of knowledge spillovers, venture funds, and spin-offs that turn into high growers [Klepper, 2007; Colombo et al., 2019]. They also act as gate openers to international markets [Munari et al., 2012]. An alternative to SMEs or LEs as regional focal firms are foreign direct investments (*FDI-based EEs*). In this case, major investment decisions, collaborative links, as well as sources of finance and technology, are located outside the region [Markusen, 2017; Guerrieri, Pietrobelli, 2004; Pisoni et al., 2013]. A regional economy reliant upon FDIs is less stable due to the volatility of external investments [Pathak et al., 2015]. In general, subsidiaries offer minor prospects for financing or knowledge transfer compared to locally owned SME- or LE-based ecosystems [Pisoni et al., 2013]. However, knowledge and R&D-intensive FDIs, as well as subsidiaries embedded in the region, were found to be conducive for the expansion and enhanced performance of local firms [Gorynia et al., 2007; Bhawe, Zahra, 2019; Herrmann, 2019].

Public investor-led EEs might be unstable due to political decisions and public budget constraints [Humphrey et al., 2021]. However, well-targeted public funds enhance structural change and progressive regional transformation [Foray, 2014; Lema et al., 2018]. Public sources of financing and knowledge transfer often trigger startups and scale-ups [Arauzo-Carod et al., 2018; Corrente et al., 2019].

EE Governance according to Socio-Business Collaboration and Human Resource Competence

Based on territorial collaboration and human resource competence, hierarchical and relational governance modes can be distinguished, which determine opportunities for learning and upgrading. Upgrading is moving up the value chain toward more knowledge-intensive activities and higher added value (such as the transition from manufacturing to engineering and design) [Humphrey et al., 2021; Gereffi et al., 2005]. The intensity of collaboration among various social and business actors determines mutual learning. Benefits from socio-business collaboration are enabled by human resource competence [Bhawe, Zahra, 2019; Lehm-

ann et al., 2019]. Lower-skilled labor is less capable of absorbing knowledge spillovers and benefiting from collaboration [Tingvall, Videnord, 2018]. *Hierarchical EE governance* features lower human resource competence and limited regional collaboration [Colombelli et al., 2019; Gereffi et al., 2005]. This governance enables only minor opportunities for upgrading local enterprises [Pisoni et al., 2013]. Alternatively, *relational EEs* demonstrate intense collaboration and high human competences, allowing for knowledge spillovers and upgrading [Colombelli et al., 2019; Gereffi et al., 2005].

EE Governance according to Knowledge Sources

Based on the criteria of knowledge sources, such as formal, science-based knowledge or tacit, experienced-based knowledge, the main governance modes are identified [Jensen et al., 2007; Alhusen, Bennat, 2021]. These in turn affect the intensity and type of innovation which is widely reported as conducive to the growth of firms [Audretsch et al., 2014; Arauzo-Carod et al., 2018]. To overcome the liabilities of smallness in the area of investment in innovation, SMEs need external R&D and knowledge transfer [Stam, 2015; Mason, Brown, 2014]. SMEs in R&D and knowledge-intensive industries often grow dynamically [Coad, Grassano, 2019; Przybylska, 2018]. In the *science-technology-innovation (STI) model*, focal enterprises use science-based knowledge from their own R&D departments, universities, and specialized technology firms to generate breakthrough product innovations [Jensen et al., 2007; Alhusen, Bennat, 2021].

These focal companies establish less intensive business collaborations with non-R&D suppliers, such as SMEs, who benefit from process innovations. In the *doing-using-innovation (DUI) model*, focal firms form intense business collaboration with SME suppliers. This governance generates incremental product and process innovations, based on the exchange of practices and routines rather than science-based knowledge [Jensen et al., 2007; Alhusen, Bennat, 2021]. In the most advanced *combined and complex innovation (CCI) model*, focal firms adopt both an R&D-intensive model of STI, as well as a practice-based model of DUI, with related product and process innovations [Isaksen, Karlsten, 2012].

EE Governance according to Evolutionary Phases

Ultimately, territorial governance changes with EE evolution or life cycles that explain how EEs start and advance into fully developed structures [Cho et al., 2021; Mack, Mayer, 2016].

A conceptual development proposed by [Colombelli et al., 2019] looks at EE evolution through the lens of intensity and density of internal collaboration. Based on their approach, the birth phase features weak internal collaboration, the transition phase represents intermediate collaboration, while the consolidation (developed) phase accomplishes strong collaboration. Brown and Mason [Brown, Mason, 2017] identify embryonic

(early stage) and scale-up (developed) EEs according to characteristics such as intensity of entrepreneurial activity and HGEs, collaboration and international linkages, and public financing. Considering that many EEs are in a transition or in an intermediate stage, a three-stage framework is appropriate for taking take into account EE progress and related governance. This framework covers *the EE phases of birth, transition, and consolidation* – from low to increasing intensity of entrepreneurial activity, international linkages, and socio-business collaboration, and from high to decreasing public involvement.

Individual EEs might concurrently represent various governance types that differently contribute to productive high-growth entrepreneurship. As mentioned, this area is empirically under-researched and requires explorative investigations. Therefore, we formulate the following research questions:

RQ 1. How does the performance of high growers differ in different EE governance types?

RQ 2. What are the characteristics and types of EE governance that generate productive high-growth entrepreneurship?

Method

The construct of EEs and their governance represent complex categories that need to be described by several observable variables. This poses a challenge for operationalizing and measuring the EE phenomenon and its outcomes in a comprehensive way. The extant evidence of EE influence is predominantly based on the case studies of successful regions, while quantitative approaches are less common [Wurth et al., 2021]. The aim of this study and the above research questions justify the adoption of an exploratory analytical approach. Consequently, we used the Hierarchical Clustering on Principal Components and a taxonomic technique to identify how different types of EEs associate with varying levels of performance of high growth enterprises [Jolliffe, 2002; Sanguansat, 2012]. This approach is also suitable when the studied phenomenon features many variables against a limited number of observations. Since EEs are delimited within the boundaries of particular territorial units, this research captures EEs as regions, based on Polish voivodeships.

We developed a unique database that combines public statistics on the expansion and performance of high growth enterprises in the Polish regions (voivodeships) and data on the structural characteristics of these regions in 2011-2018. This period has been determined by the accessibility of the data on high growers and other critical dimensions describing regional EEs. The year 2011 is the earliest available starting point for the data on high growers in the OECD, Eurostat, and Polish statistics, following the first definitions and measurement methodologies [OECD, 2007, 2021]. The source of data on high growers is a survey conducted by Statistics Poland, in which high growers are enter-

prises employing at least 10 people, with at least 20% annual increase in revenues over three consecutive years. An aggregate size increase is expressed by total revenue growth rate of 72.8% or more [OECD, 2021; see also Statistics Poland¹, 2018]. The number of the surveyed HGEs amounted to 3,746 in 2011, 5,300 in 2012, 4,012 in 2013, 3,351 in 2014, 3,768 in 2015, 3,985 in 2016, 3,940 in 2017, and 4,533 in 2018 [Statistics Poland, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020]. The data on the characteristics of EEs were extracted from the Local Data Bank of Statistics Poland that follows the methodology of Eurostat's Structural Business Statistics, Business Demography Statistics, and the European Innovation Survey in the regional context.

A theory-driven set of governance criteria versus productive high growth entrepreneurship and corresponding variables are presented in Table 1.

The structure of central tenants is expressed as the number of micro (MICRE), small (SE), medium (ME), large (LE), and FDI enterprises per 1,000 inhabitants in the region (European Commission, 2020; Markusen, 1996). The engagement of the public investor (PUBL) is captured as the amount of the EU Structural Funds per capita. Socio-business collaboration (ORG) comprised non-profit organizations that integrate social and business targets [Malizia, Motoyama, 2019; Litzel, 2017]. Human resource competences have been captured as a percentage of the population with a tertiary education (EDU). SMEs pursuing formal collaboration within clusters or other agreements are an approximation of business collaboration (CLUST). International collaboration has been captured as the export activity of high growers (EXP) and as the density of FDI-backed enterprises (FDI), with the latter variable being also informative for the structure of central tenants [Munari et al., 2012]. Internal (I_RD) and external (E_RD) expenditures in regional GDP have been separately acknowledged in order to identify the sources of science-based knowledge - within EEs or from external entities [OECD, 2015; OECD-Eurostat, 2018]. Innovative activity comprised the shares of enterprises innovating in the area of product (INPROD) or process (INPROC) [OECD, 2015]. Finally, productive high growth entrepreneurship (PHGE) has been aggregated as a latent variable comprising HGEs' size and efficiency dynamics, i.e., the dynamics of revenue and three efficiency measures. Recently, Acs et al. [Acs et al., 2008] have also adopted an aggregate variable when measuring growth input to job creation in order to avoid a bias from one size measure only.

Based on the above theoretical background, Table 2 explains the configurations of criteria and variables indicating types of EE governance.

Results

The PCA analysis produced two dimensions of variables included in Table 3. The variables of export (EXP)

and internal R&D expenditures (I_RD) did not prove a significant correlation with the first and second principal components, and they were excluded from further analysis.

The correlation between the variables and dimensions (principal components) is significant at the level of 0.01. Dimensions 1 and 2 explain 54.73% and 20.16% of variance, respectively, which accounts for 74.89% of the overall data variance [Sanguansat, 2012]. These two dimensions were selected for their highest explanatory power regarding the variance in data, and the variance above 70% enables a reliable analysis (Figure 1) [Jolliffe, 2002].

Dimension 1 reveals a positive correlation among productive high growth entrepreneurship (PHGE) and such characteristics of regional EEs as the density of socio-business links (ORG), the number of micro, small, medium, and large enterprises (MICRE, SE, ME, LE) as well as FDI-backed enterprises (FDI), human resource competences (EDU), and external R&D expenditures on investment (E_RD). The variable of public support (PUBL) has proven to be a de-stimulant, negatively correlated with Dimension 1 (Table 3, Figure 1).

Dimension 2 differentiates the regions, however, it does not correlate with the variables forming Dimension 1, including productive high growth entrepreneurship (PHGE). Based on earlier research, we adopted a theory-based assumption that business collaboration (CLUST) and innovation (INPROD, INPROC) are inputs and conditions for growth and efficiency, which reveal their impact in the longer term [Audretsch et al., 2014; Arauzo-Carod et al., 2018]. Consequently, further hierarchical cluster analysis comprised both dimensions and produced six clusters of regional EEs (Figure 2).

The descriptive statistics of EE clusters (Table 4) include an aggregate relative indicator (average) for a given dimension, defined as the average of the variables' normalized values.

The mean relative differentiation of variables in each cluster is acceptable to treat the identified clusters as internally coherent types of ecosystems (Table 4). The high shares of deviations in the mean for Cluster 1 in Dimension 1 and for Cluster 5 in Dimension 2 are acknowledged in further interpretations. Cluster 6 in Dimension 1 takes the highest values of the variables and represents the point of reference, therefore, here the relative differentiation equals zero percent.

To understand the characteristics of clusters and synthesize their governance profiles related to productive entrepreneurship, we performed a taxonomic analysis (Table 5). The variables were defined as stimulants and normalized to values ranging from 0-1.

The six clusters of EEs represent differing levels of high growth enterprises' performance and the context components correlated with this performance in Dimen-

¹ <https://stat.gov.pl/en/topics/economic-activities-finances/activity-of-enterprises-activity-of-companies/>, accessed 01.07.2021.

Table 1. Variables Describing Ecosystem Governance and Productive High-Growth Entrepreneurship

Governance criterion	Variable	Description
Central tenants	MICRE	Number of enterprises with 0-9 employees per 1,000 inhabitants*
	SE	Number of enterprises with 10-49 employees per 1,000 inhabitants*
	ME	Number of enterprises with 50-249 employees per 1,000 inhabitants*
	LE	Number of enterprises with >250 employees per 1,000 inhabitants*
	PUBL	Public support from the Structural Funds in million PLN per capita, nominal prices*
	FDI	Number of enterprises with foreign capital per 10,000 inhabitants*
Socio-business collaboration	ORG	% of non-profit organizations promoting labor market and labor activity*
Human resource competence	EDU	% of population with tertiary education*
Business collaboration	CLUST	% of enterprises with 10-249 employees cooperating in clusters or other formal initiatives*
International collaboration	FDI	Number of enterprises with foreign capital per 10,000 inhabitants*
	EXP	High-growers' net revenue from export sale in million PLN per enterprise*
Science-based sources of knowledge	I_RD	Internal R&D expenditures as % of regional GDP*
	E_RD	External R&D expenditures as % of regional GDP*
Innovation	INPROD	% of enterprises with at least one product innovation*
	INPROC	% of enterprises with at least one process innovation*
Productive high-growth entrepreneurship	PHGE	Latent variable* as the mean of four normalized indicators: % increase of revenue, % increase of gross financial result, gross turnover profitability indicator, % increase of 1 st degree financial liquidity

* Mean 2011-2018 except for E_RD and INPROC accessible only for 2011-2017.
Source: own elaboration based on Statistics Poland, Local Data Bank.

sion 1 (Table 5). They also vary in scores for Dimension 2, denoting theory-based inputs for sustainable growth. The highest performer in terms of the growth efficiency nexus (PHGE) and related EE characteristics in Dimension 1 is Cluster 6. However, it comprises only one EE, namely, the Mazowieckie region with the major city of the capital of Poland. This case needs to be treated as an outlier, since the statistics of the capital city dominate this region, and most indicators represent the city as a unique administrative unit rather than the entire region. That bias could not have been alleviated, since the data on HGEs refer to Mazowieckie, without discriminating between the Warsaw metropole and the surrounding region. Consequently, we remove Cluster 6 from the analysis of the findings and focus on the five other clusters.

Clusters 4 and 5 demonstrate the highest and relatively similar scores regarding productive high growth entrepreneurship. At the same time, the characteristics of their values in Dimensions 1 and 2 (Tables 4 and 5) and governance profiles (Table 6) considerably differ.

Cluster 5 (Pomorskie, Wielkopolskie) rates the highest in Dimension 1 including the conditions directly associated with PHGE, but it is the second lowest in Dimension 2, which contributes to longer-term efficiency. This cluster features low public involvement, but relatively high density of LEs, SMEs, and FDIs that jointly form a balanced structure of central tenants. Dense socio-business links support the relational gov-

ernance structure, however, only medium-level human resource competences weigh toward a combination of relational and hierarchical governance. External R&D scores are medium and, at the same time, the cluster reveals weak innovative activity, acknowledging the difference in favor of Pomorskie (Figure 2). The reason for the weak innovation might be that the moderate STI model based on external R&D is not supported by the practice-based DUI governance, due to low business collaboration. Regarding the evolutionary phase, dense entrepreneurial activity, socio-business collaboration, international linkages, and low public involvement point toward a developed EE system. However, considering the low business collaboration, Cluster 5 represents the late transition-consolidation phase.

Cluster 4 (Dolnoslaskie, Malopolskie, Slaskie) rates the second highest in Dimensions 1 and 2. Moderate public involvement, high density of LEs and FDIs, and only medium density of SMEs point to large firms and foreign investors as central tenants. Intense internal collaboration and highly educated human resources enable relational governance. High external R&D investment provides evidence of strong science-based (STI) governance. At the same time, the cluster's high innovative output is not directly correlated with R&D in Dimension 1, but rather with business collaboration (Dimension 1), and the cluster features a medium level of business collaboration. This suggests that the innovative performance is also driven by tacit knowledge

Table 2. The Configurations of Variables Adopted to Determine EE Governance Types

Criteria and variables	Type of EE governance
Central tenants: micro-enterprises (MICRE), small enterprises (SE), medium enterprises (ME), large enterprises (LE), foreign direct investment (FDI), public support (PUBL)	SME-based, LE-based, FDI-based, Public investor-based
Socio-business collaboration (ORG), human resource competence (EDU)	Hierarchical governance, relational governance
Science-based sources of knowledge (I_RD, E_RD), innovation (INPROC, INPROD), business collaboration (CLUST)	STI, DUI, CCI governance
Entrepreneurial activity (MICRE, SE, ME), international linkages (FDI), socio-business collaboration (ORG), business collaboration (CLUST), public support (PUBL)	Birth, transition, and consolidation governance as EE evolves

Source: own elaboration.

and the experience-based model of DUI. Strong international linkages (FDI investment) and socio-business links prove the developed EE system. However, considering a weaker entrepreneurial activity as the proportion of SMEs vs LEs, a medium level of business collaboration, and medium public involvement, the referred EEs represent the transition-consolidation phase of evolution.

Cluster 3 (Lubuskie, Lodzkie, Kujawsko-Pomorskie, Zachodniopomorskie) demonstrates only moderate values in PHGE and the correlated criteria of EE governance. FDIs, the public investor, and SMEs hold the position of central tenants. Public support takes higher values and FDIs hold a relatively stronger position vis-à-vis LEs than in the leading clusters 4 and 5. The low level of human competence and medium level of socio-business links point to hierarchical governance. External R&D is low, taking profoundly weaker values than in the best performing clusters. As a result, low-to-medium innovation activity in Cluster 3 is accomplished through a mixture of weak STI and moderate

DUI governance (medium business collaboration). The international linkages of Cluster 3 are strong, however, due to the medium levels of public involvement, entrepreneurial activity, as well as business and socio-business links, Cluster 3 meets the requirements for the transition stage.

Cluster 2 (Lubelskie, Opolskie, Podkarpackie, Podlaskie) rates the second lowest in PHGE and correlated variables of Dimension 1, while in Dimension 2, it is the highest performer among the five EE groupings. Public investor and FDIs act as central tenants. This is due to the considerably higher public funds and weaker entrepreneurial activity. Similar to Cluster 3, FDIs have a relatively stronger position compared to LEs than in the best performing clusters. Low human competence and low socio-business collaboration indicate hierarchical governance. STI governance is weak due to low external R&D. The strongest innovative output can be attributed to the most intense business collaboration among all the clusters, proving a strong DUI governance. Intense business collaboration combined

Table 3. Two Dimensions of Variables Produced by the PCA Analysis

Variable	Correlation	P-value
Dimension 1		
PHGE	0.9658343	1.331213e-09
ORG	0.9405466	6.011350e-08
LE	0.9327047	1.401061e-07
FDI	0.9128340	8.121140e-07
ME	0.8833916	5.745165e-06
SE	0.8714761	1.098492e-05
MICRE	0.8395073	4.757921e-05
EDU	0.7896126	2.747577e-04
E_RD	0.7262494	1.443392e-03
PUBL	-0.7898403	2.728606e-04
Dimension 2		
INPROD	0.9338522	1.245992e-07
CLUST	0.7615736	6.084131e-04
INPROC	0.7025502	2.406230e-03

Source: own elaboration.

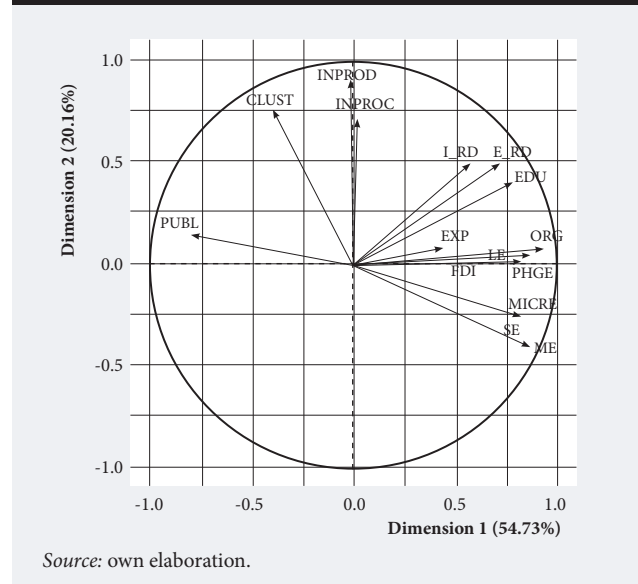
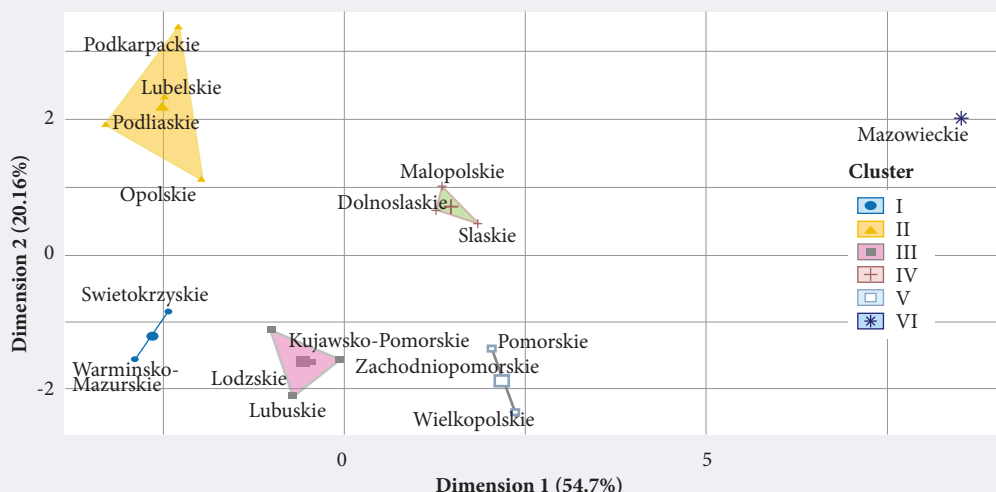
Figure 1. The Strength and Direction of Correlation between Variables and Dimensions 1 and 2

Figure 2. Clusters of Regional EEs Based on Two-Dimensional PCA



Source: own elaboration.

with medium international linkages can lead to the future advancement of PHGE. Still, weak socio-business collaboration, low entrepreneurial activity, and high public involvement point to the birth-early transition phase of EE evolution.

Cluster 1 (Swietokrzyskie, Warmińsko-Mazurskie) scores the lowest in terms of PHGE and governance criteria in Dimensions 1 and 2. Backed by public investors and SMEs as central tenants, it almost lacks FDI. Hierarchical governance is determined by very low human competences and low socio-business collaboration. Low external R&D (weak STI governance) and moderate performance in product and process innovations meet medium business collaboration. The latter acts as the driver for moderate DUI governance in terms of knowledge sources. The interpretation of the overall values for Dimension 1 should acknowledge a large differentiation between two EEs included in Cluster 1 (Table 3). Namely Swietokrzyskie shows better performance in this regard than Warmińsko-Mazurskie (Figure 2). Weak performance in entrepreneurial activity, international linkages, and socio-business collaboration as well as medium business collaboration and high public engagement reveal the birth phase of Cluster 1.

Discussion and Contributions

Discussion of Results

Our research has addressed the aim to empirically identify the characteristics and governance types of regional entrepreneurial ecosystems associated with productive high growth entrepreneurship. This aim was guided by two research questions, regarding the differences in high growers' performance in the various types of EE governance (RQ1) and regarding the

characteristics and governance types of EEs that generate PHGE (RQ2).

The identified types of EE governance enable the identification of relationships and causalities among actors and factors [Colombo *et al.*, 2019]. Instead of one solution only, two clusters ensure the similarly high performance of HGEs and they represent alternative EE governance profiles regarding expected output. These governance profiles are close to the developed EE phase of consolidation. Nevertheless, they are not fully developed and reveal both strengths and weaknesses.

Cluster 4 builds its strengths on the lead position of large enterprises and foreign subsidiaries as central tenants. The relational governance ensures absorptive capacity and knowledge spillovers to upgrade in global value chains, while LEs and FDIs provide access to international markets and resources outside the region [Colombo *et al.*, 2019; Munari *et al.*, 2012; Lehmann *et al.*, 2019]. The external orientation is also reflected in strong science-based (STI) governance that relies on the acquisition of external knowledge. Strong STI governance combined with a moderate DUI model produce high innovative performance [Audretsch *et al.*, 2014; Coad, Grassano, 2019]. This performance and business collaboration provide prospects for the future expansion and profitability of HGEs [Audretsch *et al.*, 2014]. What can raise concerns about the sustainability of this system is only the middling level of entrepreneurial activity. The latter combined with the predominance of external sources of knowledge signals weaker internal potential for innovation and entrepreneurship [Markusen, 1996] and thus threatens the prospects for the transition to the consolidation phase [Colombelli *et al.*, 2019]. The overly dominant position of LEs or FDIs vs local SMEs might prevent mutuality and balancing

Table 4. Descriptive Statistics of the EE Clusters

Statistics	Cluster					
	I	II	III	IV	V	VI
<i>Dimension 1</i>						
Standard deviation	0.10	0.06	0.15	0.09	0.22	0
Average	0.12	0.15	0.31	0.44	0.51	1
Coefficient of variation (%)	80.1	39.27	48.87	20.20	43.30	0
<i>Dimension 2</i>						
Standard deviation	0.04	0.14	0.07	0.21	0.07	0.31
Average*	0.23	0.65	0.20	0.52	0.13	0.61
Coefficient of variation (%)	19.66	22.13	33.9	39.91	50.65	51.26
* — the computation of Average in Dimension 2 recognizes PUBL as a de-stimulant, negatively correlated with PHGE.						
Source: own elaboration.						

costs and benefits among the EE tenants [Brown, Mason, 2017; Munari et al., 2012].

Cluster 5 builds its PGHE based on the balanced enterprise structure with large firms, FDIs, and strong local SMEs as central tenants [Markusen, 2017; Stam, 2015]. The combination of relational and hierarchical governance can ensure the absorption of knowledge spillovers and support upgrading toward higher value-adding activities. However, a moderately developed STI model with weak DUI application and business collaboration lower the prospects for innovation – at present, the lowest among the researched clusters [Litzel, 2017; Grillitsch, Nilsson, 2019]. The transition to

a developed EE will depend upon increasing innovation and business collaboration, and on the further advancement of human competence to reap the benefits from collaboration with LEs and FDIs [Audretsch et al., 2014; Brown, Mason, 2017].

Regarding the EEs that are less favorable environments for PHGE and occupy lower evolutionary stages, they suffer from the scarcity of large firms and host public investors, FDIs, and SMEs as central tenants. Predominantly hierarchical governance might prevent the upgrading of enterprises in value chains. Governance types employed for innovation activities are chiefly experience-based, while science-driven models are weak. Nevertheless, Cluster 2 proves that strong experience-based models of innovation supported by public investors and FDIs can produce the highest innovative output of all EE groupings. To advance to more developed EE stages that produce PHGE, the relevant clusters need to improve the conditions directly contributing to sustainable entrepreneurship. These are primarily human competences and the strength of internal collaboration toward relational governance and upgrading.

Contributions

The paper conceptually and empirically advances the research on EE governance and related output. The relationship between firm growth efficiency and the characteristics of the external environment represents the core of the concepts of EEs and enterprise growth, however, it remains underexplored [Brown, Mason, 2017; Brown, Mawson, 2019; Stam, 2015]. To the best of our knowledge and based on the most recent reviews [Wurth, et al., 2021], this study is unique in tack-

Table 5. Taxonomic Analysis of Six Clusters of EEs according to Two Dimensions

Variable	Cluster					
	I	II	III	IV	V	VI
<i>Dimension 1</i>						
PHGE	0.02 (Very low)	0.12 (Low)	0.25 (Medium)	0.42 (High)	0.44 (High)	1
ORG	0.08 (Low) ¹	0.08 (Low)	0.20 (Medium)	0.5 (High)	0.53 (High)	1
LE	0.15 (Low)	0.15 (Low)	0.21 (Medium)	0.35 (High)	0.34 (High)	1
FDI	0.02 (Low)	0.14 (Medium)	0.23 (High)	0.27 (High)	0.28 (High)	1
ME	0.30 (Low)	0.18 (Low)	0.41 (Medium)	0.46 (Medium)	0.77 (High)	1
SE	0.27 (Low)	0.26 (Low)	0.53 (Medium)	0.6 (Medium)	0.79 (High)	1
MICRE	0.14 (Low)	0.23 (Low)	0.45 (Medium)	0.51 (Medium)	0.65 (High)	1
EDU	0.02 (Very low)	0.08 (Low)	0.14 (Low)	0.43 (High)	0.32 (Medium)	1
E_RD	0.11 (Low)	0.14 (Low)	0.14 (Low)	0.43 (High)	0.22 (Medium)	1
PUBL ²	0.14 (High)	0.16 (High)	0.5 (Medium)	0.45 (Medium)	0.76 (Low)	1
<i>Dimension 2</i>						
INPROD	0.18 (Medium)	0.75 (High)	0.12 (Low)	0.67 (High)	0.08 (Low)	0.83
INPROC	0.26 (Medium)	0.72 (High)	0.22 (Medium)	0.6 (High)	0.11 (Low)	0.74
CLUST	0.25 (Medium)	0.49 (High)	0.25 (Medium)	0.28 (Medium)	0.20 (Low)	0.25

¹ Nominal scales were determined according to the least differences among the values within scale intervals.

² The values for PUBL acknowledge the nature of this variable as a de-stimulant.

Consequently, the lower the values for PUBL in Table 5, the higher the amounts of public support.

Source: own elaboration.

Table 6. PHGE and Governance Profiles of the EE Clusters

Governance criteria	Clusters				
	I	II	III	IV	V
PHGE maturity	Low	Low	Medium	High	High
Central tenants	Public investor and SMEs	Public investor and FDI	FDIs, SMEs, public investor	LEs and FDI	LEs, FDI and SMEs; a balanced enterprise structure
Socio-business collaboration, human resource competence	Hierarchical	Hierarchical / nascent relational	Hierarchical	Relational	Relational / hierarchical
Sources of knowledge (application of governance models)	Weak STI, moderate DUI	Weak STI, strong DUI	Weak STI, moderate DUI	Strong STI and moderate DUI	Moderate STI, weak DUI
Evolutionary phase	Birth	Birth / early transition	Transition	Transition / consolidation	Late transition / consolidation

Source: own elaboration.

ling these issues on theoretical and empirical grounds. Our findings raise three contributions, namely, i) to the literature on entrepreneurial ecosystems, ii) to the research on entrepreneurial growth, and iii) to related policy areas.

First, regarding the research on EEs, this research proposes a theoretical advancement, by broadening the concept of EE and by conceptualizing the output of EEs as productive, i.e., efficient and thus sustainable, high growth entrepreneurship. The concept of territorial governance enabled an advanced theorizing and generalization of EE governance types and related outcomes. Resonating with the most recent research agenda in EEs, our study fulfills the calls for functional and outcome-oriented approaches [Wurth *et al.*, 2021, Mason, Brown, 2014; Brown, Mason, 2017]. By emphasizing governance rather than isolated components and individual variables, it addresses the complexity of EEs [Stam, 2015; Grillitsch, Nilsson, 2019].

To identify alternative governance arrangements associated with enterprise growth and performance, a configurational and taxonomical approach has been adopted. This approach reflects a variety of territorial EEs, instead of promoting one universal model for all locations [Herrmann, 2019; Hassink *et al.*, 2019]. It also enhances knowledge building through profiling these complex phenomena [Brown, Mawson, 2019]. Namely, the research can accumulate the knowledge of several alternative governance solutions and move toward a more comprehensive understanding of EEs [Wurth, *et al.*, 2021]. Nascent studies in EE governance focused on qualitative cases of life cycles captured as particular organizations and territories [Colombelli *et al.*, 2019]. This study is unique in the quantitative generalizations of EE governance, since extant quantitative studies were focused on individual EE components.

Second, this research contributes to the studies on firm growth by expanding the knowledge on external and

*territorial conditions for profitable and thus sustainable expansion. The extant studies are dominated by internal characteristics of high growers, while external factors are under-researched [Shepherd, Wiklund, 2009; Welter *et al.* 2019]. Moreover, the existing research does not pay enough attention to growth performance relationships [Davidsson *et al.*, 2009, Coad *et al.*, 2020]. This paper explores how the external environment formed by EE governance associates with the performance of HGEs and it identifies the most effective governance arrangements in this regard. Like other studies, it confirms the importance of environmental resource munificence [Chandler, McKelvie, Davidsson, 2009; Corrente *et al.*, 2019]. It differs in going beyond environmental components toward advanced theorizing through the lens of governance.*

*Third, our findings provide a policy-relevant contribution. The identified alternative EE profiles might serve as canvas for setting up entrepreneurship policy and regional policy directed toward the upgrade of EEs [Brown, Mawson, 2019]. Policymakers might consider the best performing EEs as benchmarks for developing tailored public measures for weaker ecosystems [Brown, Mawson, 2019; Colombelli *et al.*, 2019]. The latter can be strengthened in the areas that proved less developed than in the leading environments.*

The policies for entrepreneurship and regional development should also consider the role of the EU Structural Funds identified as negatively correlated with the performance of HGEs. This relationship might be typical of less developed regions, where EU funds are predominantly directed at cohesion [Wojnicka-Sycz, 2020]. In the period considered, Polish regions were low-to-moderate performers in terms of competitive and innovative positions among their European counterparts (RIS data, 2012, 2016²; and ERCI data³, 2010, 2013, 2016). Nevertheless, since productive entrepreneurship is recognized as a key driver of re-

² https://ec.europa.eu/growth/industry/policy/innovation/regional_en/, accessed 01.07.2021.

³ https://ec.europa.eu/regional_policy/en/information/maps/regional_competitiveness/, accessed 01.07.2021.

gional development [Audretsch et al., 2014; Grillitsch, Nilsson, 2019], policy should also target regional upgrading and innovation capacity development for enterprise growth and performance. As was revealed for the EEs with the greatest public support (Clusters 1 and 2), the EU funding can yield different results in terms of catching up. One of the explanations rests on the different quality of governance regulating these ecosystems.

Limitations and Implications

Ultimately, we need to acknowledge the limitations of this study and ways of addressing them. One country-specific setting can be seen as a limitation of this study. However, considering the heterogeneous nature of regional EEs, a more fine-tuned approach can be accomplished when a consistent institutional system is investigated [Asheim, 2019; Hassink et al., 2019]. This enhances proper interpretations of causal mechanisms and alertness to potential biases [Asheim et al., 2019]. Further research might consider expanding the setting to other countries. Moreover, EEs can be researched at different evolutionary stages separately (young, growing, mature EEs) and with regard to the type of output when evolving (not only HGEs' performance, but also population wealth, knowledge spillovers, etc.).

Another limitation might stem from the short, eight-year period of the investigation that does not capture regional dynamics. However, the longevity and evolutionary nature of regional development point to the persistence of the identified EE profiles. This persistence is also supported by the rankings in regional innovation and competitiveness (RIS 2017, 2019; ERCI, 2019). By adopting mean variables from eight years, we avoid the bias if only one point in time had been measured. As statistics expand in this area, future research should comprise long-term panel data to directly investigate the dynamics of EEs, such as their converging or diverging paths.

The set of EE governance criteria we investigated may be treated as non-exhaustive. Nevertheless, EE theorists propose a functional approach that tracks EE governance vis-à-vis a particular outcome [Stam, 2015; Brown, Mawson, 2019]. The selective EE characteristics are justified by the focus on the performance of HGEs and its drivers derived from the extant regional studies. By following a theory-driven set of variables, we add to the profiling of ecosystems. This approach is more feasible than the attempts to accommodate all the possible characteristics [Wurth et al., 2021; Brown, Mason, 2017]. The profiles of EEs identified in further studies can be ultimately synthesized in narrative and systematic reviews.

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