

Do clusters with public support perform better? Case study of Czech cluster organizations

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Abstract: *This paper deals with an evaluation of the differences in financial performance of member organizations of two types of clusters in the Czech Republic. The first type of cluster was created on the basis of the primary activity of the member entities, bottom-up, without any direct public support. The second type of cluster was created top-down on the basis of a cluster initiative with support from public budgets (mainly from EU structural funds). Cluster initiatives are used as a regional policy tool to foster innovation and competitiveness. Both types of clusters that met the conditions of maturity (created before 2012 inclusive) and high activity were selected for the research. In total, there were 32 clusters, 24 of which were created using the top-down approach and 8 using the bottom-up approach. The financial performance of the member business entities was evaluated using the ROA, ROE and EVA/employee and EVA/revenue indicators. The aim of the research was to prove whether public support for clusters would be reflected in the member entities achieving a better level of financial performance. The results of the analysis show that member entities in clusters established with public support do not achieve a better level of financial performance. Differences in financial performance between the two types of clusters are nonsignificant throughout the entire 2012-2017 reporting period. Therefore, no correlation connected with support for clusters from public funds and increased financial performance by their member enterprises was proved. The conclusion discusses the possible causes of this phenomenon, which include the purported establishment of clusters in order to obtain subsidies.*

Keywords: industry cluster, public sector, bottom-up approach, top-down approach, financial performance

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Introduction

Clusters, whose concept was developed by Michal Porter in the 1990s, are among the mainstream regional policies. The establishment and development of clusters are among the current trends in economic and regional innovation policy. The innovative ability of clusters is considered one of the key sources of a region's and nation's competitive advantage (D'Alise *et al.*, 2014). The past two decades have witnessed a great wave of interest in the area of clusters by both scholars and economic policy makers. Supporting clusters has become a significant strategy to support economic development in most European countries. Despite all the benefits offered by clusters, the impact of the concept of clusters on competitiveness or performance of member entities has not yet been extensively objectively quantified.

The beginnings of clustering in the Czech Republic are closely associated with the accession of the Czech Republic to the European Union. As regards the specific form of financial support for clusters in the Czech Republic, their creation and development are mainly financed from public sources, namely the EU structural funds through three operational programmes.

In the Czech Republic, the establishment and development of cluster organizations has been actively supported since 2004. The first was the Operational Programme Industry and Enterprise (OPIE), and within it the Clusters sub-programme that ran until 2006. The main objective of this programme was to support projects for establishing and developing clusters at the regional (NUTS 3 region) and supra-regional (NUTS 2 region) level. The managing authority was the Ministry of Industry and Trade (MIT), which implemented this programme through CzechInvest. The Clusters programme was divided into two phases: Phase I focused on mapping potential cluster initiatives and Phase II focused on the establishment and development of clusters. Under this programme, subsidies and soft loans were granted to 53 cluster projects in a total amount exceeding CZK 168 million (MIT, 2010a). However, not all cluster projects ended in the establishment of a cluster. 23 clusters were established in this first phase.

The Clusters programme was followed in 2007, with the Operational Programme Enterprise and Innovation (OPEI), by the Cooperation – Clusters sub-programme that ran until 2013. The managing authority was again the Ministry of Industry and Trade and the programme was also implemented through CzechInvest. Newly established clusters or already established clusters which, for example, used the support from the previous OPIE could apply for this programme. Altogether, 3 calls were announced under the Cooperation – Clusters sub-programme: Clusters – Call I (2008), Clusters – Call II (2010) and Clusters – Call II, extension (2012). For the 2007-2013 period, support in the total amount of CZK 1.075 billion was granted to a total of 39 clusters (MIT, 2010b).

Since 2014, clusters have been supported by the Operational Programme Enterprise and Innovation for Competitiveness (OPEIC), which lasts until 2020. Clusters can draw on funds under the Cooperation – Clusters sub-programme,

which aims to support the creation of clusters and technology platforms that focus on the development of innovation and international competitiveness. As of March 2019, 91 projects have been supported from this sub-programme in the total amount of CZK 550 mil. (API, 2019).

In addition to the operational programmes described above, clusters could also use other subsidy programmes, such as the Operational Programme Education for Competitiveness managed by the Ministry of Education, Youth and Sports, or the Operational Programme Human Resources and Employment and the subsequent Operational Programme Employment managed by the Ministry of Labour and Social Affairs.

The above overview shows that most clusters in the Czech Republic have been significant recipients of public support. The aim of this paper is to find out whether there is a difference between the financial performance of cluster organizations created using the bottom-up (without any public support) approach and cluster organizations created using the top-down (with public support) approach. That is, whether public support is positively reflected in financial performance of cluster members.

1. Literature review

It has already been observed that competing companies have a very strong tendency to agglomerate or group together if they are located in a particular, narrowly defined geographic area (Alcácer & Chung, 2010). An agglomeration of related economic activities is a central element of economic geography that has been studied by a large number of scientists, e.g. Marshall, 1920; Porter, 1990; Krugman, 1991; Ellison & Glaeser, 1997 and Krugman, 2011. As part of the cooperation between several completely independent enterprises, broad business networks including clusters may form (Dvořáček & Tyll, 2010).

The current concept of clusters in its economic sense is based on the knowledge of Alfred Marshall, who dealt with industrial districts. At the end of the 19th century, this British economist stated in his work entitled “Principles of Economics” that certain industries tend to concentrate locally around companies with similar or complementary profiles, which brings significant benefits from externalities both to the region and to the industry itself (Marshall, 1920). Alfred Marshall did not use the term cluster in his work, rather he spoke of industrial districts, which in many ways resemble clusters. Marshall (1920) characterizes an industrial district as a geographical location in which a specialized industry is concentrated. Marshall explained the development of industrial districts due to the existence of positive externalities in concentrated and interconnected companies and industries. These externalities are produced by the following three factors:

- flows of knowledge between companies,
- specialized outputs and services from supporting industries, and
- geographically combined labour markets (Marshall, 1920).

Marshall's definition of industrial districts basically states the existence of dynamic complementarity within a system of interdependent economic entities. He expected that a cluster of industrial districts would perform better than the sum of its individual units in case of a more scattered distribution (Marshall, 1920).

Other scientists have built on Alfred Marshall's work. One of them was, for example, Becattini (1979), a representative of the Italian school, who analysed successful Italian regions and subsequently examined the differences in their development. He introduced the term "industrial district" as a socio-territorial unit, characterized by the active presence of both communities, i.e. the population and companies in one naturally and historically delimited area (Pyke, 1990). A key feature of the Italian industrial district model is its multidimensionality: it goes beyond a purely economic dimension and extends to territorial and social dimensions (Pyke, 1990; Becattini *et al.*, 2009). Industrial districts are still considered one of the typical features of the Italian economy and one of the pillars of the Italian manufacturing industry (Cucculelli & Storai, 2018).

In the early nineties, M. E. Porter built on the previous findings of Marshall and the Italian economists, interconnecting them with the theory of strategic management into the cluster concept. In his work, Porter focused mainly on industry clusters. He was the first to introduce their definition (see below), included them in the focus of interest of his concept of the competitiveness diamond, and researched their impact on regional and national development.

Porter's first definition of a cluster is from 1990. He defines a cluster as a geographically proximate group of mutually interconnected companies, specialized suppliers, service providers and associated institutions in a specific field as well as companies in related fields that compete with each other, but who also work with each other, have common characteristics, and also complement each other (Porter, 1990).

Later, Porter (1998a) partly completed the definition and defined a cluster as a geographically proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities. In another definition, Porter (1998b) characterizes clusters as a group of companies and institutions existing in very close proximity that maintain interactive mutual relations, interact and support each other, and that achieve externalities and production efficiency through a division of work.

Porter's definition of a cluster contains two key elements. The first element is the fact that enterprises in a cluster are interconnected in a certain way. Clusters consist of interconnected firms and affiliated institutions that are similar to each other and are complementary. The links between the enterprises are both vertical (the customer-supplier chain) and horizontal (complementary products and services, the use of similar inputs, technologies, labour, etc.). The second key feature lies in geographical proximity. Clusters are geographically concentrated, interconnected companies. Collocation enhances the advantages resulting from networks of direct and indirect interactions between companies (Asheim *et al.*,

2006). Sharing knowledge among members creates a synergy generating unique knowledge (Skačkauskienė *et al.*, 2018).

Porter's theory of clusters has sparked debate across a range of disciplines: from spatial planning, geography, and public administration to economic development (Motoyama, 2008). The past two decades have witnessed a great wave of interest in the area of clusters by experts and economic policy makers, and support for clusters has become a strategy to support economic development (Fang, 2015). The process of cluster formation began during 1990s in various EU countries. The main reason was to strengthen the relevant industry's ability to innovate and increase national competitiveness. As the global economy is increasingly influenced by entire industries and branches, clusters could be an effective tool to facilitate and encourage business progress, to stimulate and maintain competitiveness (Bialic-Davendra *et al.*, 2014). Clusters are currently the predominant form of industrial organization, and their innovative nature is considered one of the key sources region's and nation's competitive advantage (D'Alise *et al.*, 2014).

Clusters can be created in two basic ways: top-down and bottom-up (e.g. Lindqvist *et al.*, 2012). Bottom-up clusters are created on the basis of the actual needs of a group of companies, they are based on existing contacts, and the members are strongly directly involved in the decision-making and planning of cluster activities. Funding from private sources is important. The top-down approach is characterized by a strong involvement of governmental bodies. Clusters are created on the basis of broader public interest and policy objectives concerning regional development. They include a wide range of companies and organizations, and isolated actors are also invited to become members. Public funding, e.g. from EU structural funds, is typical for such clusters. A combination of both approaches may be advantageous, where clusters are formed using the bottom-up approach, but the top-down approach is applied for their further development, especially by national and regional governments.

Some authors, e.g. Bresnahan *et al.* (2001), believe that publicly-initiated clusters lack dynamism and are therefore skeptical about the effectiveness of top-down cluster initiatives. They further argue that the success of a regional cluster depends on several factors, including the presence of highly skilled workers, the entrepreneurial spirit and links to relevant markets and sources of demand. In their opinion, this set of factors cannot be "cloned" artificially. In general, they believe that bottom-up clusters have a greater potential to develop favourably. Enright (2003) stresses the lack of sustainability in the case of top-down cluster initiatives. It seems that the professional public generally considers the mechanism of creating clusters with the help of public management to be weaker than the private management mechanism. One reason for this skepticism may be the potential inefficiency of public policy programmes. Examples include studies on the effectiveness of public subsidies for R&D subsidies and cluster policy programmes pointing to several benefits of public support, but they also reveal some weaknesses. For example, Nishimura & Okamuro (2011) found that direct

R&D support has only a slight impact on the performance of enterprises in the area of innovation. On the other hand, Prokop *et al.* (2019) found that in the conditions existing in CEE countries, cooperation within a group of enterprises is a vital way to support corporate innovation.

Taking into account the above aspects, it can be assumed that the way clusters are formed can also have some impact on the overall performance of clusters. According to the Meier zu Köcker (2009) study, more than 75% of all bottom-up and top-down cluster initiatives have achieved a very good or good level of performance. However, the authors also state that the share of clusters whose performance is rated “very good” is much higher for bottom-up clusters. The remaining 25% of clusters have shown some shortcomings in the past; these were exclusively top-down clusters.

2. Research methodology

Due to the diversity of individual clusters in terms of their date of formation and due to the availability of financial statements, the research was focused on the 2012-2017 period. Corporate data for 2018 are not yet available for a significant proportion of the enterprises. The whole body of research can be divided into the following eight steps:

1) Selection of suitable cluster organizations – a database of clusters in the Czech Republic was created using a search of the Commercial Register, websites and results of cluster mapping by CzechInvest. This database contains 114 clusters formed in the Czech Republic since 2002. However, 16 clusters have already ceased to exist. For a number of other clusters, membership information cannot be obtained, their websites do not exist or have not been updated for many years. Only 68 active clusters have been identified. The clusters analyzed must meet the three below conditions.

- Only active clusters were included in the research. This category includes clusters with projects and updates listed on the official cluster website. For these clusters, financial statements can also be found in the public register and in the collection of documents in the commercial register. At the same time, these organizations show non-zero revenue values in their financial statements over a long period.
- Only clusters in the maturity phase (i.e. organizations established up to and including 2012) were included in the research. The age of the cluster was taken into account in the research for the reason of monitoring the development of financial performance over time. The second reason is that the positive impact of a business entity’s membership in a cluster on its performance will manifest itself only after a certain amount of time has elapsed.
- A list of cluster members could be identified or made. 32 clusters met the above three conditions.

2) Defining research samples and creating a list of evaluated companies – the list of cluster members was obtained from the cluster website or by a inquiry made with the cluster manager. As the research focuses on the evaluation of financial performance, only business entities were included in the research. All non-business entities (e.g. universities, secondary schools, chambers of commerce, public benefit companies, etc.) were therefore excluded from the analysis. All natural persons were also excluded from the research because financial statements cannot be obtained in respect of them. As it is desirable to compare only business entities engaging in the same or similar branch of business activity, an analysis of the scope of business according to the NACE statistical classification was performed for each member business entity. For individual clusters, business entities in branches according to the NACE classification with the same or similar industry as the industry focus of the whole cluster were identified as a homogeneous core. The research was based on a comparison of two research samples. The first research sample (designated with the letter “B” in Table 1) consisted of homogeneous cores of 8 active clusters in the maturity phase operating within the territory of the Czech Republic, which were created using the bottom-up approach. These clusters were not recipients of any public financial support. The second research sample consisted of homogeneous cores of 24 active clusters in the maturity phase operating within the territory of the Czech Republic, which were created using the top-down approach (designated with the letter “T” in Table 1). These clusters were recipients of public financial support.

3) Creation of an overview of subsidies drawn for cluster projects – in order to divide the clusters into the first and second research samples, it was necessary to obtain an overview of the drawn subsidies and repayable financial aid from the state budget for the 2012-2017 period. The data were drawn from the CEDR information system operated by the Ministry of Finance of the Czech Republic. A total of 32 clusters were analyzed; public support was identified in 24 clusters.

4) Determining the number of employees – data on the number of employees were collected for both research samples. The sources of data were the notes to financial statements available in the Collection of documents of the Commercial Register and annual reports. The following situations were recorded when determining the number of employees. Where a range was stated in the documents for any given year, the middle of the range was used for making further calculations. In case of a zero number of employees declared by an enterprise, one employee was included in the calculation (the owner working as a self-employed person). If the figure concerning the number of employees in the year in question was not given, the missing figure was replaced by the arithmetic mean calculated from the values determined in the previous year and the year immediately following the year in which the figure was missing. If figures were missing for several consecutive years, the missing figures were replaced by the arithmetic mean calculated from all remaining values of the time series.

5) Collection of financial statements and obtaining data from financial statements – for the aforementioned research samples (a total of 420 enterprises), the necessary data were obtained from financial statements (balance sheets and profit and loss statements for 2012-2017). The MagnusWeb commercial database was used as the main source of accounting data. If this database did not contain the required financial statements, a public register (Commercial Register) and the Collection of documents in the Commercial Register were used. The Collection of documents typically contained the missing financial statements. In addition, due to the relatively short time series, companies with financial statements missing for more than one year were excluded from the research samples.

6) Calculating economic value added – the economic value added indicator (hereinafter “EVA”) was calculated for all business entities. EVA was calculated using the EVA equity method. The capital asset pricing model (CAPM) was used to estimate the cost of equity. The EVA indicator can take both positive and negative values. A positive EVA means that a company is generating value for its owners. If EVA is negative, the value of the company is decreasing. This indicator provides a basic picture of the financial performance of an enterprise. Furthermore, it must be noted that the EVA indicator according to the chosen methodology can only be determined for companies with positive equity. Therefore, it was necessary to exclude companies with zero or negative equity from the research samples.

7) Calculation of other financial indicators – the following indicators were compared for the research samples: return on assets (ROA), return on equity (ROE), EVA per employee and EVA on revenue.

8) Comparing the chosen characteristics of the individual research samples – in the last step of the research, the non-parametric Mann-Whitney W-test was used to compare the medians of both types of clusters. This test is constructed by combining the two samples, sorting the data from smallest to largest, and comparing the average ranks of the two samples in the combined data. Since the P-value is greater than or equal to 0.05/0.10, there is not a statistically significant difference between the medians at the 95.0%/90% confidence level.

3. Results of the research

The basic characteristics of descriptive statistics for both research samples are provided in Table 1. The Mann-Whitney W-test was used to compare the differences in the financial performance of member enterprises in individual years according to ROA, ROE, EVA/employee and EVA/revenue. The differences were tested at alpha significance levels of 90% and 95% (see Table 2).

Tables 1 and 2 show that although there are some differences between the financial performance of member enterprises in both types of clusters, they are not statistically significant, other than two exceptions in 2015. At the same time, however, it was also proved that in none of the years under review was the financial performance of top-down clusters significantly better than that of

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bottom-up clusters. It must be noted that the time series includes the 2012-2013 period when the Czech economy was in recession. In 2012, GDP fell by 0.8% year on year; in 2013, it fell by 0.5% (CZSO, 2018). This fact influenced the economic results of the member companies of clusters. Economic value added including, unlike accounting profit, implicit costs of equity, was significantly negative in both types of clusters throughout the period under review. An exception was 2015 for bottom-up clusters, where some improvement occurred. However, it is evident from subsequent statistics that this was only an accidental fluctuation. This means that overall, the member enterprises did not create any value for their owners; on the contrary, they used up the capital invested. The analysis also shows that, during times of economic crisis, the differences in financial performance between the member entities from both types of clusters were paradoxically the smallest. The gap has only started to widen since 2015. Thus, it can be stated that the subsidies drawn for cluster development during the recession had a positive impact on companies in top-down clusters.

Table 1. Medians of financial performance indicators

INDIC. Type	ROA		ROE		EVA/E		EVA/R	
	B	T	B	T	B	T	B	T
2012	0.0418	0.0527	0.0568	0.0818	-27.9065	-26.8543	-0.0140	-0.0133
2013	0.0576	0.0489	0.0912	0.0766	-15.5478	-26.5009	-0.0081	-0.0168
2014	0.0595	0.0593	0.1067	0.1037	-15.2780	-20.5083	-0.0058	-0.0092
2015	0.0800	0.0560	0.1125	0.0840	-4.7191	-24.5935	-0.0018	-0.0137
2016	0.0555	0.0547	0.0951	0.0731	-19.1966	-27.1020	-0.0091	-0.0151
2017	0.0546	0.0525	0.0849	0.0858	-16.3920	-31.2972	-0.0074	-0.0145

(Source: the authors' own contribution)

**Table 2. Mann-Whitney (Wilcoxon) W-test for Financial Indicators
(p-values)**

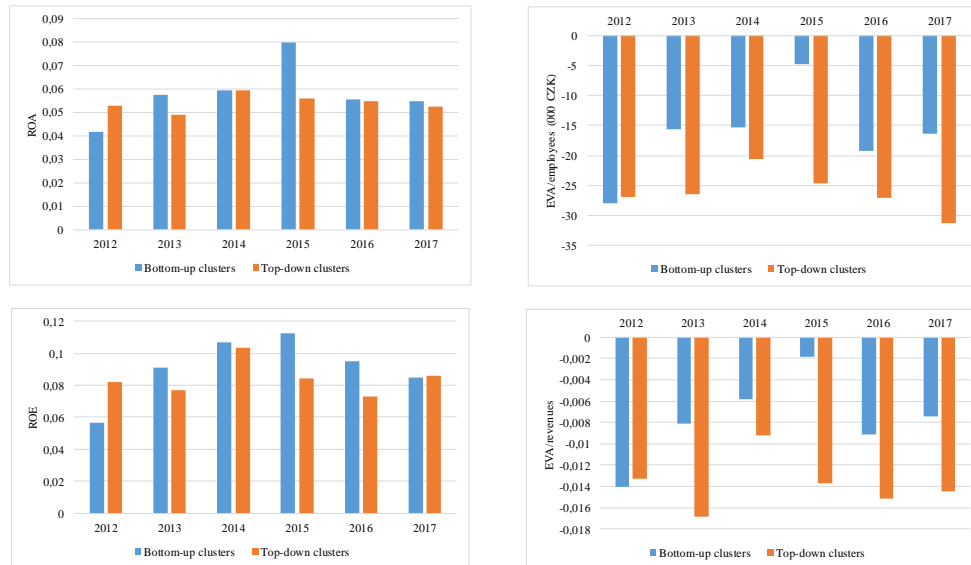
INDIC. Type	ROA		ROE		EVA/E		EVA/R	
	Statistics	P-value	Statistics	P-value	Statistics	P-value	Statistics	P-value
2012	10,695	0.3423	10,847	0.2567	10,708	0.3343	10,454	0.5111
2013	8,704	0.3174	8,546	0.2321	8,672	0.2987	8,649	0.2857
2014	9,266	0.4445	9,340	0.4995	9,299	0.4686	9,237	0.4239
2015	8,507	0.1047	8,422	0.0846*	8,216	0.0485**	8,513	0.1063
2016	11,203	0.3976	11,125	0.3531	11,908	0.9215	11,472	0.5750
2017	11,685	0.4683	11,832	0.5669	11,511	0.3645	11,541	0.3812

* statistically significant at $p = .10$, ** at $p = .05$

(Source: the authors' own contribution)

Figure 1 compares the development of the main financial performance indicators of member enterprises in bottom-up and top-down clusters in the 2012-2017 time series.

Figure 1. Development trends for the financial performance indicators for both types of clusters



(Source: the authors' own contribution)

In all monitored indicators, member enterprises developed similarly in both samples. The average ROA indicator growth rate, expressed as the geometric mean of the individual growth coefficients, reached 5.71% per year in the bottom-up cluster sample. For top-down clusters, the value was 5.39% per year. For the ROE indicator, the geometric mean for bottom-up clusters was 8.49% per year, while for top-down clusters it was 8.58% per year. The average EVA per employee was CZK -16,510 in bottom-up clusters and CZK -26,140 in top-down clusters. The return on revenue expressed by the EVA/revenue ratio was -0.77% in the first sample of clusters, and -1.38% in the second sample of clusters. The development trends for all indicators are similar in the period under review 2012-2017: some improvement in performance until 2014/2015, followed by a deterioration in performance in the last two years. It can only be said that the economic value added reached more favourable values (was less negative) in bottom-up clusters.

4. Conclusions

Based on the research carried out, it can be stated that public support invested in the establishment and development of clusters (top-down approach) in the Czech Republic had no significant effect on improving the financial performance of member enterprises. The efficiency of public support expended on cluster development is thus questionable. However, it cannot be inferred automatically that clusters as such cannot be a successful instrument for supporting the competitiveness of enterprises. However, it has not been confirmed that purposefully created top-down clusters have a significant effect on performance. The performed research confirmed the skepticism of some authors (Bresnahan *et al.*, 2001; Enright, 2003; Meier zu Köcker, 2009) regarding the effectiveness of cluster initiatives and the potential inefficiency of their public support.

The performed analysis of clusters in the Czech Republic shows a connection with their support programmes. The main impulse was the first operational programme, during which 23 clusters were established (most – 19 – in 2006). This was followed by 2009, when 14 clusters were established, which is associated with the second operational programme. In total, 61 clusters were established during the existence of the second support programme. Out of the clusters established in the first two phases, 15 no longer exist. The average lifespan of these unsuccessful clusters was 8 years. It is evident that subsidies from public budgets were the motivation for the establishment of some cluster initiatives. At the end of the project's sustainability period, the clusters went into liquidation.

Clusters based naturally on existing contacts of companies and other organizations, with funding from internal resources of their members, actually fulfill Marshall's and Porter's original idea of positive externalities from the sharing of knowledge and other specific resources. The role of the state, then, lies rather in cultivating the business environment or in supporting specific projects for the transfer of basic research results into practice. This concerns, for example, the area of nanotechnologies and biotechnologies, where it is necessary to interconnect research carried out at universities and in research institutes with the commercial sector. Mass support for clusters across industries does not seem to be efficient, as demonstrated by the research published in this paper.

Further research should be aimed at comparing clustered and non-clustered enterprises in the same industries in order to identify the specific impact of the cluster on the financial performance of its member entities.

The authors are aware of the limits of the research, which consist mainly in the short time series. It is possible that the positive effect of top-down clusters will be manifested only after a considerable amount of time has elapsed. On the other hand, after 7 years, there should already be seen some favourable trends in the development of the financial performance of their members. However, the research conducted did not show them.

Authors Contributions

The main benefit of this study is the verification of whether the support for clusters from public budgets has a real effect in terms of the improving the financial performance of their member entities. That means whether such public support is effective. There are many studies in literature that map the influence of clusters on innovation or that present models for measuring the performance of clusters themselves (focusing on projects, growth of membership, etc.). Research on the impact of clusters on the financial performance of their members is rare and no similar research is known to these authors in the Czech Republic.

Conflict of Interest Statement

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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