Funding Structure of the European and North American Clusters: Results from an Independent Questionnaire[1]

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Abstract

We use a unique dataset of 167 North American and European clusters' funding structures, obtained from an independent questionnaire survey carried out in the first half of 2016. The aim of this study is to determine possible differences in the proportions of public and private funds in the financing clusters from these two regions. Our results show that there is not a statistically significant difference in public-to-private funding sources among the European vs. American clusters. The proportion of public-to-private sources is on average approximately 43:57 in both regions. However, overall private sources of financing are significantly higher than funds obtained from public sources when we compare average values without respect to geographical regions. Furthermore, using a seemingly unrelated regression model, we identify dominant sources of public funding – in the European clusters dominate European Union budgets (24.29%), and for American clusters, the more prevailing sources are national (26.25%) and local budgets (10%).

Keywords: *clusters, funding, public/private sources, financial structure*

JEL Classification: L52, O38, R58

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Introduction

The topic of the advantages of spatial agglomerations has been analysed since the late 19th century in the works of Alfred Marshall (Cumbers and MacKinnon, 2004; Andini et al., 2013; Ehrl, 2013). More recently, the development in the area has been shaped by the 'new geographical economics', most notably the writing of Paul Krugman, whose work is considered to be a building block leading to the current cluster theory (Tsvetkova, 2014). However, the topic of clusters, cluster initiatives and cluster policies has become a subject of great interest to the professional public, mainly as a result of the publication of Michael Porter's book *The Competitive Advantage of the Nations* (Porter, 1990). Since then, research studies dealing with clusters, their funding and various other aspects have been growing in numbers. Clusters have gradually received even more attention from practitioners and policy-makers. As noted by Martin, Mayer and Mayneris (2011), industrial clusters are especially popular among policy-makers; during the last three decades, national and local governments have attempted to foster their development.

Many countries, including North America and Europe, are still active in developing and implementing cluster policies and programs. These policies have very strong practical consequences – they influence the location where clusters emerge, what they do and how they are financed. However, the issue of the public support of clusters is a somewhat controversial topic – although several authors consider the investment of the public sector to be a key factor in cluster success (e.g., Potter and Miranda, 2009), other studies by both economists and geographers are more critical towards the establishment of cluster policies (e.g., Martin and Sunley, 2003; Asheim, Cook and Martin, 2006; Falck, Heblich and Kipar, 2010; Duranton, 2011). Due to these differing opinions regarding cluster policy, as well as its actual implementation in North American and European countries, it is reasonable to assume that the financing of clusters also differs.

As far as we know, there is no previous study directly comparing the financing of clusters in North America and Europe. Europe poses a particularly interesting case, as over the past decade, European policy-makers have been very active in creating cluster programs. As Europe and other countries have absorbed the lessons from successful clusters in the U.S., U.S. development policy-makers have also studied the cluster policy strategies and experiences of other nations (Wessner and Wolff, 2012, p. 433).

In this paper, we have collected data from an independent questionnaire survey, carried out in the first half of 2016. The aim of the paper is to determine the budget structure of the clusters in the North American and European regions and the proportion of public and private funds in their financing, of course with

a focus on identifying possible differences among North American and European clusters. We find that there is not a statistically significant difference when we compare the ratio of public-to-private funding sources in the European vs. American clusters.

The remainder of the paper is organized as follows. In Section 1, we discuss the factors that can influence the shares of public and private sources in cluster financing. One of the most important factors is the implementation of cluster policy; therefore, we discuss the differences between cluster policies in Europe and North America, and then we synthetize the results of previous empirical research on cluster financing in Europe and North America (mainly in the U.S.). Section 2 presents the data obtained from the questionnaire and the applied methodology. The main results are presented in Section 3, followed by a brief discussion in Section 4 and the last section concludes.

1. Public and Private Sources of Cluster Financing

Our work focuses on the topic of the financing of clusters, as the ability to access funding is one of the key factors in cluster development (Zademach, 2009). The public sector usually provides support either through grant funding and loans, but forms of support may also include more general factors such as legislation, taxation and technical assistance for cluster management organizations and cluster members. According to the OECD (2007), specific policies targeting cluster and regional innovation system support include regional policy, which brings local actors and assets together; science and technology policy, which finances collaborative research involving networks and links with commercialization; and industrial and enterprise policy, which supports the common needs of companies and technology absorption. The OECD (2009) also includes higher education policy, as it promotes closer links with industry and joint research. Coordination of these public policies is also important because they are implemented at all levels of the government – the supra-national (such as EU policies), federal/national, regional (including state level in federations) and local levels.

Private sources of cluster financing include membership fees, sales of services, and other sources, including private foundations and donations. According to Andersson et al. (2004), the evolution of clusters has increased the need for financial actors (such as banks, insurance companies, public pension funds, investment funds, venture capitalists, etc.) to be involved. These actors can provide "seed finance, help in the initial stages of spin-offs, and coordinate the set-up of special funds targeted to the specific needs of the cluster" (Andersson et al., 2004, p. 99).

A number of studies have examined clusters, cluster initiatives, and their support and financing on a worldwide basis (Sölvell, Lindqvist and Ketels, 2003; OECD, 2007; Lindqvist, Ketels and Sölvell, 2013; Burger et al., 2015). Most studies in the past decade have focused on clusters and their financing in Europe (Borrás and Tsagdis, 2008; Oxford Research, 2008; Kačírková, 2011; Barsoumian, Severin and van der Spek, 2011; Lämmer-Gamp, Meier Zu Köcker and Christensen, 2011; Müller et al., 2012). Other studies analysed clusters and their support within groups of countries that are somewhat specific, and have some common features that frequently distinguish them from others. Ketels and Sölvell (2006) studied clusters in the EU-10 new member countries; Ketels, Lindqvist and Sölvell (2006) explored clusters in advanced, developing and transition economies. Kuchiki and Tsuji (2005) analysed industrial clusters in Asia. Feser (2005) compared industry cluster concepts in the U.S. and Latin America. Several authors have conducted comparative studies of the operation and financing of clusters in a small number of countries, to show that even in countries with high levels of cluster policy, their approaches to the support of clusters may vary and success may be achieved in different ways. For example, Sternberg, Kiese and Stockinger (2010) compared cluster policies in the U.S. and Germany; Pavelková et al. (2013) compared cluster' activities in V4 countries and advanced economies; Hantsch et al. (2013) compared Germany, France and Norway; and Okamuro and Nishimura (2015) compared Germany, France and Japan. Based on an analysis of the studies dealing with cluster policies, including their financing, it is possible to show that while in some European countries (e.g., Germany, France, Denmark, Sweden and Norway) the support and financing of clusters is meticulously documented, other countries, even countries with highly developed cluster policies, are missing a comprehensive information set on the clusters and their financing. Such countries include the U.S. and Canada.

1.1. Cluster Policies in Europe and North America

Even though clusters generally emerge spontaneously as a result of the interaction of market forces, they involve powerful externalities and the provision of associated public goods, and thus, there is a strong incentive for the adoption of a cluster-based public policy (Porter, 2007). Therefore, in the past two decades, regional innovation clusters have become a target for more focused public policy in many countries (Wessner and Wolff, 2012).

In this paper, we will focus our attention on the differences between North America and Europe. As opposed to the U.S., where cluster policies at the federal level have only been better supported since 2009, the European Union has developed a more extensive framework of programs supporting clusters. This

varying focus on cluster support is also evident from the data that are being assembled on their performance. The EU started mapping clusters in the EU-10 in 2004 within Europe's INNOVA, which was followed by the project *The European Cluster Observatory* in 2007 and covers the EU-27, Iceland, Norway, Switzerland, Turkey and Israel (Ketels, Lindqvist and Sölvell, 2012). U.S. cluster mapping dates back to 2000 when cluster mapping was developed by Porter, but the U.S. Cluster Mapping Project (partially on a similar web platform to the EU's) dates back only to 2012, when the Economic Development Administration (EDA) joined in a partnership with Harvard University. An agreement on mutual EU and U.S. cooperation on clusters was signed in 2015. As for other countries of North America, efforts on cluster mapping in Canada started in 2001, and the major industrial clusters and their performance are identified in the Cluster Atlas of Canada (Spencer, 2014). The Canadian cluster data are provided by the Institute for Competitiveness & Prosperity in a manner consistent with the U.S. Mexico launched a national cluster map compatible with the U.S. map in 2016 in an effort to increase North America competitiveness. As Manning et al. (2010) noted, Mexico has been an important location for U.S. companies for a long time. In 2002, Mexico changed its economic policies from targeting low-cost manufacturing to targeting knowledge services. One example mentioned by Manning et al. (2010) is the electronics and information technology (IT) services cluster of Guadalajara, whose beginnings stem from the 1960s, when multinational corporations from the U.S. set up manufacturing companies, ultimately becoming the most competitive IT cluster in Mexico.

In the U.S., many cluster efforts have traditionally been driven by the private sector and individual states. The most famous examples are Silicon Valley and the Greater Boston area. Even though these clusters were established close to major research universities receiving substantial federal research funding, they emerged without government coordination. By contrast, the Research Triangle in North Carolina has received substantial direct public and private support (Wessner and Wolff, 2012). North Carolina is often used as an example of positive state level cluster policy, which evolved as a reaction to serious job losses in dominant manufacturing industries and low wages and transformed North Carolina into an economically powerful region (Sternberg, Kiese and Stockinger, 2010).

As Tsvetkova (2014) noted, the U.S. government is rather decentralized when it comes to economic development policies. State governments utilize a wide range of policy tools, but only a few of these initiatives can match the financial resources and policy support in other nations (Wessner and Wolff, 2012). The development and growth of clusters was in some cases also stimulated by local

governments, private foundations and other regional organizations, but until recently, a coordinated national effort was missing. Porter (2007) criticized federal economic development programs as often being fragmented, duplicative and inefficient. Around 2010, the federal government launched a range of cluster programs involving collaboration with a number of federal agencies, including the Economic Development Administration (EDA), the Small Business Administration (SBA) and a number of more specialized agencies (Lindqvist, Ketels and Sölvell, 2013). Thus, a U.S. approach to clusters that allows coordination between federal, state and local cluster initiatives has been undertaken only recently.

When we look at Europe, the list of early adopters of cluster policies includes Denmark, Italy, the Netherlands, Sweden, Austria and Germany, where cluster policies were established during the period of 1990 – 1995. A review of cluster policies in 31 European countries (Oxford Research, 2008) within the Europe INNOVA Cluster Mapping Project in 2008 showed that half of the countries established their cluster policies before 2000 (mainly countries in Eastern Europe; except, for example, France and Greece, which had centralized cluster policy at the national level before 2005, or Ireland and Portugal, which established cluster policies only fairly recently during 2007 and 2008; see Barsoumian, Severin and van der Spek, 2011) and that there was a notable difference between Eastern and Western Europe. Barsoumian, Severin and van der Spek (2011) stated that the new member states developed cluster policies mainly after 2004. There are still some countries, such as Slovakia, with no explicit cluster policy, and although there are references to cluster formation in other policies, Sirak and Rehak (2005) have explicitly identified programs for SME support and regional development programs in Slovakia, which do not specifically target clusters but nevertheless support their development. Balog (2016) states that cluster managers according to 2012 questionnaire survey consider the support for cluster organizations in Slovakia useful, but unsystematic and insufficient.

At the supranational level, cluster policy has become more important with EU enlargement, as the PHARE program has explicitly included cluster support. Coordination between supranational and national programs has increased due to the utilization of the European regional development fund. Structural funds also promote cluster initiatives across national borders within the objective European territorial cooperation. Besides the EU regional policy, the European Union has created a number of programs in the areas of research and innovation policy, as well as industrial and enterprise policy.

In 2008, the European cluster programs were mostly financed by national budgets, while the EU structural funds represented only approximately 20% of financing (EC, 2008). Cluster policies are currently used very extensively in

Europe, which in part follows the Lisbon and Europe 2020 strategies. A recent survey on cluster programs in Europe found that even though cluster programs are still priorities for regional and national policy-makers, the number of cluster programs has declined compared to 2008. These programs have also become more selective. In the past, almost all types of clusters were supported. Current support tends to focus on mature clusters, world class clusters and clusters in emerging industries. Another important change is that the majority of programs contain non-monetary support schemes for cluster organizations (Meier zu Köcker and Müller, 2015).

The importance placed on cluster policies differs among the European countries. According to Sölvell (2008), cluster policies play a less significant role at the national level and a more significant role at the regional level in countries organized as federations (such as Belgium and Switzerland), countries that are functionally quasi-federal (such as the UK and Spain) or that have a higher degree of autonomy at the regional level (such as Denmark and Italy). The reasons for cluster policy differences across EU member states include a bottom up approach tailored to fit the needs of industries, the influence of the overall economic climate in each country on cluster policies, the existing structures and institutions, and private sector willingness for cooperation (Barsoumian, Severin and van der Spek, 2011). Sternberg, Kiese and Stockinger (2010) stressed the importance of institutional contexts for adapting cluster policies to specific circumstances. They compared cluster policies in two different institutional and political settings. Different institutional settings are captured by the concept of "varieties of capitalism", developed by Hall and Soskice (2001) and the multi-level governance framework. They emphasized that cluster policies have developed differently in the U.S., which can be described as a liberal market economy, and in Germany, which can be described as a coordinated market economy.

1.2. Empirical Research on Cluster Financing

Initial research on clusters including their financing was mainly based on case studies (e.g., Wonglimpiyarat, 2006, in the U.S.; Lucas, Sands and Wolfe, 2009, in Canada; and Zademach, 2009, in Münich). Over the past decade, cluster mapping has opened new possibilities for cluster research. Governments have also been engaged in more systematic efforts to collect data about cluster initiatives and cluster programs (Ketels, 2013). As cluster mapping does not include data on financial sources, such data have to be obtained primarily through research (questionnaires or interviews).

The first extensive worldwide survey on the funding of clusters and cluster initiatives was carried out by Sölvell, Lindqvist and Ketels (2003), which was

based on The Global Cluster Initiative Survey from 2003. After an analysis of 238 completed questionnaires, it was concluded that the public sector was the primary source of funding in 54% of the cases. In 25% of the clusters examined, the funds were from a combination of both public and private sources, whereas in 18% of the clusters, their activities were financed predominantly by the private sector. Only a small number (1%) of the clusters were financed by universities. International organizations acted as the major funds providers in 2% of the clusters examined. As the sample was created mainly from clusters in advanced economies, these results may not be easily generalized. According to Sölvell, Lindqvist and Ketels (2003), new cluster initiatives receive primarily public funding, whereas funding sources for mature clusters vary.

Ketels and Sölvell (2006), using the data from The Global Cluster Initiative Survey 2005, have addressed an interesting question of differences in the operation and financing of cluster initiatives among advanced, developing and transition economies. The oldest cluster initiatives are associated with advanced economies, while cluster initiatives in developing and transition countries were more extensively adopted after 2000. According to Ketels and Sölvell (2006), economic policy in developing and transition economies is typically centralized at the national level. The cluster initiatives are usually initiated by international donor organizations or international consultants whenever there is either little policy support for clusters or the level of trust among participants is low. Hence, in developing countries, international funding (through donors and their partners) usually represents the main source of income. In the case of transition economies, some of the international funding comes from the EU, but the largest share usually comes from businesses. The most important source of financing in advanced economies is usually the government. Ketels and Sölvell (2006) conclude that the initiator has great influence on financing.

Lindqvist, Ketels and Sölvell (2013), using the data from The Global Cluster Initiative Survey 2012, examined 356 clusters and cluster initiatives from 50 primarily OECD countries. The structure of cluster revenues was as follows: 34% of funds were provided to the cluster initiatives from private sources, such as membership fees and sales of services; 54% of financial resources came from governmental bodies, mainly regional and local, and from national and international public organizations; and 12% came from other sources. This represents a 60 – 40 split between public and private funding (ignoring the “other” category). It can be said that despite the slightly different categorization of financial resources, which was narrower and more specific in The Global Cluster Initiative Survey 2012 than in 2003, the proportion of public and private funds in cluster funding over the last 10 years did not change. The public sector and the public

funds are still extremely important for clusters and cluster initiatives (Lindqvist, Ketels and Sölvell, 2013).

In contrast to the Global Cluster Initiative Survey from 2005 in which Lindqvist, Ketels and Sölvell (2013) found public funding declining with the age of the cluster, they observed that even though national public funding still decreases with age, it is compensated with increasing international public funding (e.g., EU funding). In the case of private sources of revenue, increasing sales of services are compensated with decreasing membership fees. As a result of these changes, a 60 – 40 split between public and private sources did not change with age.

The cluster initiatives analysed within these worldwide surveys were, however, not analysed by countries or continents, and thus, their conclusions have not led to the identification of differences or similarities in financing of cluster initiatives in, e.g., Europe or America.

Another interesting research study pertinent to cluster financing was a comparative study by Lämmer-Gamp, Meier Zu Köcker and Christensen (2011). They explored 143 cluster organizations in eight European countries (55 cluster organizations from Germany, 26 from Denmark, 20 from Poland, 16 from Norway, 11 from Sweden, 10 from Finland, four from Iceland, and one from Austria). It was shown that many of these organizations are dependent upon public financing, which they use to cover the wages and salaries of their employees and the expenditures on their offices and equipment. The proportion of public funds in the overall cluster budget was to a great extent influenced by the representatives of cluster organizations and their individual personal preferences, as well as by the opportunity for cluster programs to gain support from the public sector. In 77 cluster organizations, the proportion of public funds exceeded 60% of their overall budget. The budgets in 43 clusters were more than 80% dependent on public funds. The proportion of public financing in the overall funds remained below 20% in only 29 clusters.

Müller et al. (2012) complemented and extended the previous detailed survey by exploring a number of aspects, including financing and cluster management organizations, in a broad range of technology areas. They found that in the beginning, a majority of benchmarked cluster management organizations relied heavily on public funding. They observed a clear correlation between the establishment and inception of funding programs. Cluster management organizations depend heavily on public funding to finance staff, office space and equipment. The median percentage of public funding in the overall budgets of cluster management organizations ranged from almost 98% in Finland to 70 – 80% in Sweden, Austria, and Norway, to more than 50% in Denmark, France, Iceland and Spain,

and almost 50% in Germany. The small share of public funding in the budget of Polish cluster management organizations (less than 10%) is due to the fact that these organizations do not have a legally institutionalized cluster management organization and therefore are not eligible for public funding programs.

Based on this research study, Müller et al. (2012) stated that a higher share of private financing (over 75%) is typical for industry-driven clusters, which are highly specialized in their respective industry. However, their financial situation generally seemed to be less stable and secure in comparison with clusters financed mainly from public funds. On the other hand, clusters financed largely by private funds were older and more successful when considering their influence on business, R&D and international activities of SMEs than research-driven clusters. They conclude that clusters should be considered as individuals that need individual support for sustainable growth and enhanced competitiveness.

Similar scientific research conducted by Hantsch et al. (2013) analysed various aspects of cluster operations in Germany, France, and Norway, including their sources of revenue. The analysis was based on the results of benchmarking activities of the European Secretariat for Cluster Analysis. Since cluster initiatives are usually established by means of public co-funding, there is an intensive on-going debate on how much public funding should be recommended and for what length of time. European countries follow very different approaches. They believe that a certain part of the budget of a cluster organization should come from private sources in order to provide better financial sustainability in the medium- and long-term.

The number of surveys focused on cluster financing in the U.S., and in North America in general, is lower than in Europe. Differing approaches to clusters and cluster policies show that there is no single successful model for cluster support.

In general, we may conclude that the factors influencing the financing of clusters include the nature of the cluster policies in a particular country, the institutionalization of a cluster and thus its eligibility for public funding, the entity behind the cluster initiative, the age of the cluster, the size of the cluster in terms of its staff, individual personal preferences of representatives of cluster organizations, and the availability of other sources of financing such as venture capital.

2. Data and Methodology

Data were obtained from an independent questionnaire survey, carried out in the first half of 2016. The goal of our survey was to determine the budget structure of the clusters in question and the proportion of public and private funds in their financing.

Our sample consists of the European and North American clusters. In all cases, persons responsible for the management and operation of the clusters (managers or facilitators) were directly asked to participate in our survey. This empirical investigation is based on extensive primary research. The main source of information about European clusters was the "European Cluster Organisation Directory", conducted by the European Cluster Observatory (2010). In addition to this source of cluster contacts, four portals were used which contained the e-mail contacts of clusters all over the world. These portals are as follows: "The Global Practitioners Network for Competitiveness, Clusters and Innovation" (which contains hundreds of cluster contacts from around the world), "The European Cluster Collaboration Platform" (which is particularly suited to gain contacts of European clusters), "The U.S. Cluster Mapping Project" (which contains contacts about the clusters in the U.S.) and finally, "The Institute's Canadian Cluster Data Portal" (which has contacts on Canadian clusters).

Out of 29 European countries, a total of 1,017 clusters were invited to participate in the survey. We obtained 119 completed questionnaires; hence, the response rate was 11.70%. The largest numbers of correctly filled questionnaires were recorded in the Czech Republic (13); Poland (11); Germany, Slovakia, Spain and Sweden (10 each); Hungary (7); Norway and Italy (6 each); Austria, Switzerland and Great Britain (5 each); and Bulgaria, Denmark, Romania and Slovenia (4 each). Clusters from other European countries delivered only two, one or no responses.

In North America, we invited 397 clusters to participate in our survey, including those located in Mexico (46) and Canada (55), but of course, most of them were located in the U.S. (296). Altogether we obtained 48 correctly completed questionnaires (34 from the U.S. and 7 each from Canada and Mexico). The response rate in North America was thus 12.09%.

Overall, we contacted 1,414 organizations; with a response rate of 11.81%, our final dataset is composed of 167 cluster initiatives. This response rate is lower in comparison with the Global Cluster Initiative Survey in 2003 and 2005, where the questionnaire response rates were 46.76% and 32.14%, respectively. However, the follow-up Global Cluster Initiative Survey in 2012 had a substantially lower response rate of 13.8%, which is quite similar to our case. Lindqvist, Ketels and Sölvell (2013) discussed this decline in response rates, and they believe that it is caused by an oversaturation of cluster managers being frequently asked to participate in a large number of surveys. They also observed that it is especially difficult to get replies from respondents outside of Europe.

Based on the literature, eight possible funding sources were included in the questionnaire[2] (see Table 1).

T a b l e 1

Funding Sources Included in the Questionnaire

Abbreviation	Description
Public sources	
source_1	European Union budgets (EU funds to finance cluster activities).
source_2	National budgets (national/governmental funds).
source_3	Regional budgets (regional funds, including state level in case of federal states).
source_4	Local budgets (municipal funds).
Private sources	
source_5	Membership fees of cluster members.
source_6	Revenues generated from the cluster's own activities.
source_7	Credit instruments – bank loans.
source_8	Venture capital, "business angels" (crowdfunding circles), and donations.

Note: "source_1" was an option available only for the European clusters.

Source: Authors.

Formally, we test two hypotheses to identify possible differences in cluster funding in North America and Europe:

• Hypothesis 1: There is not a statistically significant difference in utilizing public or private sources between the two regions. To verify this hypothesis, we use a non-parametric Wilcoxon test for comparison of the average ratio of public/private sources in both regions.

• Hypothesis 2: There is not a statistically significant difference in the structure of public or private sources between the two regions. Within this hypothesis, we are interested in a comparison of the particular types of public/private funding sources (given in Table 1). To verify this hypothesis, we estimate the following SUR model (Seemingly Unrelated Regression):

$$source_{ij} = \alpha_{j0} + \beta_{j1} budget_{ij} + \beta_{j2} age_{ij} + \beta_{j3} region_{ij} + \varepsilon_{ij} \quad (1)$$

where

i – the number of examined clusters,

$j = 2, 3,\ldots,8$ – a given equation in our system corresponding to a specific type of public/private sources of funding,[3]

α_{j0} – a constant term, and

ε_{ij} – an error term.

[2] Clusters were also offered the possibility of selecting "other sources", without closely specifying which source of financing it was. Despite having that possibility, none of the clusters decided on such an option. However, our categorization of public and private sources differs a bit from other studies, such as, for example, Lindqvist, Ketels and Sölvell (2013). The main difference lies in the handling of credit instruments, venture capital, "business angels", and donations, which we have included within the category of private sources.

[3] Source_1 (EU budgets) is excluded, as it is relevant only for clusters located in Europe. Our system of linear equations is thus composed of seven equations.

In our setting, we employ three explanatory variables: *budget* (budget rank of a given cluster, as there are significant differences among cluster budgets in our sample, see Table 3 for details), *age*, a variable depicting the number of years the cluster has been operating, and *region*, a dummy variable set to 1 if the cluster is from Europe, 0 otherwise. As we are explaining the ratio of a given funding source to total sources, it is reasonable to assume that error terms are correlated across equations for a given cluster but are uncorrelated across individual clusters. This is also formally tested using a Breusch-Pagan test of independence among residuals.

3. Results

Basic descriptive statistics – calculated from the percentage ratios of a given funding source to total cluster funds – are presented in Table 2. We can see that there are clusters in our sample from both regions that are financed solely from public sources or private sources. From the average values of public/private sources, it is apparent that the differences among regions are not significant. In the European clusters, the average percentage of funding from public sources is 42.82% vs. 44.79% in the North American clusters; for private sources, it is 57.18% in European vs. 55.21% in the North American clusters. This is also confirmed using a non-parametric Wilcoxon test (p-value = 0.6619). Thus, our first conclusion is that Hypothesis 1 cannot be rejected, i.e., there is not a statistically significant difference in public and private funding sources in cluster financing among clusters located in the European and North American regions. However, the overall difference between utilizing public sources (43.38%) and private sources (56.62%) is highly statistically significant (at the 0.001 significance level). From our sample, it is quite clear that private sources of financing dominate over funds obtained from public sources.

In Table 2, we also present two additional variables from our questionnaire: *age* and *year_support*. The first one depicts the age of the cluster initiative. We can see that there are clusters established in 2014, as well as much older initiatives, dating back to the early 90s. Due to such significant differences, this variable is therefore also included in our system of equations as an explanatory variable. The second variable represents the answer to the question: how many years should support for the clusters last? As we can see, the answers in both regions are practically the same; the average length of the support should be around six to seven years (according to interviewed cluster initiatives). This variable was not significant in our models. We also experimented with other specifications, for example, we included variables to capture possible differences among industries

(classification as in Ketels, and Sölvell, 2006), but these variables were also not significant even once in any of the equations.

T a b l e 2

Descriptive Statistics (% ratios)

	ALL (obs. = 167)				EU (obs. = 119)				North American (obs. = 48)			
Variable	*Mean*	*Std. dev*	*Min*	*Max*	*Mean*	*Std. dev*	*Min*	*Max*	*Mean*	*Std. dev*	*Min*	*Max*
age	10.72	5.17	2	24	10.85	4.90	2	22	10.40	5.84	2	24
public_sources	43.38	31.55	0	100	42.82	31.09	0	100	44.79	32.97	0	100
private_sources	56.62	31.55	0	100	57.18	31.09	0	100	55.21	32.97	0	100
source_1	17.31	25.61	0	100	24.29	27.41	0	100	0.00	0.00	0	0
source_2	11.98	19.27	0	85	6.22	9.54	0	40	26.25	28.12	0	85
source_3	7.46	10.24	0	65	7.02	10.15	0	65	8.54	10.47	0	40
source_4	6.65	11.21	0	80	5.29	7.29	0	25	10.00	17.17	0	80
source_5	27.96	21.73	0	80	27.61	20.51	0	80	28.85	24.69	0	75
source_6	18.86	15.81	0	80	21.51	15.08	0	80	12.29	15.81	0	80
source_7	1.23	5.36	0	50	1.13	5.69	0	50	1.46	4.49	0	20
source_8	8.56	17.49	0	100	6.93	16.16	0	100	12.60	20.03	0	90
year_support	6.94	2.99	0	10	7.25	2.86	0	10	6.17	3.19	0	10

Source: Authors.

T a b l e 3

Frequency Table

	ALL			EU			North American		
Budget	*Freq.*	*Percent*	*Cum.*	*Freq.*	*Percent*	*Cum.*	*Freq.*	*Percent*	*Cum.*
A < 5,000	11	6.59	6.59	9	7.56	7.56	2	4.17	4.17
B 5,000 – 25,000	30	17.96	24.55	28	23.53	31.09	2	4.17	8.33
C 25,000 – 50,000	11	6.59	31.14	10	8.4	39.5	1	2.08	10.42
D 50,000 – 100,000	33	19.76	50.9	27	22.69	62.18	6	12.5	22.92
E 100,000 – 500,000	42	25.15	76.05	25	21.01	83.19	17	35.42	58.33
F 500,000 – 1,000,000	16	9.58	85.63	8	6.72	89.92	8	16.67	75
G 1,000,000 – 5,000,000	22	13.17	98.8	11	9.24	99.16	11	22.92	97.92
H > 5,000,000	2	1.2	100	1	0.84	100	1	2.08	100
Total	167	100		119	100		48	100	

Source: Authors.

In Table 3, we show the last explanatory variable employed in our system of equations – *budget*. The variability among total budgets of examined clusters is substantial. To obtain a better perspective, Table 3 is a frequency table of eight budget categories. Clusters from the American region clearly operate with higher budgets than those in Europe, at least for those in our sample. This could be a sample-specific perspective, so we hesitate to draw any general conclusions. Nevertheless, this heterogeneity is captured in our model through the variable *budget*.[4]

The last step in our analysis is the estimation of the SUR model, specified in Equation (1). The main results are presented in Table 4. From a methodological point of view, the application of the SUR model appears to be the best choice to

describe our data, as the correlation between residuals among individual equations reaches in a few cases the value of 0.5. The Breusch-Pagan test also suggests rejecting the null of residual independence at a 0.001 significance level.

T a b l e 4

Estimation Results from the SUR Model

Equation	Variable	Coef.	SE	*z*-stat	
source_2	const	13.4445	4.7886	2.81	***
	budget	2.6718	0.7643	3.50	***
	age	–0.1121	0.2544	–0.44	
	region	–16.3599	2.9927	–5.47	***
source_3	const	1.4545	2.9037	0.50	
	budget	1.3724	0.4635	2.96	***
	age	–0.0086	0.1543	–0.06	
	region	0.3389	1.8147	0.19	
source_4	const	9.5369	3.2155	2.97	***
	budget	0.0067	0.5132	0.01	
	age	0.0412	0.1708	0.24	
	region	–4.7154	2.0096	–2.35	**
source_5	const	39.308	6.2029	6.34	***
	budget	–2.7306	0.9901	–2.76	***
	age	0.3679	0.3296	1.12	
	region	–5.1163	3.8767	–1.32	
source_6	const	20.8549	4.3837	4.76	***
	budget	–1.4934	0.6997	–2.13	**
	age	–0.0725	0.2329	–0.31	
	region	7.2299	2.7397	2.64	***
source_7	const	1.0898	1.5603	0.70	
	budget	–0.1116	0.2491	–0.45	
	age	0.0916	0.0829	1.10	
	region	–0.5166	0.9751	–0.53	
source_8	const	8.5507	5.0388	1.70	*
	budget	0.7388	0.8043	0.92	
	age	0.0183	0.2677	0.07	
	region	–4.6784	3.1491	–1.49	

Note: "SE" are standard errors. Symbols *, **, *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Source: Authors.

Significant results are obtained in the equation explaining "source_2", i.e., national budgets. This type of funding is significantly lower in the clusters from the European region, and the same applies to "source_4", i.e., local budgets. This might be caused by the option to raise European Union budgets, which on average represent around 25% of the overall funds in the European clusters

[4] One possible explanation was given by Sternberg et al. (2010), who compared cluster policies in the U.S. and Germany. They concluded that because of a larger integrated internal market with mobile factors of production in the U.S., the clusters tend to be larger, benefiting from economies of scale and scope. On the other hand, the European Commission (2008, p. 5) stated that because of market fragmentation, weak industry-research linkages, and insufficient cooperation within the EU, the clusters do not always reach the necessary critical mass. These differences in the size of the clusters may have an influence on the size of the budget.

(see Table 2) and are of course not available for clusters from the North American region. That is why the largest public sources of the European clusters' funding are European Union budgets, and for American clusters, the more prevailing sources are national and local budgets. Our results are thus quite intuitive.

On the other hand, in the North American region, the revenues generated from the cluster's own activities (i.e., "source_6") represent a lower proportion of the financing structure than in the European clusters. This is somewhat surprising and cannot be as easily explained as previous findings. Revenues from the clusters' own activities in the North American group are on average 12.29% of total funds, while in the European clusters, this proportion is 21.51%. A similar difference is also observed in "source_8" (6.93% vs. 12.60%); however, based on our data sample, it did not manifest as a significant result. To conclude, we were able to reject the second hypothesis, as some differences in the structure of public/private sources among the analysed two regions actually exist.

4. Discussion

As far as we know, our study is one of the few in this area of research. It has some limitations; for example, it would be beneficial to have a larger sample size, but even bearing this in mind, some of our results are quite convincing. It is possible that there are some other differences in the funding structure of European and North American clusters, but they did not manifest as significant in our system of equations due to the limited number of observations. Our best guess is the last funding source – venture capital, "business angels" (crowdfunding circles), and donations – which on average is almost twice as high in American clusters (around 12%) as in European, almost as high as the funding sources stemming from generated revenues.

Statistically significant differences between the cluster support in Europe and North America within the "source_2 – National budgets (national/governmental funds)" in which the support of clusters in North America on the national level is much higher than in Europe is somewhat interesting, especially when we consider that even the OECD (2007) study claimed that "the United States has no national level cluster-based policies". Although the U.S. clusters are only a part of the North American sample in the study, they represent the majority (70.83%). Our results might therefore be explained by a modified approach to the implementation of cluster policy at the national (federal) level, which occurred after the inauguration of President Obama in early 2009. Since then, the U.S. has started to implement cluster support at the national (federal) level and the financial support of the U.S. clusters has become more balanced and complex.

An important role has been played (Muro and Katz, 2010; Wessner and Wolff, 2012) by the Economic Development Administration (EDA), Small Business Administration (SBA), U.S. Department of Energy (DOE), U.S. Department of Agriculture (USDA) and their implemented programs to support clusters at the national (federal) level such as the Regional Innovation Clusters framework, i6 Challenge (both EDA), Regional Innovation Clusters program, Advanced Defense Technology program (both SBA), Energy Efficient Building Systems Regional Innovation Cluster (E-RIC) (DOE) and Rural Innovation Initiative (USDA). Thanks to these programs, the support for the U.S. clusters from the national level is higher than in most of the European countries and to some extent compensates for the lack of EU funds.

In comparison with Lindqvist, Ketels and Sölvell (2013) and Hantsch et al. (2013), our results are a bit different. The proportion of public-to-private sources was 54:46 in Lindqvist, Ketels and Sölvell (2013), 56:44 in Hantsch et al. (2013), and 43:57 in our study. There are, however, some differences in the data samples, although 281 (78.93%) clusters in Lidqvist, Ketels and Sölvell (2013) were from Europe and North America. The sample used in Hantsch et al. (2013) is composed of only European clusters located in Germany (60), France (71), and Norway (10). The differences among these three countries are quite significant (e.g., public funding represents 41% of funding in German clusters, 59% in French clusters, and 69% in Norwegian clusters). To make these results comparable to ours, we have computed average values of individual funding sources.

T a b l e 5

Comparison of Our Results to Similar Surveys (averages) (in %)

		Lindqvist, Ketels and Sölvell (2013)	**Hantsch et al. (2013)**	**Our study**
		Obs = 356	Obs = 141	Obs = 167
Public sources				
source_1	European Union budgets			17.31
source_2	National budgets (national/governmental funds).	18		11.98
source_3	Regional budgets (regional funds).	23		7.46
source_4	Local budgets (municipal funds).			6.65
	International public sources.	13		
SUM		**54**	**56.33**	**43.38**
Private sources				
source_5	Membership fees of cluster members.	26	23.00	27.96
source_6	Revenues generated from the cluster's own activities.	8	10.33	18.86
source_7	Credit instruments – bank loans.			1.23
source_8	Venture capital, "business angels", and donations.			8.56
	Other sources (not specified).	12	10.33	
SUM		**46**	**43.66**	**56.62**

Source: Lindqvist, Ketels and Sölvell (2013); Hantsch et al. (2013); own research.

5. Concluding Remarks

Based on our unique dataset obtained from the questionnaire survey, we were able to shed some light on the structure of financing for cluster initiatives located in Europe and North America. Let us summarize our main results:

(1) There is not a statistically significant difference when we compare public--to-private funding sources in the European vs. North American clusters. The ratio of public-to-private sources is around 43:57 (public to private) in both regions.

(2) However, overall private sources (56.62%) of financing dominate over funds obtained from public sources (43.38%) when we compare average values without respect to geographical regions.

(3) Within the public sources of the European clusters dominate European Union budgets (24.29%), and for American clusters, the more prevailing sources are national (26.25%) and local budgets (10%).

(4) In the North American region, the revenues generated from the cluster's own activities (12.29%) represent a lower proportion of the financing structure than in the European clusters (21.51%).

This paper did not focus on the impact of differences in the funding structure of clusters on their effectiveness. It would be interesting in future research to examine in more detail the relationship between cluster financing and cluster effectiveness measured by, e.g., job creation, number of new firm formations, new products launched, increased research activity or sales growth. Even though this paper did not seek to argue which structure of financing is better, we note that the doctrine on the topic (e.g., Sternberg, Kiese and Stockinger, 2010), according to which the clusters in the U.S. are mostly driven by the private sector and European clusters are financed predominantly from the public sector, has changed. The proportions of private and public funding in the North American and European clusters are practically equivalent.

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