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MACROECONOMIC DIMENSIONS IN THE CLUSTERIZATION PROCESSES: LITHUANIAN BIOMASS CLUSTER CASE

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Abstract

The Future production systems' increasing significance will impose work, which maintains not a competitive, but a collaboration basis, with concentrated resources and expertise, which can help to reach the general purpose. One form of collaboration among medium-size business organizations is work in clusters. Clusterization as a phenomenon has been known from quite a long time, but it offers simple benefits to researches at micro and medium levels. The clusterization process evaluation in macroeconomic dimensions has been comparatively little investigated. Thereby, in this article, the clusterization processes is analysed by concentrating our attention on macroeconomic factor researches. The authors analyse clusterization's influence on country's macroeconomic growth; they apply a structure research methodology for clusterization's macroeconomic influence evaluation and propose that clusterization processes benefit macroeconomic analysis. The theoretical model of clusterization processes was validated by referring to a biomass cluster case. Because biomass cluster case is a new phenomenon, currently there are no other scientific approaches to them. The authors' accomplished researches show that clusterization allows the achievement of a large positive slip in macroeconomics, which proves to lead to a high value added to creation, a faster country economic growth, and social situation amelioration.

Keywords: clusterization, macroeconomic strategies, cost–benefit analysis, biomass cluster

JEL classification: B22, M21, O11

1. INTRODUCTION

The constantly volatile business environment separates companies, therefore it becomes difficult to adjust to permanent changes. Due to this and various other reasons companies tend to use internal and external resources in order to enter new markets and in turn enhance financial benefits in the long term. Clusterization processes' is a broad topic with multiple areas under analysis, therefore it is widely analysed by various researchers. Current research on clusterization is mostly oriented to clusterization's benefits microeconomics and at a medium level. Skaržauskienė et al. (2014), Vaz and Nijkamp

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(2009) in their works state that clusters afford benefit for their members. Semlinger (2008) maintains that a cluster helps to develop innovations and it creates better additional value. On the other hand, Ketels et al. (2006, 2013) analyse clusterization's benefit from a broader perspective, emphasizing the macroeconomic dimensions which operate a cluster's activity. However, seeking wider clusterization processes in macroeconomics evaluation confronts with lack of information, which allows to get to the conclusion that this topic has been little investigated by scholars so far.

This article tackles prevailing clusterization processes, which develop through macroeconomic dimensions. In this article it is also analysed how different cluster processes could differently influence economic conditions in a particular country, its' society or their decisions making, as well as economic and social situation as a whole. The authors propose a methodology, through which one can measure clusterization's benefit for a country's macroeconomic development, and an instrument which can describe clusterization processes for macroeconomic strategies dimensions.

The novelty of the study: the research carried out by the authors of the article show that clusterization processes operates in macroeconomic dimensions, influencing a country's economy and social life. Usually clusterization exists in microeconomics, mostly searching in meso level, where the majority of changes for companies or a country's separate economic sector activity appears. The authors research shows that clusterization allows to achieve most positive slip in macroeconomics, which proves high additional value of creation, a country's rapid economic growth, and social situational upturn. Article authors also value structured research methodology for clusterization of macroeconomic influences as part of scientific novelty.

The object of the particular study is: macroeconomic dimensions of clusterization processes.

Moreover, the goal of the study is to investigate clusterization processes in the economy using macroeconomic dimensions.

The objectives of the study are:

1. To analyse clusterization's influence on countries' macroeconomic development;
2. To form research methodology for clusterization's macroeconomic influence evaluation;
3. To propose clusterization processes' benefit in macroeconomic analysis.

2. LITERATURE REVIEW – CLUSTERIZATION PROCESSES AND THEIR INFLUENCE ON MACROECONOMICS

Clusterization as a phenomenon characterizes obvious and structural processes, which will relegate in companies; they can get economic benefits and achieve a business expansion effect. In a company's meso level, clusterization provides the opportunity to achieve these markets, even though achieving it was not possible for limited company size and production potential. Herewith clusters can help form stable new customers base, which warrants fixed incomes and opportunities for better planned production manufacturing amount. However, all of this form clear influence of the region and country, which shows cluster development activity. New workplaces, increased tollage, infrastructure development – these are just a few of the basic clusterization influences for macroeconomics factors. A cluster's activity rebounds for all countries as competitive, because increasing a country's knowledge level emerges as an opportunity to position it as a particular commodity producer.

Companies activity in the cluster is not only useful to themselves, but also its positive influence affects a region's activity. "Clusters and collaborate companies network significantly promote region's competitiveness, because clusters develop innovative projects, new technologies or other subjects connect with required resources, abilities and costs synergy decisions" (Semlinger, 2008) Clusters activity additionally expands research and development centres, which lets companies from different sectors collaborate together with academic institutions and other organizations to create additional value (do Carmo Farinha et al., 2014).

Clusters can importantly determine competitiveness in a particular market. Herewith clusters encourage cooperation between various companies. Competitors compete with each other, in order to survive in the market and for customers (Čiburienė and Keršienė, 2002). Without competition, a cluster is weakened. On the other hand, together with competition, cooperation follows, mainly vertical, in which included companies form related activities and other institutions. Competition can exist together with cooperation, because they show evidence in different dimensions ground and between different subjects. Cooperation can reduce emigration level (Vojtovich, 2013).

Clusters influence competitiveness in three manners:

1. When enhancing particular regions' influence on companies' productivity;
2. When controlling innovations direction and rate, to which companies' future productivity growth belongs;
3. When encouraging new business initiatives, which then can expand and strengthen a cluster.

To make various types of clusters, always seek tangible benefits, which reflect on enlarged profitability and customers' quantity. Clusterization also help achieve other purposes – affecting companies culture, enrich newest management decisions. Clusters afford discernible benefits to their members (Skaržauskienė et al., 2014):

- Operating together, cluster companies have more opportunities to increase productivity, rather than when acting separately;
- Clusterization can assist not only one company, but the entire sector's competitiveness;
- Together with entrepreneurship perception, clusterization creates more inviting conditions for innovations.

"Creativity and productivity objective encourages the flock of clusters, that in turn encourages enterprise objective, will to rise business structures effectiveness and productiveness, and this is a key to a sustainable development, which is emphasized in today's world" (Vaz and Nijkamp, 2009). Regional industrial clusters can enlist and connect large companies, thus composing agglomerate compounds. The basic provision is a specific geographical zone, where all business subjects can unify their strength and resources for general work (Lechner and Leyronas, 2012).

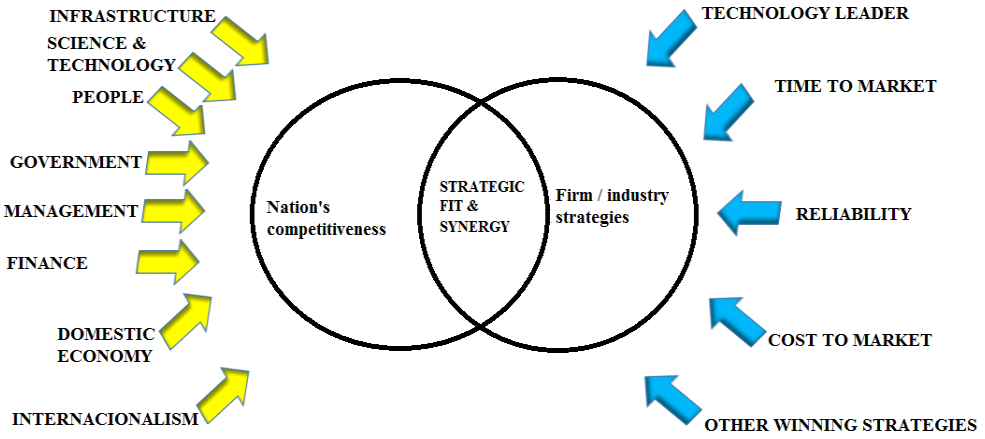
It is particularly important to exclude the productivity increase factor. Because cluster members are oriented to one purpose and activity opportunities seek to concentrate, productivity rises equally and coherently, because the workload and orders lot are equal between cluster members. Meanwhile, when increasing competitiveness, it also increases companies' income and importance in sector.

Operating together is really useful for cluster companies, because they can achieve effectiveness. When they operate together, they can enhance the income through better customers' demand recognition and satisfaction, thus minimizing the costs for

standardization. Concerning geographical repartition, they can reduce logistics and transaction costs, herewith creating effective movement and create best benefit of all country. Herewith cluster can work with public sector and its resources satisfying that particular market part demand (OECD, 2005).

Clusters benefit is not only economic, but can promote social partners to create benefit. "Financial and technological cluster companies successfully meet community interests: incomes, additional workplaces, social welfare creation and general economic growth, which is higher or not – clusterization regions" (Bernat, 1999). Clusters assistance includes better number of various professions representatives, who can use their knowledge and resources to create general welfare. Ameliorative economic situation, additional resources, which comes from taxes, can be invested in infrastructure development and other means, which can assist to improve social situation.

Conveys exist in various models for cluster's behalf, which capability specifically shows, how clusters create benefits for both cluster members and society. A cluster creates benefits that can convey to strategic fit and synergy, with a discernible connection between country competitiveness and manufactory strategy, which orient to leadership retention and costs policy effectiveness.



Source: Kuah (2002)

Figure no. 1 – Strategic cluster fit model

The model shows that strategic cluster output is concerned both with cluster members and with all nation competitiveness, which can determine cluster strength and synergy achievement extent. Clusters can enhance competitiveness by improving infrastructure, scientific achievements, management means and economic situation as a whole. It can also help to achieve a strategic fit, because cluster members can be companies progressing in technological range, which can control the costs and herewith create new value. Also, when all resources concentrate on cluster, synergies occur, which additionally reduce companies' costs.

Country business environment effectiveness and productivity, which measures country overall competitiveness level, depends not only to technological, scientific infrastructure or labour and finance markets, but also to business advancement, which

include companies accountability, management and culture practice and clusters development (Rakauskiene, 2013).

Ketels et al. (2006, 2013) argues that clusterization influences country and its members' measures by invoking quantitative and qualitative parameters and separating direct and indirect benefit groups. Therefore, such method allows separating what type of goods would bring universal benefits for society and measure where clusters could be created.

Table no. 1 - Direct and indirect clusterization influence for cluster partners

Cluster direct influence for clusterization partners	**Cluster indirect influence for clusterization partners**
Increase in competitiveness	Collaboration and integration for B2B level
Additional value indexes increase	Collaboration and integration for B2S level
Profitability indexes increase	Collaboration and integration for B2Credit agency level
Wage increase for one employee	Collaboration and integration for B2G level
Sales increase	Collaboration and integration for B2Cluster level
New or better products and service creation	Collaboration and integration for "Business – global market and value creation chain " level
Increase in employment	
Operating conditions and implements equality	
Operating conditions variety and diversity	
Sustainability	

Source: Ketels et al. (2006, 2013)

Previously mentioned influences are one of the most apparent direct cluster influences. However, it is harder to evaluate indirect influence. One of the potential ways is to evaluate new collaboration opportunities is by formulas, however it has yet to be fully introduced to physical business. Business – to – business (B2B) and other collaboration forms are by far usual in information and communication technologies, but clusters enable to seek maximum integration effectiveness between companies. Direct influence is concerned not only with economic and social factors, but it also includes sustainability definition, which describes sparing resources usage and making the most wastes recast.

Companies that work in clusters not only create benefits for their partners, but also create economic benefit for a country's economy. Clusterization provides a huge impulse for macroeconomics, because through its assistance new business models can be developed, which allow the creation of new ones, often raising additional value to all country or region. Deliberate clusterization influences macroeconomics research, needed to form research methodology, which allows evaluating clusters benefit at country level. Methodological basis constitutes several methods for region competitiveness evaluation and method, which permitted the evaluation of a cluster's influence according to cluster costs and benefits, as perceived by society.

3. METHODOLOGY AND RESEARCH

When research methodology is formed, it is necessary to evaluate cluster influence on the country that is versatile. The main methodology goal was to perform initial research of regions' biomass demand fulfilment, which was used for cost and benefit analysis. The methodology's precision is related to incentive of biomass energy's economic research.

A few aspects were pending – a region's competitiveness and clusters' influence for the economic situation of an entire country. It is necessary to evaluate regions' competitiveness so that every region has a distinctive economic specification, which determines the unequal regions input to a country's welfare growth. Then precise research of regions' economic potential can lead to conclusions, where divert investment flows. When the exact regions data is gained, penetrating investment to regions effectiveness is evaluated, and then a cost and benefit analysis is performed. The main strengths of the methodology are the ability to research perspectives on a region's energy independence, also by enabling the design of a region's energy strategies. The methodology can help eliminate negative interpretations, which could appear due to unavailable data. The methodology shows how to make initial research, which would provide the necessary background for in-depth analysis. The essential weakness of this methodology is the necessity for specific data. Research results would be incomplete, without data on biofuel's potential and utilization.

Primarily pending comparative indexes are usable for research on a country's administration regions economic potential. The potential is importantly evaluated therefore, that will find the precise influence for country in economic opinion. For potential use, a constantly changing market situation can have a negative influence. Therefore, both strategic resources and strategic potential wise can talk about the potential use grade. They show the relation between made production and strategic potential (Ginevicius and Andriuskevicius, 2000):

$$MP = \frac{SP}{SPUG} \tag{1}$$

where: MP – Made production; SP – Strategic potential; SPRG – Strategic potential use grade.

The next index is intended to search opportunities developed in various business in several regions. The regional coefficient (RQ) is calculated by the formula:

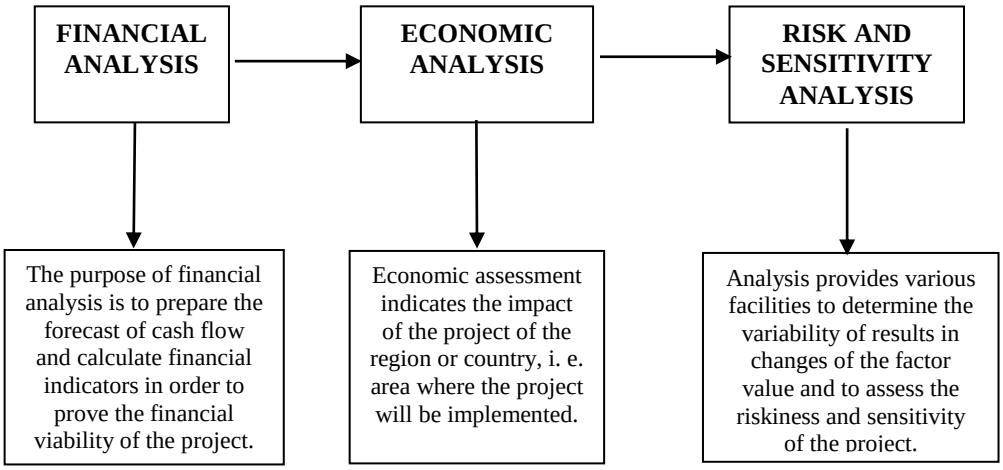
$$RQ = \frac{\frac{E_{ij}}{E_j}}{\frac{E_{in}}{E_n}} \quad RQ = \frac{\frac{E_{ij}}{E_{in}}}{\frac{E_j}{E_n}} \tag{2}$$

where: E_{ii} – employment i industry j region; E_i – general employment j region; E_{in} – national employment i industry; E_n – general national employment.

If the regional coefficient exceeds 1, it means that comparative employment in a particular region and in a particular industry is higher than the average country employment. Accordingly, RQ below 1 demonstrates a lower than average comparative employment in the particular region's industry sector. If RQ is higher than 1, 25, this shows regional specialization in a concrete industry sector.

Cost and benefit analysis (CBA) assists in finding all possible benefits and costs, which can be comprised when a cluster develops an investment project. CBA especially take off then, when expanding sustainable development ideas area.

CBA has three parts – financial, economic and sensitivity analysis. It warrants that an analysis will be performed widely and with reference to various aspects, that this allows the evaluation of a phenomenon's acceptability and opportunity development in new business.



Source: Baranauskiene (2013)

Figure no. 2 – CBA component and purposes

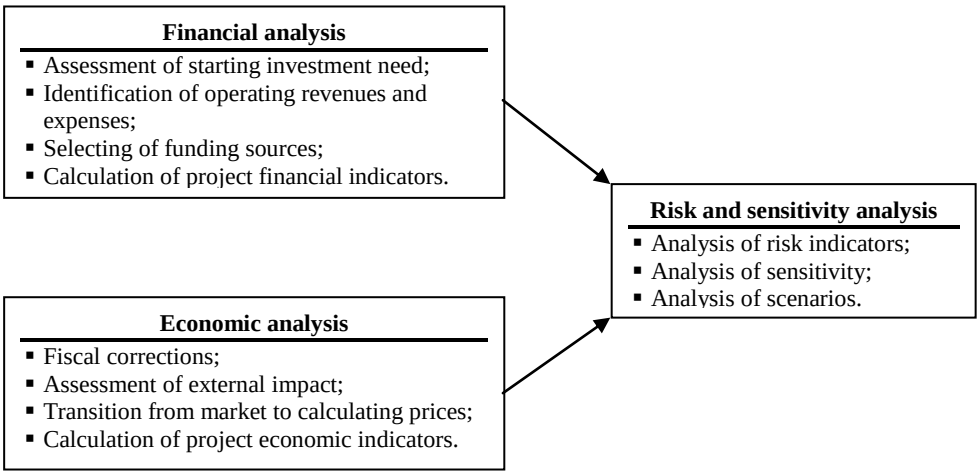
Clusterization creates benefits for country economy by often invoking particular methods or these methods' groups. However, these methods tend to be complex and therefore a cluster for companies is created which in the long term is usually beneficial for countries' economies. CBA can assist objective research clusters to generate an influence on market and country, because this analysis includes various methods, which help to evaluate both benefits and costs created by the cluster. Often clusters create much more benefits than these costs require, because several companies have different resources, that are shared in cluster (see Table no. 2).

Table no. 2 – Cost and benefit analysis in cluster case

	Demand side	**Supply side**
Benefits	Customer proximity	Knowledge spillovers
	Reduced customer search costs	Specialised labour
	Information externalities	Infrastructure benefits
	Reputation	Information externalities
Costs	Congestion and competition in output markets	Congestion and competition in input markets (property and labour)

Source: Kuah (2002)

When researching several cases by CBA method, indicators must be excluded, with their assistance research will be performed. Costs and benefits analysis is made up of three parts, which assist in evaluating desirable development activities demanding both projects investors and society, that feel a project's impact. Necessary information for such analysis is provided in the figure below (see Figure no. 3).



Source: Baranauskiene (2013)

Figure no. 3 – CBA components

When available, all required costs and benefits component data give the possibility to calculate the benefit and cost ratio (BCR). This comparative index shows how a constructive project is for its developers and investors, herewith simplifying the final decision to invest acceptance opportunity. Benefit and cost ratio is calculated using the following formula:

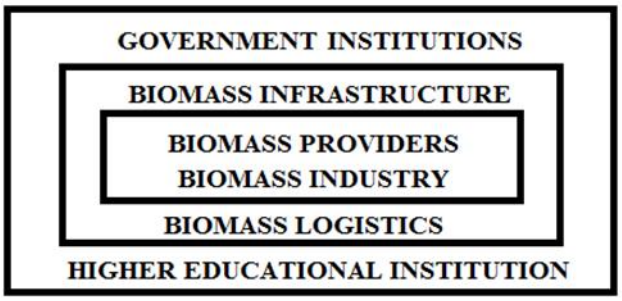
$$\frac{B}{C} = \frac{PV(B)}{PV(C)} \tag{3}$$

where: *PV (B)* – Present benefit value; *PV (C)* – Present costs value

For our research we used data from the Lithuanian biomass energy sector, which fits a general cluster's influence for macroeconomics research. The assumption was that in the country a wide extent biomass cluster is formed, which can satisfy chunk country heat and electricity needs, thus reducing energy import and use of large biomass resources in the country. Thus we can search for general cluster influence for macroeconomic development.

Biomass cluster structure is directed to one purpose: to satisfying a country's energy demand and to create benefit, which is noticeable at macroeconomic level. Herewith on biomass clusters occasion, often geographical position is not necessary, because biomass is an easily transported material. Also biomass equipment producers dispensable are in separate regions, because both equipment installation and observation can work expeditiously. However, for the purpose of profitability and appreciation in other objective cases (biogas and their components resort in locally), basic biomass raw centres will be within the local cluster core (see Figure no. 4).

Biomass cluster core consists of biomass providers and biomass industry subjects – biomass cauldron, equipment producers, construction and exploitation subjects. The second layer of operative service structures – the infrastructure concerned with the necessary electricity transmission system, consists of biomass logistics companies. Policy dictates government institutions, and higher education institution's purpose – searching for more effective cluster working ways, enrich it with innovations.

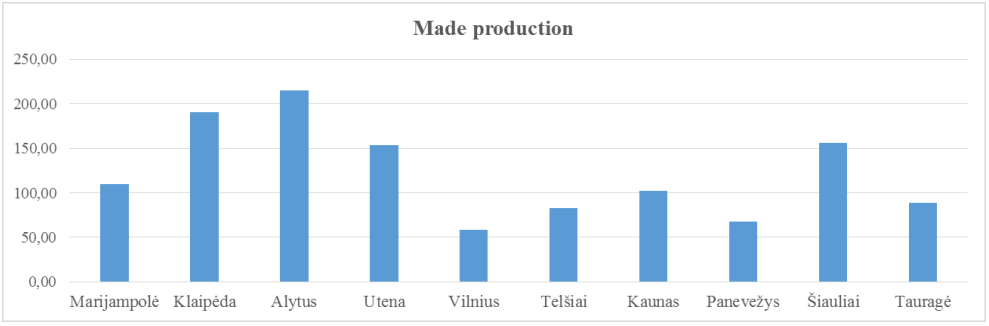


Source: made by authors

Figure no. 4 – Simplified biomass cluster structure

When the biomass cluster structure is formed, several regions are searched. Performing benefit and costs analysis is needed to investigate all country regions by their facilities providing renewable fuel. Investigating them is obvious, which investment part imposes them and what financial benefit investors will obtain.

Made production calculation evaluates Lithuanian regions situation. Regions are fairly different – one of them dominates the large forests area, but their use is lower. Other territories starve on forest resources, but they nevertheless suffice to provide heat for region.



Source: made by authors

Figure no. 5 – Made production information by Lithuanian regions

The lowest index meaning distinguishes these regions, which are great Lithuanian cities. At the same time, lower indexes certainly indicate a lower economic development, but with more forest regions, which will have huge strategic biomass potential. When more biomass is used, the general macroeconomic situation can be improved, because raising local fuel is usable to create new workplaces and increase collected tax amount.

When appreciating a regional coefficient's apparent similar trends – less regional coefficient in great cities regions, one can nevertheless state that evident regional specialization exists. Cumulating this index means that this region will show much bigger increase in cluster influence for macroeconomic processes.

Smallest index meaning apparent in the region, which is established in country capital and which is the most advanced in economics. Also, the main country city at this moment uses fossil fuel, which requires heat production. Most index meanings are in forests regions,

where almost all places for heat production use biomass. Many regions set fairly gradually and distinguish important employment in biomass fatigue for energetic industry sector.

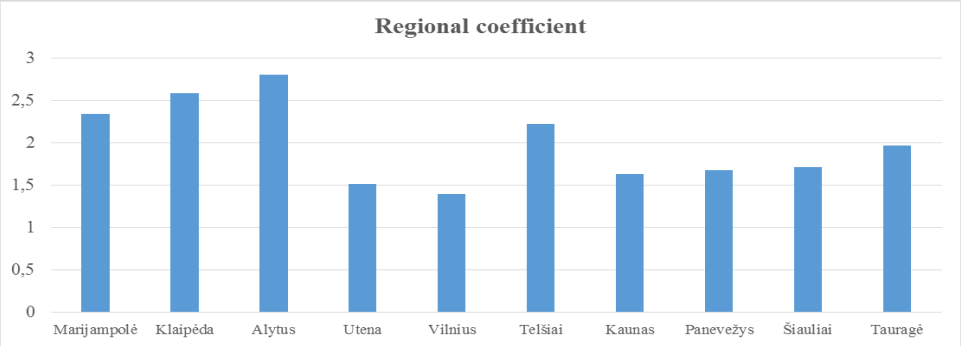


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Figure no. 6 – Regional coefficient information for Lithuanian regions

Benefit and cost analysis for biomass cluster case allows to solve one of the basic evaluation problems – in this analysis both available benefits for project developers are related, and positive influence of society and country when it allows to develop a project (Table no. 3).

Table no. 3 – Benefit and costs analysis creation required components

Benefit components	**Costs components**
Financial benefit	**Investment costs**
Energy production layaway	Biomass plants
Heat damage reduces effect	Cogeneration biomass plants
Electricity sales	Storage sites
Heat sales	Electricity connects
Gas sales	Manifolds
Incomes for burning	Work costs
	The test works
	Reconstruction
Economic benefit	**Operating costs**
Citizens layaway	Fixed exploitation costs
EU Pollution limits quantity reduction	Non – qualified employee costs
Business layaway	Qualified employee costs
Waste removal benefit	Inside heat energy consumption
Silt removal benefit	Biomass fatigue costs
Water vegetation removal benefit	Fuel
Grain cleans removal benefit	Electricity
Straw removal benefit	Amortization
Public wood removal benefit	Manifolds care
Other wood removal benefit	Ash removal costs
Social pay reduced benefit	Required work implements
Financial benefit-cost ratio	2,189
Economic benefit-cost ratio	1,841

Source: made by authors

Financial benefit in the biomass clusters case is a versatile subject to cluster specification. Incomes for burning are obtained, when burning waste. Clusters can sell green heat, electricity and gas. Energy production layaway emerges, when rear new burning equipment with heat from stream extraction. This decision helps with the smaller fuel production, more heat energy and better use of equipment. BCR is much more than recommended value.

The economic benefit for society is various. It concerns both waste and unused fuel removal, and social welfare growth, unemployment decreases and increase in taxes for the country. Another economic benefit is when people and businesses save finance which early impose to buy energy. As macroeconomic opinion exact economic analysis information shows, clusters cannot only create value for their partners, but clusters benefit society groups. BCR shows that the economic benefit to society is obvious.

Operating costs group in this case is very wide. It concerns with a cluster's pursuit of a wide activity spectre, from biomass fatigue to biomass usage. Every operating flank encounters various costs, which then relate to obtain the general cluster's operating costs group. Most expenses are imposed on employee earnings, fuel and amortization.

Biomass clusters with their activity create large economic and financial benefits to both interested subjects and society. They lead to higher incomes, when usable local renewable fuel allows to divert investment to new directions, and create economic benefit letting regions and societies develop and increase general country competitiveness levels. A cluster involves various business subjects, and this determines that investment and costs divert to wide spectre ranges.

4. CONCLUSION

The clusterization influence on a country macroeconomic development is unambiguously positive – encouraging new workplaces and technology creation. The cluster encourages country competitiveness to increase, and growing work productivity allows the creation of new additional value throughout the country. Cluster strategic fit model shows that both cluster partners competitiveness and country opportunities can form a synergy, which enhance a country's economic potential. The research methodology is oriented in the country and its regions' potential evaluation, also allowing to perform a cluster's financial opportunity analysis and to evaluate how separate regions have particular resources, which are needed in production processes, and which then can develop cluster activity. The case study of Lithuania's example indicated that higher potential and regional coefficient indexes are in rural regions. Higher indexes in rural regions appear, because provincial regions concentrate human and natural resources in order to fulfil cities' demand.

The costs and benefits analysis, which assists in researching both cluster influence on its partners, and cluster influences for the country macroeconomics, shows that such influences are increasing. In our analysis, we have used various individual indexes groups, and we have finally formalized the benefit and cost ratio. Our clusterization benefits research invokes the biomass cluster example in the energy sector. The cluster activity creates not only financial benefits for its partners, but also economic benefits for society groups, because renewable wood wastes are usable. This allows the reduction of imports and creates new workplaces. Most operating costs stay in locally, and this contributes to the improvement of the general macroeconomic situation.

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