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# CLUSTER EFFICIENCY STUDY THROUGH BENCHMARKING

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**Abstract.** This study was carried out in order to compare the most successful, in a certain extent, clusters in Lithuania. Benchmarking approach was employed as the most precise technique of data analysis in given conditions. There were several methods employed in a study, such as an interview for the initial stage of data collection, questionnaire survey as well as multi-criteria analysis in later stages and benchmarking for the final stage of the study as to generalize the results. The research has shown that multi-criteria and benchmarking methods are helpful in determining cluster performance. There might be some inaccuracies regarding the results as there were several questions with information not available for the cluster managers. A great number of elements included in the questionnaire survey may have led to some discrepancy. Benchmarking can help companies in cluster to evaluate their performance in comparison to others and seek for better results. The most successful clusters in Lithuania were studied to be a role model. Benchmarking is a practice which can help clusters to measure their performance as there is no systematic evaluation of cluster excellence in Lithuania.

**Keywords:** cluster efficiency, benchmarking, case analysis

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## 1. Introduction

It is common that both, academic and policy fields draw a lot of attention to industrial clusters. Clusters are widely known as geographic agglomerations of economic activities that operate in the same or interconnected sectors and the most prominence in recent literature is put on the study of the main features of a cluster, which are exploration capacity, networking intensity and external resources (Expósito-Lange *et al.* 2015). It is characteristic to clusters to sustain productivity growth of firms in specific regions or create new businesses in larger sectors of a particular nation. Industrial clusters perform as instruments in strengthening the innovative capabilities of firms, industries and even nations. The main feature of the cluster, which exposes itself in the long run is that companies within cluster increase their competence of an organization and achieve a competitive advantage in global markets (Park *et al.* 2012; Prause 2014; Tvaronavičienė *et al.* 2014; Tvaronavičienė, Černevičiūtė 2015). Competitiveness is one of the main issues that small and medium enterprises are aiming at and cluster helps companies to achieve better results as one of concern is that isolation, rather than size, is the key obstacle preventing from understanding how to compete in the wider market (Connell *et al.* 2013).

Dynamic environments have changed competition among companies as it has increased and knowledge that can be created within organizations became the source of competitive advantage instead of material resources (Martínez 2012; Tvaronavičienė, Černevičiūtė 2015). Many study positions themselves in the interest of the effect of clustering either on the level of individual companies or on the common level of regions or nations. Competitiveness has been a core of co-operation of companies since the 1990s and a large number of cluster organizations have been formed as public-private partnerships which aimed at promoting the growth and competitiveness of clusters (Bileišis 2012; Balkienė 2013; Singh 2013; Figurska 2014; Vasiliūnaitė 2014; Prause 2014; Tvaronavičienė, Černevičiūtė 2015). The concept of collective efficiency can be used in order to help in understanding how companies in cluster achieve higher performance or benefit from co-operation. As well as that, compliance with national standards can add a competitive edge for many producers and service providers (Nadvi 1999; Tvaronavičienė, Černevičiūtė 2015). Scholars claim another feature, that helps a company to become more competitive is embeddedness in an industrial cluster the degree of which determines how high innovative or market performance of a company will be. Embeddedness is believed to be one of the strengths of an industry cluster – a successful form of industrial organization. Being one of the main theoretical concepts, local embeddedness means that clusters of economic activity can provide a solid basis for local and regional economic growth (Giuliani 2013; Prause 2014; Tvaronavičienė, Černevičiūtė 2015). Companies initiate clusters aiming at benefits which they expect from co-operation with others. Competition is one of them and it is one of the reasons why cluster efficiency is important.

This article aims at proving the efficiency of cluster in comparison to other clusters by benchmarking. Benchmarking databases and services are available on the internet which let companies share performance information and get feedback with the possibility to compare their data with other companies. Such instrument enables clusters to improve organizational learning and the collective efficiency of a cluster. By collecting data from companies of four different clusters, regarding cluster activity, resources and processes, the comparison has been made and further described. The attempt was to use benchmarking in order to see the performance and competitiveness of the clusters.

The purpose of this study is to apply benchmarking in order to examine cluster efficiency among other clusters. This research analyses the data collected from four different clusters in Lithuania regarding cluster activity, resources and processes. Benchmarking is a good practice in business among organizations to improve performance and competitiveness, but it is rarely used to check cluster parameters in Lithuania. The article is insufficient as some data which was needed in comparison to others was not available. Benchmarking can also be bias as the comparison is based on author‘s personal opinion as well as expert evaluation of factors was not equal in empirical assessment of expertise. Moreover, the missing data might change the final results. At the beginning of the research clusters in Lithuania were identified and several satisfying certain features were selected for further examination. The chosen clusters were not limited by a geographic area or scope. The attempt was to compare chosen clusters which are considered the most successful in order to verify their efficiency.

The article is structured as follows. Section 2 describes the research design, study procedure and the methods that were used in each stage in data collection or analysis. Section 3 presents some descriptive statistics on Lithuanian clusters and their features. Section 4 illustrates the results of cluster efficiency study through benchmarking. Finally, Section 5 incorporates the concluding remarks.

## 2. Data and methodology

In order to get all the necessary information and to be precise at further analysis and comparison, several stages of data collection have followed. Different methodology was applied to each stage so that the best results could be achieved. Such a sequence was chosen for the complexity of a research which obligates to incorporate as many participants as possible.

At the initial stage an interview with the coordinator of cluster development in Lithuania was arranged. The main aim of the meeting was to get information from a person who is participating in the life of cluster from the beginning of it about the successful clusters in Lithuania. As it is complicated to measure how successful cluster is some features were named as obligatory which characterize cluster and show how good it is at accomplishing goals, if the companies are working together for a common purpose. Measurements such as cluster activity, resources and processes must be taken into account. There is no systematic evaluation of

cluster excellence in Lithuania, although there are some clusters which have employed financial aid not only for EU funds but also private institutions. It was decided to consider that cluster is successful if it has been operating for longer than two years, receives funding either from EU funds or private institutions and the results of cluster activity are satisfactory. The interlocutor has named seven clusters of such nature. As there is no official rating system in Lithuania, none of these can be identified as the most successful or effective as well as there could be more clusters selected of comparatively equal performance.

The second stage covered data collection from the clusters which were regarded as successful in the above mentioned conditions for case analysis. A questionnaire survey which was composed of evaluative matrix of processes and open questions regarding the statistics of cluster resources and activity was submitted for the cluster managers. The feedback reached 57% as four out of seven clusters have provided the answers. Others responded as well, although they could not provide the bigger part of answers as some of information was considered as confidential or not available at a particular moment and the collection of it from cluster members would have taken too long.

The following stage involved the same clusters which have responded to the questionnaire survey. The managers were asked to give evaluations for indicators of cluster efficiency according to their importance so that a multi-criteria analysis could be carried out. A multi-criteria analysis was chosen for it serves in making a comparative assessment among heterogeneous measures.

In the last stage the data was structured and a multi-criteria analysis carried out to prove the efficiency of the clusters. The results were compared through benchmarking.

Benchmarking was chosen as the most reasonable method of data analysis to serve the purpose of this article. As a process benchmarking, this method serves to compare the three main dimensions which reveal cluster efficiency: cluster activity, resources and processes. The clusters were selected paying attention to their performance regardless of the industry sector as for generic benchmarking. As to agree with the principles for benchmarking (Carpinetti 2008), some restrictions were applied to this article. In order to verify legal aspects of the study, statistical data are given in the normalized value and the clusters are not identified. All the benchmarking partners will receive the same type of information for perceiving mutual benefits. Benchmarking data will be communicated outside for study purpose as it was prior agreed with benchmarking partners.

To sum up, after comprising all the steps that have been taken moving towards the results of this study, generic benchmarking process has been followed. At first cluster efficiency was determined as a subject of this benchmarking study. Then a coordinator of cluster development in Lithuania as a consultant for choosing the partners was approached. Later seven clusters were identified as the partners of the study four of which participated in the process of benchmarking. Further step was to collect and analyse data using questionnaire survey and multi-criteria analysis methods to serve the purpose. Finally, the results were implemented and monitored.

## 3. Descriptive statistics

Clusters tend to strengthen companies by helping them to improve their performance and competitiveness. As well as that, clusters are formed in order to find new technologies, qualified personnel, investments in scientific research. Clusters enable companies to cooperate, reduce expenses for knowledge or technologies, help to create more possibilities to study or distribute expenses for risk management, scientific research and development, promote flexibility, help to reduce the period of time for presenting a new product or process to the market.
Recently there are less than 50 cluster initiatives in Lithuania. Some of them are still at the initial formation stage, or is a group of companies that gathered together seeking only for EU SF aid. From all the identified clusters in Lithuania only a forth is formed naturally, through long term co-operation in development of new products or services, by common work aiming at bigger part of market and increasing competitiveness of cluster companies.

The majority of clusters are initiated at the service sector. The number of initiatives founded there is considerably greater than in industry sector. Services, changing client's physical or mental qualities (especially

health and cultural industry) and information services are the dominant in cluster initiatives. Chemistry industry and food and beverage industry are the most interesting for companies to cooperate and create clusters in manufacturing industry. Just a few or none of the clusters are initiated in textile and clothing industry, wood and furniture industry and metal, machinery and equipment manufacturing industry (Figure 1).

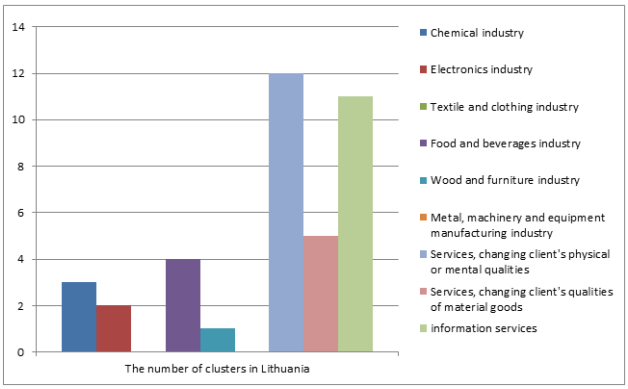


**Fig. 1** The number of clusters in Lithuania by sector

Clusters in Lithuania are initiated in economically strongest cities (Vilnius, Klaipeda, Kaunas, Alytus) where the concentration of operating entities and employed population is the highest. There are micro-clusters in smaller regions as well where the specifics of activity are characteristic of that region (Birzai, Druskininkai, Kedainiai, Mazeikiai, Ignalina, etc.).

Clusters in Lithuania mostly participate in international projects (Baltic Sea Region 2007-2013, EUREKA Eurostars, EU SF initiated projects, etc.), other EU initiatives helping to create knowledge and innovation area, develop commercial cooperation with foreign partners.

The main strengths of clusters in Lithuania are activity friendly environment (relatively cheap and qualified workforce, convenient location in terms of logistics, developed logistics structure, a high level of technological base).

## 4. The cluster efficiency analysis

Multi-criteria methods are used for both theoretical and practical tasks since they are universal and enable to carry out a quantitative study for any complex phenomenon with many indices (Ginevičius 2008). The multi-criteria SAW (Simple Additive Weighting) method was applied to process the results. The research has shown that D is the most effective cluster. It was noticed that it has the best resources. Cluster A goes second and it was seen as superior in area of activities. Thence, cluster B shows the best results through processes and goes third. Finally, cluster C stays far behind the leading clusters, as almost all the factors have the smallest values (Table 1).

**Table 1** Total of values

| | A | B | C | D |
|---|---|---|---|---|
| Resources | 0,196 | 0,182 | 0,084 | 0,427 |
| Activity | 0,331 | 0,198 | 0,251 | 0,217 |
| Processes | 0,268 | 0,382 | 0,034 | 0,250 |
| Total | 0,80 | 0,76 | 0,37 | 0,89 |

Such results encourage continuing on comparing the data that were suggested by the managers of clusters. The research itself suggests that all three groups of measurements, which are resources, processes and activity, should be discussed separately and the performance should be compared. Table 2 provides standardized values of the measurements as well as weights assigned by experts.

**Table 2** Standardized values and weights

| | A | B | C | D | Weight |
|---|---|---|---|---|---|
| Number of cluster coordinating members | 0,188 | 0,125 | 0,063 | 0,625 | 0,136 |
| Number of cluster members - companies, R&D subjects, supporting organizations | 0,175 | 0,349 | 0,270 | 0,206 | 0,140 |
| Number of R&D personnel | 0,000 | 0,273 | 0,000 | 0,727 | 0,117 |
| University graduates working at cluster companies | 0,000 | 0,000 | 0,000 | 0,000 | 0,112 |
| Common cluster projects in two years | 0,625 | 0,031 | 0,281 | 0,063 | 0,126 |
| Financed common cluster projects in two years with cluster initiatives co-financing | 0,500 | 0,000 | 0,000 | 0,500 | 0,112 |
| External finansing for cluster initiatives in two years | 0,038 | 0,393 | 0,000 | 0,569 | 0,121 |
| Total sum of cluster members' investments for cluster initiatives in two years | 0,046 | 0,241 | 0,014 | 0,698 | 0,136 |
| Common supply and order scheme | 0,227 | 0,364 | 0,182 | 0,227 | 0,049 |
| Common distribution channels | 0,320 | 0,280 | 0,160 | 0,240 | 0,046 |
| Common cluster members' tenders for external clients | 0,409 | 0,182 | 0,182 | 0,227 | 0,050 |
| Exchange of common market information between cluster members | 0,357 | 0,179 | 0,321 | 0,143 | 0,052 |
| Cluster advertisement (leaflets, media) | 0,357 | 0,179 | 0,286 | 0,179 | 0,052 |
| Common participation in exhibitions and fairs | 0,417 | 0,042 | 0,333 | 0,208 | 0,055 |
| Lobbying | 0,040 | 0,400 | 0,320 | 0,240 | 0,049 |
| Common internet site | 0,294 | 0,294 | 0,235 | 0,176 | 0,049 |
| Visual identification (common logo, brand) | 0,357 | 0,107 | 0,321 | 0,214 | 0,045 |
| Contacts and image of cluster in mass media | 0,294 | 0,294 | 0,235 | 0,176 | 0,052 |
| Regular meetings of cluster members | 0,323 | 0,226 | 0,290 | 0,161 | 0,053 |
| Cluster integration events | 0,286 | 0,250 | 0,286 | 0,179 | 0,050 |
| Common communication platform | 0,417 | 0,125 | 0,250 | 0,208 | 0,050 |
| Common cluster publications (buclets, newsletters, etc.) | 0,333 | 0,185 | 0,296 | 0,185 | 0,049 |
| Co-operation while creating new products or technologies | 0,409 | 0,136 | 0,182 | 0,273 | 0,050 |
| Co-operation while creating innovations (organizational, marketing, etc.) | 0,375 | 0,125 | 0,250 | 0,250 | 0,050 |
| Common training, workshops, conferences, internships | 0,409 | 0,136 | 0,182 | 0,273 | 0,052 |
| Common data base | 0,316 | 0,158 | 0,211 | 0,316 | 0,048 |
| Informal sharing of knowledge and experience | 0,267 | 0,267 | 0,267 | 0,200 | 0,049 |
| Trasference of technologies | 0,412 | 0,059 | 0,235 | 0,294 | 0,048 |
| Increase of cluster members' employees in two years | 0,811 | 0,000 | 0,189 | 0,000 | 0,068 |
| Number of internal cluster training participants in two years | 0,417 | 0,500 | 0,000 | 0,083 | 0,059 |
| Number of cluster organized common training in two years | 0,242 | 0,712 | 0,000 | 0,045 | 0,061 |
| Number of qualification upgraded employees in two years | 0,893 | 0,107 | 0,000 | 0,000 | 0,071 |
| Increase of direct employement in cluster innovative activities | 0,176 | 0,824 | 0,000 | 0,000 | 0,066 |
| Part of R&D expences in common expences in two years | 0,130 | 0,870 | 0,000 | 0,000 | 0,061 |
| Number of common submitted/funded EU SF projects in two years | 0,000 | 0,000 | 0,000 | 1,000 | 0,051 |
| Number of common international R&D projects, funded not from EU SF, in two years | 0,000 | 0,000 | 0,000 | 1,000 | 0,054 |
| Products/goods of cluster, sold in internal market | 0,750 | 0,200 | 0,100 | 0,050 | 0,051 |
| Products/goods of cluster, sold in external market | 0,222 | 0,356 | 0,400 | 0,422 | 0,078 |
| New cluster members in two years | 0,158 | 0,579 | 0,158 | 0,105 | 0,073 |
| Start-up in cluster | 0,000 | 0,000 | 0,000 | 1,000 | 0,034 |
| Foreign markets where members of cluster works | 0,000 | 0,000 | 0,000 | 0,000 | 0,066 |
| Part of export in total cluster sales | 0,222 | 0,356 | 0,400 | 0,422 | 0,076 |
| Number of official co-operation agreements with foreign entities | 0,071 | 0,714 | 0,000 | 0,214 | 0,063 |
| Participation in international exhibitions and sales offices in two years | 0,035 | 0,614 | 0,140 | 0,211 | 0,068 |

Regarding resources, D cluster dominates as it has 4 highest values out of 8 parameters as well as one parameter is equal to A cluster. D cluster has the greatest number of personnel, namely R&D personnel takes 72,70 % and the number of cluster coordinating members takes 62,50 % of all analysed clusters. The same goes with financing as total sum of cluster members' investments in cluster initiatives in two years stand out taking 69,80 %, external financing for cluster initiatives in two years has 56,90 % and financed common cluster projects in two years with cluster initiative co-financing has 50% together with A cluster. Altogether, D cluster is at an advantage of resources.

The situation with activity is not that exclusive as none of the clusters take the dominant part in this measurement. Still, the best results are achieved by A cluster as 13 parameters out of 20 has the highest values

in comparison to other clusters and 4 more are equal to those of B, C, or D cluster. The parameters that has the highest values are common distribution channels, common cluster members' tenders for external clients, exchange of common market information between cluster members, cluster advertisement (leaflets, media), common participation in exhibitions and fairs, visual identification (common logo, brand), regular meetings of cluster members, common communication platform, common cluster publications (buclets, newsletters, etc.), co-operation while creating new products or technologies, co-operation while creating innovations (organizational, marketing, etc.), common training, workshops, conferences, internships, transference of technologies. These parameters take from 32,00 % to 41,70 % in comparison to all the clusters. Other 4 share the same part as other clusters, which are common internet site, contacts and image of cluster in mass media – the same as B cluster, cluster integration events – shared with C cluster and common database has the same value as D cluster. Overall, A cluster achieved the best results through activity.

Processes are exploited mostly by B cluster. It takes 7 highest values out of 16 parameters. These are number of internal cluster training participants in two years, number of cluster organized common training in two years, increase of direct employment in cluster innovative activities, part of R&D expenses in common expenses in two years, new cluster members in two years, number of official co-operation agreements with foreign entities, participation in international exhibitions and sales offices in two years. This section has a clear leader, bet A and D clusters have pointed high results in this area. These are participation in international exhibitions and sales offices in two years, number of qualification upgraded employees in two years and products/goods of cluster, sold in internal market for A cluster and Number of common submitted/funded EU SF projects in two years, number of common international R&D projects, funded not from EU SF, in two years, products/goods of cluster, sold in external market, start-up in cluster for D cluster. Even though above mentioned clusters have also high values in some of the processes, B cluster kept distance from them and took a leadership position with this parameter.

The gap between A, B, D and C clusters is evident. C cluster stays behind in resources and processes, but it tries to keep up with activity. It is worth noting that even though the received financing is low and the cluster number of personnel is smaller than in other clusters, C cluster is worth being compared to successful clusters in previously determined conditions. This cluster also stands behind in processes. Cluster members either do not participate in processes or do not provide information about participation. Hence, there were no participants in internal cluster training as common training was not arranged in two years, increase of direct employment in cluster innovative activities was not recorded, R&D expenses in common expenses in two years do not take any part, number of common submitted/funded EU SF projects or common international R&D projects, funded not from EU SF does not prevail, start-up is not initiated in the cluster, official co-operation agreements with foreign entities are not made. In comparison to other clusters, C cluster can keep up with processes as many of the procedures are not employed. The main reason of lower cluster performance may be because of financing for common cluster affairs. This cluster is financed mainly from private budgets. Projects are not financed from common cluster budget. Cluster members cover the costs of participation in projects by their own resources. The performance of C cluster might be increased by external financing for cluster initiatives and a greater number of personnel, concerned with cluster affairs.

All of the analysed clusters may be considered as having features which are superior over others. The main task for all of them is to divert the funds either from EU SF or private institutions properly over the resources, activity and processes. All three areas must be employed in order to make the cluster work efficiently.

## 5. Conclusions

This article aims at comparing the most successful clusters, in the given conditions, in Lithuania. After comprising all the steps that have been taken moving towards the results of this study, generic process has been followed. Competitiveness was determined as one of the main reasons why clusters are interesting for companies to join. The statistics of clusters in Lithuania were provided and they show that there is interest in establishing clusters in industry sector. Seven clusters were identified as the partners of the study four of which participated in the process. Data was collected and analysed using interview, questionnaire survey and multi-criteria analysis methods to serve the purpose. The results were implemented and monitored which showed that three of the clusters are of almost equal efficiency and one stands behind. Benchmarking was employed to further analyse the clusters.

The choice of clusters puts some limitations to the work. Successful cluster has to meet such conditions: it must have been operating for longer than two years, receiving funding either from EU funds or private institutions and the results of cluster activity must be satisfactory. Seven clusters were selected, four of which participated in the research. It must be noted that the results may have some discrepancies as some of the information was not available and it was considered as zero for further analysis.

This research needs further development as there are more aspects of the analysed clusters that must be compared and discussed. Benchmarking may be helpful for companies in clusters to measure their performance and reach for better results. The research takes time and consists of many questions which require gathering data for at least two years. A tool for measuring cluster performance or efficiency may be used by companies or scholars as there are the main points highlighted in the research.

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