Clusters and their driving forces - lessons learned from the CNCB project

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AIMS OF THE STUDY

The aims of the article are to deal with the global role of clusters, to examine certain major features of their development, to define the driving forces behind their establishment and success and to analyse the results of an empirical research project. By this, it is hoped to make some contribution to the general results of research into the role of clusters in improving the performance of the economy.

METHODOLOGY

The study analyses the Cluster and Network Cooperation for Business Success in Central Europe (CNCB) project – an exercise focusing on three crucial areas which help to establish and sustain the development of clusters (HR Development in clusters, the optimisation of cluster processing and the internationalisation of clusters). To present the results of this empirical research, statistical methods, such as descriptive statistics and one-variable analytical methods, pair comparison such as cross-tables were used – together with regional, sectoral and size-related comparisons, factor-, variance and scoring analysis.

THE MOST SIGNIFICANT FINDINGS

The analyses show that significant relations exist only in internally driven, optimised clusters: there are none between the global composite indices (measuring economic development and competitiveness) and the data set examined. Negative correlations can be interpreted as problems within the system of supporting clusters.

PRACTICAL SUGGESTIONS

The findings of the study should be of interest to all those involved in establishing and developing clusters, in their direct funding or in applications for appropriate resources. The use of development resources and funds is only effective if the clusters are motivated not only to meet the bureaucratic requirements of the applications, but also to build and maintain an ecosystem based on serious cooperation and where the use of funds is monitored and reflected by business performance indicators.

Keywords: cluster, competitiveness, cluster initiatives, driving forces, CNCB project

INTRODUCTION

The geographical factors of economic development are studied in various disciplines, from economics (Krugman 1994) and management studies (Porter 1990, Ketels et al. 2012) through regional studies (McCann and Ortega-Argilés 2015) to economic policy (Sölvell 2008). This paper aims to contribute to the literature published since the beginning of the 21st century in respect of the organisational inducements of economic development. The research focuses on two basic questions related to the business success of clusters:

- What are the main features of successful clusters?
- Is the policy of clustering or clusterisation more effective with the efficient use of EU and national government funds?

In order to answer these questions, the paper first explores the reasons for the rapid growth of clustering as globalisation expands. Macroeconomic factors are summarised and these provide a background to the establishment and development of cluster organisations. In the light of certain specific cluster initiatives, the organisational form and structure of clusters, the advantages and disadvantages of cluster membership and, especially, the polemics of clustering mechanisms are discussed to clarify our picture of the ecosystem of clusters.

The second part of the study looks at the Cluster and Network Cooperation for Business Success in Central Europe (CNCB) project in which the author took part. This was a Central European cluster research programme funded by the European Union which, through international research cooperation, used online questionnaires to examine the state of Central European clusters. Emphasis was laid on three crucial areas (human resources development in the clusters, the optimization of clusters' processing and the internationalization of clusters) and helps the establishment and sustainable development of clusters.

THE ECOSYSTEM OF MODERN ORGANIZATIONS

In general, the ecosystem of organizations is based on (1) national unity and culture, (2) the geographical position, (3) the general institutional and legal framework and (4) the macroeconomic environment (Sölvell et al. 2003). Regarding the latter, Porter (1990) defines the competitiveness of a country or region in his well-known Diamond or Rhombus model (Lengyel 2000) through the interaction of four factors. In the Diamond model (1) the 'Factor (input) conditions' mean whether a country has appropriate input factors such as a trained workforce, raw materials, infrastructure etc. to be competitive (2), while 'Demand conditions' refer to the impact of domestic demand on an industry's products and services. The existence of (3) 'Related and supporting industries' supports (or a lack of them) inhibits activity at international level and (4) 'Context for company strategy, structure and rivalry' describes the regional or national environment and conditions for founding new companies, their management and competition (Porter 1990, 71). The immanent factors of the model can be completed with two further external elements: (+1) 'The role of the state is of special importance', because governmental and regional policies influence all of the four components in the model. In addition, (+2) the 'Unexpected, as the sudden change of political environment or the appearance of innovations' can enhance or inhibit the market success of a nation or a region (Lloyd-Reason and Wall 2000).

The globalisation of the world economy meant a new challenge for organisations striving to grow or fighting for survival (Porter 1990, Krugman 1994, Ács and Varga 2000, Coletti and Di Maria 2015). As a result, cooperation, networks and the ability to renew utilising common organisational knowledge (Schwab 2014, Cardeal et al. 2014) became distinct success factors of competition in the global market (Barabási 2002, Bode et al. 2010, Jungwirth et al. 2011), which increases the adaptability of the organisation (Porter 1998a, Aron 2013). Some assert that one of the most successful answers to the challenges of globalisation is the establishment of clusters (Porter 1998b).

THE RELEVANCE OF CLUSTERS

A number of international empirical studies have dealt with mapping cluster initiatives, such as the ESDP project in 1999, the European Commission's studies in 2002 and 2003, the Innobarometer in 2006, the CLOE programme in 2006, the Europa Innova Cluster Mapping Project and the CMQ research project in 2008, the GCIS survey in 2012, The Cluster Initiative Greenbook 2.0 in 2003 and 2013 (Sölvell et al. 2003, 2013) and the European Cluster Observatory (ECO) Report (Ketels and Plotsiv 2014). Complementing these studies, a rich current literature provides theoretical and empirical evidence that innovation activities cluster in space (Broekel et al. 2015, Molina-Morales et al. 2015).

Referring to the first research question, we can assert that successful clusters endogenously generate and diffuse knowledge (Malmberg and Maskell 2002), and that this shared knowledge becomes, in clusters, of premium value (Spencer et al. 2010). The coopera

tion and innovation within a cluster could be enhanced through, for example, value chains and technology (Cardeal et al. 2014, Palcic and Pandza 2015) which can be connected to each other (Porter 2007) and their operations (Malmberg et al. 1996, Tessitore et al. 2013) or in a geographical/regional sense and location (Porter 2000, Gilding 2008), the accessibility and interaction of members (Saxenian 1994, Lengyel – Deák 2002, Lengyel – Rechnitzer 2004). This is the reason why the European Union gives high priority to enhancing regional competitiveness and clustering (ESDP 1999, 10, The European Cluster Memorandum 2008).

The characteristics of clusters

Marshall (1920) mentioned the importance of cooperation between organisations as an opportunity for regional improvement in his theory of external economic scale. Some revealed the so-called global-local paradox, according to which the sources of globally persistent competitive advantage concentrate locally in a geographical sense. A good example is Silicon Valley in the USA (Manning 2013), where companies in the microelectronics industry are based close to each other, where the local environment provides the most favourable conditions. An area with geographically concentrated, active cultural, economic and communicational relationships is known as an agglomeration – which can be categorised by its differing features. In this way a cluster can be described as an organisational form of modern regional economic growth, as it responds to macroeconomic challenges, based on permanent innovation and technologically linked activities (Malmberg et al. 1996). The definition of clusters in the modern age, however, is rather linked to Porter, who defines clusters as a group of companies and institutions that cooperate in a specific field and that are geographically concentrated (Porter 1998b). Clusters incorporate specialised raw material suppliers, background suppliers, companies of related industries and institutions connected to them such as universities, government organisations, commercial agencies, professional associations and alliances that are linked through their similarities and complementing features (Sölvell 2008). Hence clusters are 'Bridge Builders' between the socio - economic actors (Ketels et al. 2012).

The internal structure of cluster organisations is based on naturally emerged constructive interaction and collaboration between organisations (Rosenfeld 1996). However, the architecture of clusters can be described as a network of various forms (Gedai et al. 2015), or which come about on the basis of existing networks (Lengyel 2002). It is questionable whether, with the spread of ICT tools, geographical proximity is still crucial to a highly developed cluster cooperation. Regarding this it is assumed as a hypothesis (H1) that the success of clusters

- heavily depends on the internal (virtual) organisation level (H1/1),
- the instruments of which are country-, industry- and size-specific (H1/2),
- although, as a result of the development of infocommunications, the geographical concentration of cluster members is a lesser success criterion (H1/3).

The pros and cons of cluster membership

A cluster provides opportunity for each member – both at individual and at organisational level – to realise higher profits through joining others without giving up their own flexibility (Jungwirth et al. 2011). The main advantages and disadvantages of cluster membership are presented in Table 1:

Table 1 The advantages and disadvantages of cluster membership

Advantages of cluster membership	Disadvantages of cluster membership
(1) Higher productivity as a result of economies of scale or joining complementary technologies	(1) Clustering can be set back by certain macroeconomic factors
(2) Better access to workforce, suppliers and lower transaction costs	(2) Significant problems may be deficiencies in physical infrastructure such as transport and communication networks
(3) Access to special market, innovation and technological information through sharing	(3) Adequate logistics are essential for the strong cooperation required for clustering.

(4) Exploitation of complementarity based on members' mutual dependence	(4) Clustering is rather a phenomenon of modernisation and upgrading, than an innovation activity to raise individual technological competitive advantage
(5) Better access to state, education and research institutions providing opportunity for consortium applications, dual education or mutual research funds	(5) Limited availability of special funding such as seed or venture capital and business angels, so restricting collaboration between stakeholders of the cluster, especially in capital-intensive areas such as innovation and investment
(6) Higher motivation as cluster members learn about performance, which stimulates pressure to develop	(6) The lack of experience and expertise in the operation of clusters
(7) Higher innovation potential is reached, due to industry-specific knowledge and experience, technology and innovation sources accumulate rather than polarise	(7) The lack of trust between (international) partners can hinder the clustering process
(8) New organisational configurations are developed that enable individual, flexible and quick adaptability to market demands	(8) Peripheral or less developed regions are in disadvantaged position.
(9) Group-thinking and knowledge transfer may result in joint investment, profile refinement and transition	
(10) Implementation of cluster-thinking in organisations can further improve effectiveness of cluster processes and helps eliminate initial distrust between members.	

Source: Porter, 1998b, 1999, Porter et al. 2007, Szanyi et al. 2009 (advantages), and Lagendijk 1999, Grosz 2004, Delgado et al. 2014 (disadvantages).

Cluster development initiatives

Cluster initiatives are organisational forces which enhance the cluster's growth and strengthen its competitiveness within a region (Dasanayaka et al. 2014), including its member enterprises and/or research institutions. Based on Sölvell (2008, 53), these driving forces include certain organisational goals such as: (1) human resource development and training (Hoffmann et al. 2014), (2) cluster expansion (Schiele et al. 2014), (3) internationalisation and network building (Schwab 2014), (4) broadening of commercial cooperation (Rosenfeld 1996), (5) innovation and technology development (Lai et al. 2014), and finally (6) the improvement of conditions in the business environment (Clusters for Competitiveness 2009, 4, Koszarek 2014).

In addition, today we should consider a crucial driving force dilemma: *Clustering or clusterisation?* The bottom-up form - that of the self-generating clustering of business actors -needs to be complemented by state-stimulated top-down clusterisation support, defining a requirement of competitiveness improvement (Porter and Schwab 2008, Ketels and Memedovic 2008). Porter (1998a) identifies the first step of clustering as (1) the selection of location, the next steps as (2) the formation and local adaptation of a cluster, (3) cluster development and (4) the enhancement of collective actions and interactions. So it is inevitable that the approach of clusterisation should be applied in the state's regional policies for economic development and sustainable growth (Cluster Policy in Europe 2008). However, this adaptation based ecosystem, known as the 'Visible hand' and based on Adam Smith's 'Invisible hand' theory, should be

supported by calculated orientation and networking to generate sustainable economic growth (Chandler 1977, Langlois 2003). It is questionable regarding the resource allocation policy of the Horizon2020 application system and the establishment of principles for cluster development, whether the artificial generation of clusters through funding grants creates sustainable economic units, or whether existing, internally driven clusters should be catalysed through EU and/or state funds (Sölvell 2008). Hence another hypothesis (H2) to be reviewed in this connection is the following:

- It is not sufficient to provide clusters with external financial resources towards reaching goals of regional or sectoral Economic Policy (H2).

Without an innate own initiative to build itself from bottom up, any desire to cooperate or to innovate and internationalise, clusters only deplete outside resources and their activities are restricted to "fund-hunting" (Horváth et al. 2013) further limiting the opportunities for clusters, six which are viable but lack resources. Hence the present EU policy for cluster development needs revision.

THE DRIVING FORCES OF CLUSTER ESTABLISHMENT: THE CNCB PROJECT

The aim of the 'Cluster and Network Cooperation for Business Success in Central Europe' (CNCB) project was to support Central European cluster initiatives and to contribute to the improvement of their competitiveness and innovation capacity in the long term, in connection with the 'Horizon2020' plan. Based on these strategic goals, a further operative objective was to help clusters and cluster managers with practical guidance and suggestions on how to develop their management skills, optimise their resources and find new opportunities for growth and international cooperation. For this reason, the project investigated the HR development, system optimisation and internationalization level of clusters in the region. The project was completed in February 2014 after 30 months of work (see more: http://cncb.eu/), Hungary was represented by the Chamber of Commerce and Industry of Pécs-Baranya and researchers of the Faculty of Business and Economics at the University of Pécs, including the author of this study (Jarjabka and Weiner 2011).

RESEARCH METHODOLOGY

Participants in the CNCB project included eleven partner organisations from eight countries (Austria, Czech Republic, Hungary, Italy, Lithuania, Poland, Slovakia and Slovenia). The survey included 95 clusters and generated a set of data with 157 variables in 5 work packs (WP), the first two of which contained the basic data of clusters (formation, number of members, size, region, profile, etc.), and also managed the information flow and dissemination between partners (WP1, WP2), while WP3 focused on the human resource development activity of clusters, WP4 on cluster optimisation and WP5 on internationalisation (CNCB Expert Group 2011, 2012). Each group of questions consisted of 20-30 items which included open, semi-closed and closed, Likert scale, simple, multiple choice and prioritising questions. As a qualitative element, cluster managers' interviews were also conducted. The survey involved about 275 potential clusters to be asked, almost one third of which gave evaluable answers, and so 95 questionnaires were processed. The interviews with 32 managers and the recommendations based on other qualitative methods were published as pilot proposals, handbooks and annual workshop presentations (Pamminger 2010, Jarjabka and Weiner 2011, CNCB Project 2011, 2012, 2013).

Based on the cluster relatedness tree of the European Cluster Observatory (Ketels and Protsiv 2014, 9), the industry-based division of surveys showed that 31.6% (30 by number) of the sample were in technology-based industry (IT (10), production technology (7), medical devices (6), biotech (4), telecom (3) although the focus of clusters was wide. Many clusters (14.8%) were significant in tourism and hospitality (10), and in the atveservices (business services (2) and financial services (2)) area. Other areas, such as aerospace (1), agricultural products (1), automotive (2), distribution (2) and other smaller industries, however, were underrepresented, at below 4% each. The size of clusters showed a similar distribution: most clusters (44) having less than 25 members, 21 clusters between 26 and 50 members, 14 between 51 and 100, 13 between 101 and 250, and 3 clusters had even more participants (CNCB Project 2013).

Data analysis was carried out with the extended version of Microsoft Excel, the IBM SPSS Statistics software and the R statistical software. Data processing utilised descriptive statistics, one-variable analytical methods and pair comparison – for example cross tables, and also regional, sectoral and size-related comparisons, factor, cluster, variance and scoring analysis were applied. For graphic representations, graphs were generated.

RESULTS AND DISCUSSION

The analysis of the significant relationships mapped the internal organization of clusters which is assumed to be one of the prerequisites of successful clusters. Regarding the research of clusters' internal level of organisation (H1/1), it can be stated that significant relationships between the 157 variables derived from the questionnaire were identified using the Pearson's chi-squared test, at 5% significance level with a condition that each cell of the generated cross tables had a minimum 5 observations (min n=5/each cell). These criteria were fulfilled by 2*11 variable pairs with 7 variables which all belonged to the topic of cluster optimisation (later: Optimised clusters), especially in connection with the inner driven cluster managing activity (Work Pack 4, WP4), as presented in Table 2.

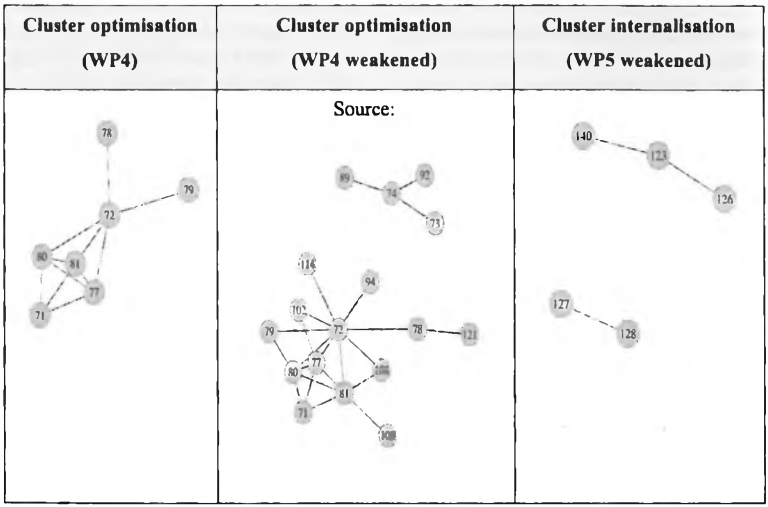
Table 2 Related variables identified by hypothesis testing

Question number	Variable: Indicators used by clusters	Number of significant relationships with other questions
71	Written guide to cluster strategy (market positioning, processes of internationalisation)	3
72	**Annual activity and operation plan (hub)**	**5**
77	Directing consulting body	4
78	Key account management	1
79	Development of new topics for the organisation	1
80	Regular strategy workshops	4
81	Annual evaluation of cluster performance	4

Source: Own analysis

The structure of the network of significant relationships above was illustrated using the graph technique (Figure 1), where edges represent the logical relationships between variables, while nodes stand for the questions identified by their number. Those questions are defined as 'hubs', which have the most significant relationships with other questions. They are the determinative ones of a group of questions as a relationship means that the replies to questions affect each other – and so are not independent of each other. It can be seen that there is no relationship in the sample connected to human resource competencies and activity (WP3), and there is not a strong relationship connected to internationalisation, even when applying weaker criteria such as disregarding the minimum 5 observation in cells of cross tables (WP5 weak). However, it is important that there are multiple relations connected to cluster optimisation (WP4). The graph shows that, if clusters have an annual activity and operation plan (Variable 72, with 5 significant relations), other strategically important planning and organisational tools can also be found as means of optimisation. These include a formal directorial board or body, written cluster strategy, workshops with the participation of significant members for cluster operations and periodic evaluation activity. Hence this element is a form of hub of the conscious behaviour of optimised clusters, and these findings underline and specify the statement. It should be noted that, if analytical criteria are weakened, more relations can be discovered, which indicates that expanded research and a higher rate of responses may result in finding additional network relations (Figure 1: WP4 weakened, then min

Figure 1 Network of significant relationships based on question groups



Source: own construction

n≤5/each cells).

These elements which establish the internal level of organisation do not prove the economic success of optimised clusters (H1/1) on their own, since they can be generated through administrative means without these elements having any actual effect on business performance. To analyse this statement further examinations are needed.

The indication of group effect

To gain a better overview of the sample, the information was densified, for which scoring technique was used. The methodology is based on generating a weighted average of variables so that it explains the most variance, or, in other words, completing a factor analysis where the number of factors is 1. In this way each observation will receive a score (the weighted average of variables linked to the observation) in the question groups. The method is applied for all three question groups of the analysis and the WP4 significant network also, and so each observation will receive a 3+1 scores (WP3, WP4, WP5 and WP4 network) at the end of the procedure.

The next step in the analysis was to find grouping variables in the sample. Variance analysis (ANOVA) was used to test whether a given qualitative criterion (explaining variable) has a significant influence on a given numeric variable (result variable). Specifically, we tested whether the value of scores is significantly affected by the country, industry or cluster size. Thus, the three qualitative criteria are the country, industry and cluster size, while the explained variables are the three types of score (Pintér – Rappai 2007). In total, 3*3=9 ANOVA tests were run with the following

Table 3 Result matrix of variance analysis

Variable/Question group	HR of Clusters (WP3) score	Optimisation (WP4) score	Internationalisation (WP5) score
Country	.006 ***	0.019 **	0.137
Industry	0.226	0.071 *	0.765
Size	0.273	0.561	0.020**

Source: Own analysis

results (Table 3.):

The starred relations are significant with the number of stars referring to the level of significance. In connection with the H1/2, it can be concluded that the human resource development areas and methods (WP3) are strongly country specific, while, cluster optimisation activities (WP4) differ based on both countries and industries. Obviously, the internationalisation of clusters is linked to cluster size, and so it is usually the expansion of sizable clusters which results in international activity.

The economic impact of clusters

If we accept the scientific reasoning above, according to which, from a regional perspective, clusters represent the best organisational answer to economic challenges, it could also be assumed that the growth of clusters leaves a positive 'footprint' in their location, contributing, for example, to local competitiveness.

Regarding competitiveness, complex indices are frequently used, aiming to characterise the complex performance of examination units (countries, regions, companies) with a single number (Szerb 2010, Szerb et al. 2014). Combining the components of indices is now a separate field of research (OECD 2008). The data of the CNCB research was tested through widely used composite indices, as the Global Competitiveness Index (GCI), World Competitiveness Index (WCI), (Global Entrepreneur and Development Index (GEI – GEDI) (Ács and Szerb 2010, Ács et al. 2016). For finding correlations WP3-4-5 and WP4 network scores derived from CNCB data were used along with the aggregated cluster values of the European Cluster Observatory's (CO) NUTS2 regions (http://www.clusterobservatory.eu/index.html). The following correlation matrix was formed for hypothe

Table 4 Correlation matrix of WP scores and composite indices and the aggregated number of clusters by country (significant elements are shown with a *)

	Network score	Cluster HR WP3 score	Optimisation WP4 score	Internationalisation WP5 score	GCI	WCI	GEI	Cluster numbers (by country)
Network score	1,000							
WP3 score	0,037	1,000						
WP4 score	-0,070	*0,621**	1,000					
WP5 score	-0,307*	*0,280**	0,061	1,000				
GCI	-0,061	-0,323*	-0,470*	-0,171	1,000			
WCI	0,112	-0,172	-0,326*	-0,066	0,551*	1,000		
GEI	-0,171	-0,376*	-0,359*	0,181	0,784*	0,343*	1,000	
Cluster numbers (by country)	-0,032	0,133	0,413*	0,401*	-0,306*	-0,522*	0,135	1,000

Source: own analysis

sis testing (Table 4.):

The Network score presented in the table is a score derived from the values of related questions, and so it is the score of the hubs. Data strengthen that part of H1/3, according to which the geographical concentration of clusters is *no longer* a competitiveness factor, since the number of clusters correlates negatively with WCI and GCI indices. Although with the GEI index the value is positive it is not a strong relation (see framed cells in Table 4.). The data tested for linear relations unfortunately did not show a significant connection regarding the optimal size of clusters. In addition, there are a notable number of negative correlation values between composite indices and CNCB WP scores (see white cells). This strengthens the reality of the H2 hypothesis: in the author's opinion, the potential reason for the negative values is the problem of clusterisation and clustering, since the artificial creation of clusters financed by subsidies or grants may increase the number of clusters but it does not contribute to regional competitiveness. Therefore the answer to the second research question would be that heavy subsidies through funding applications cannot be automatically recommended, because the efficient use of resources is not confirmed by macroeconomic indicators.

The H1/1 hypothesis, however, seems to be justified, so that the internal optimisation -seeking organising effort of clusters and the export potential are related to the number of clusters, since there is a positive relation between variables (see bold cells). The categories measured by the CNCB strengthen each other through the human resources working in clusters (see cells with italics). It can be seen that the viability of clusters depends on whether they are able to generate an ecosystem and field of gravitation that start up and maintain a cluster operation. To achieve this, a self-starting, self-renewing cluster system has to be born, whilst externally a broad network going beyond national borders should be created. These are the attributes of professional, Accredited Innovation Clusters (AIC) as opposed to newly founded or artificially operated, grant-funded clusters (Horváth 2013). Only such clusters are able to survive the incubation phase in which there is a need for these factors, and in which the organisations respond appropriately; otherwise a cluster will only deplete the financial resources granted whilst giving nothing in return. The cluster-oriented development policies of the EU could be improved by elaborating the relevant selection criteria.

The Cluster Observatory vs. CNCB database

For a further and more detailed analysis at NUTS2 level, regional and sectoral data had to be compared. For this the 2011 database of the Cluster Observatory's website was filtered, whilst the relations between the CO 3 star international cluster qualification system and the CNCB data were examined (Table 5). The methodology was developed by Ketels and Sölvell (2006a) for the 10 EU member-states which joined in 2004, and which was then expanded to apply to the whole EU. The qualification uses an indicator system based on employment data, which consists of (1) size, which is measured by the absolute number of the cluster's employees (E) (min.E= 15.000), (2) specialisation, which is the ratio of a regional cluster's share of national employment and that of the region (SQ) (min. SQ=1,75), and, finally, (3) the dominance which can be measured by the cluster's share of regional employment (D) (min.D=7%) (Ketels and Sölvell 2006b).

Table 5 Selected fields of the correlation matrix of the CNCB research Work Pack (WP) scores and Cluster Observatory NUTS 2 level data (significant elements are shown with a *)

	Network score	Cluster HR WP3 score	Optimisation WP4 score	Internationalisation WP5 score
Employees	-0.031	-0.011	0.010	0.140
Enterprises	-0.006	-0.025	-0.054	0.085
Average wage (1000 EUR)	-0.260*	-0.313*	-0.369*	0.295*
Observatory star rating	0.031	0.024	0.105	0.154
GDP per capita (EUR)	-0.182	-0.345*	-0.177	0.376*
Employment rate (%)	-0.064	-0.359*	-0.400*	0.152
Business R&D personnel (% of total)	-0.214*	-0.461*	-0.368*	0.181

Source: http://www.clusterobservatory.eu

The results of testing hypothesis H2 also confirmed the inefficient resource allocation as did the previous tests. The NUTS2 regions' data by sector showed no relation with CNCB WP scores, and, moreover, mostly negative correlations can be found. An exception to this is the CO qualification system (see white cells in Table 5.), but these correlations are not strong. A more serious correlation can be seen between internationalisation (WP5) and a few, NUTS2 level macroeconomic indicators when filtered based on region and sector, as between the average wage and the GDP per capita (see framed cells in Table 5.). This may possibly be due to the economic buoyancy and importance of international clusters, which could be especially well supported by a system of tenders or funding applications.

LIMITATIONS OF THE FINDINGS AND IMPLICATIONS FOR FURTHER RESEARCH

It has to be noted that, on one hand, the questionnaire of the CNCB project was not created with a scientific research objective but to ensure that the Horizon2020 tender projects related to Central Europe would contain suitable terms and conditions. Because of this the questionnaire mostly worked with explaining the variables surveyed on a Likert scale, whilst the acquired data did not contain result variables and performance indicators. On the other hand, unfortunately, not all the questionnaires were fully completed, and so the database of certain analyses contained fa different number of elements. A further limitation to the survey is that the data was not sufficient for the completion of linear regression since there were only a few objective and numerical indicators. Consequently, the data are rather to be used for explorative analyses, than as a hypothesis testing, scoring method or factor and cluster analysis. Due to the small sample size (95) there were not enough data for a NUTS2 level regional comparison or its sectoral equivalent. The subjects of the survey cannot be regarded as representative – either from a regional or from a sectoral point of view, since participants were randomly recruited based on connections, and so they are heterogeneous. For example, there was a considerable variance between the values of accredited clusters with a sustainable operation in an internationally well-established NUTS region and "formal" clusters in their incubator phase, which were founded to obtain funds from EU cluster-related applications. Although the database of the CNCB research cannot be regarded as representative, due to its international and regional feature and the relatively high number of respondents, it provides valuable information about Central Eastern European clusters, although needing further data collection.

In the future, further research is required to increase the completion level of the existing database, although increasing the sample size should not be undertaken randomly if we are to achieve a serious level of representativeness. In addition, new topics should be introduced in the questionnaire to analyse clusters in different phases of their lifecycle – especially in respect of accredited innovation clusters and those with a distinctive behaviour in utilising application-derived funds. The questionnaire should also include questions on business performance and the return on utilised resources. Finally to be recommended is that the internally-driven, bottom-up organised clusters should be compared with subsidised, top-down clusters based on their operational efficiency and return – essentially by result indicators replacing explaining indicators in the course of the analysis. This would probably help resource owners to formulate application goals to improve the utilisation of EU funds.

CONCLUSION

Clusters are likely to be an appropriate organisational response for the international requirements of globalisation, since they are organised on regional and industrial bases, whilst attracting numerous institutional forms and actors into a single group. As in all coherently working organisations, conditions for development and joint action are created by mutual trust among members of clusters. The analysis confirmed, in connection with hypothesis H1/1, the success of internally-driven, optimised clusters (WP4 interesting to see that the tools used by clusters proved to be country-, industry- and size-specific (H1/2), whilst geographical concentration was not a success criterion (H1/3). It was a surprising, however, to find that, contrary to expectation, there was no material correlation between composite indices used to measure economic development and competitiveness and the examined set of data. Negative correlations in connection with hypothesis H2 imply the existence of system-level problems - hence an inefficient use of development funds – a conclusion which can be reached despite the limited applicability of the data.

On the whole, the results of the CNCB research contributed to the picture of what knowledge and competencies are needed by cluster managers when developing a cluster organisation and can be a competitive advantage for them in the future. Significantly, a need was indicated that cluster operations should require a qualification system and specific qualifications based on this, and, in addition, that open and

interactive network forums still play a significant role in organisational learning, in order for participants to give substance to best practice and share it with others. In addition, awareness should be raised among a region's clusters of the generation and implementation of internationalisation strategy, since this could be one of the main driving forces in their development.

The responsibility of government is to generate appropriate incubator conditions for cluster founding and development, and, in addition, to recognise and support clusters which contribute to competitiveness. In order to achieve this, all factors should be analysed which are potential motivational or inhibiting forces of successful cooperation. It is predictable that, besides the learning process of best practice dissemination, the direction of future research will still be to identify the driving forces of clustering, their implementation in other environments and the way of converting this knowledge into sustainable competitive advantage (Aron 2013). The recognition of cluster driving forces and the implementation of best practice may be such stimulations for clusters which contribute to sustainable economic growth.

On the whole, research questions and the analyses included in this study show that clusters need to be subsidised by application-derived funds, although the focus should be on existing clusters to prove their ability to develop. Hence forced clusterisation should be avoided. Monitoring systems should be based on actual result and performance indicators, instead of on bureaucratic reports which sustain artificial clusters. The development of cluster management is essential in the future, but joint, networking-based cooperation is also to be encouraged, especially those should involving international partnerships. This study should also remind those who manage applications and who participate in them that the depletion of EU and/or national and regional resources by, for example, artificially created clusters, takes resources from more efficient regional development opportunities. A badly managed driving force could inhibit competitiveness and business success. The conclusion of this present study seeks to draw the attention of those involved in cluster founding, development, application planners and participants to the fact that the utilisation of development funds can only be efficient, if clusters do not only aim for bureaucratic compliance to the external requirements prescribed in applications, but also build an active and sustainable (accredited) ecosystem based on real internal cooperation which continues even after the initial funding period is over.

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