

**CLUSTER ANALYSIS OF EXPRESSION OF ENTREPRENEURSHIP  
CHARACTERISTICS IN THE EU INNOVATIVE PROJECTS FOR SME's AND  
KTU REGIONAL SCIENCE PARK**

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**Abstract**

The actuality of entrepreneurship induces important and profound research in this area. The questions of entrepreneurship expression are valuable for business practice defining the expressed characteristics of entrepreneurship. The empirical research presented in the article is based on theoretically defined characteristics of entrepreneurship expression in economic, managerial, social cohesion, and environmental activities in an enterprise.

The research problem of the article is expression of entrepreneurship characteristics and its peculiarities in the EU (European Union) innovative projects for small and medium size enterprises (SMEs) and KTU Regional Science Park. The research is based on cluster analysis of entrepreneurship characteristics analysing projects' content and interviewing enterprises of KTU Regional Science Park.

The made cluster analysis reveals the different clusters of entrepreneurship characteristics combining them as connected for some reasons and actuality in enterprises and projects. Researching the EU innovative projects for SMEs under the programme FP6 (2002-2006) two clusters were found. The first cluster is the cluster of entrepreneurial characteristics reflecting orientation to production. The second cluster is the cluster of entrepreneurial characteristics reflecting innovative orientation. The made cluster analysis allow make the assumptions that innovation and orientation to production are desirable in the activity of enterprises working by projects regime and expecting the support from the EU funds.

Researching the enterprises of KTU Regional Science Park three clusters were found. The first cluster is the cluster of modern managerial characteristics. The second cluster is the cluster of entrepreneurial characteristics reflecting orientation to society development and responsiveness to society. The third cluster is the cluster of entrepreneurial characteristics striving to be competitive and socially responsible. Such clusterisation of entrepreneurship characteristics expressing in the enterprises of KTU Regional Science Park reveals that social aspects and modern entrepreneurial management are the main accents of the expression of entrepreneurship in the park.

The fulfilled cluster analysis revealed that only part of theoretically grouped characteristics of entrepreneurship are expressing in practice by connecting with each other. The clusterisation allows make the assumptions on the orientation of activity in the researched enterprises.

The made research is valuable for entrepreneurial enterprises clarifying their activity priorities and for SMEs applying for the EU funds support. Also research results may be useful for enterprises valuating their activity from entrepreneurial viewpoint.

**Keywords:**

**Entrepreneurship, cluster analysis, characteristics of entrepreneurship.**

**Introduction**

Entrepreneurship as a phenomenon is the object for research for many years, but as any phenomenon it is changing and requires deeper investigation in fast developing economic and business environment. There should be stressed that especially expression of

entrepreneurship is researched not enough. Expression questions are discussed as separate factors or aspects in research works, and sometimes there is a lack of systematic approach. The research of this article is based on theoretically defined characteristics of entrepreneurship expression empirically tested in

practical business activity. These implications reveal the *research problem* how to evaluate the expression of entrepreneurship characteristics and its peculiarities in the EU innovative projects for SMEs and KTU Regional Science Park.

*The research aim* is to define different clusters of expressing characteristics of entrepreneurship in the EU projects for SMEs and enterprises of KTU Regional Science Park.

*Research object* is entrepreneurial characteristics expressing in the EU projects for SMEs and enterprises of KTU Regional Science Park.

*The tasks* of article are: shortly present theoretical background of the research of expression of entrepreneurial characteristics; present research methodology for cluster analysis of entrepreneurial characteristics' expression in the EU innovative projects for SMEs and KTU Regional Science Park; and evaluate the research results.

### Theoretical background for research of expression of entrepreneurship characteristics

As theoretical research problem reveals, entrepreneurship concept is changing depending on economic and social development and its transformation. Importance of entrepreneurship as phenomenon is

nevertheless smaller than in previous economic situation, but the context and its perception may be different.

Analyzing research works on entrepreneurship and related questions (Schumpeter, 1934; McClelland, 1961; Shapero, 1975; Vesper, 1980; Pinchot, Pinchot, 1983; Hisrich 1986, 1989; Siropolis, 1986; Peters, 1989; Drucker, 1992; Lydeka, 1996, 2000, 2001; Mintzberg, 1998; Juzevičius, 1998; Swedberg, 2000; Messeghem, 2003; Grebel, 2004; Zakarevičius, 2004; Stokes, 2004; Bannock, 2005; Martinkus, Žičkienė, 2006; Fuller, 2001, 2006; Warren, 2006; Ginevičius, Sūdžius, 2006; Kvedaravičius, 2006; Kriščiūnas, Daugėlienė, 2006; Janiūnaitė, 2007 ir kt.), and analysing the evolution of research schools, it is possible to disclose characteristics of entrepreneurship expression. Those characteristics systematically can be divided into the appropriate groups. Those groups encounter different theoretical characteristics of entrepreneurship, expressed in economic, managerial, social cohesion, and technological (also environmental) activity. Those mentioned characteristics are crystalized analysing scientific theories of economy, and management, starting from Schumpeter works. In totality they reflect the context of entrepreneurship concept in the economy, based on knowledge, innovation and technologies (see Table 1).

**Table 1. Theoretical characteristics of entrepreneurship expression**

<b>Theoretical characteristics of entrepreneurship's expression</b>	
<u>Economic activity</u> Profitability Activity effectiveness Competitiveness Creation of new job places Economic risk Economic vitality Added value creation Meaning for financial investments Risk capital investments Meaning of production/ services process Coordination of production factors Activity dynamics Value of trade mark	<u>Social cohesion activity</u> Responsiveness to the owner Responsiveness to investors Responsiveness to employees Responsiveness to society Friendliness to problematic social groups
<u>Managerial activity</u> Innovation creation and usage Change management Knowledge creation and usage Human resources quality and management Learning and training Implementation of sustainable development concept Existence of team work Existence of entrepreneurial motivation Organizational development Leadership Meaning of decision making Networking Appliance of intrapreneurship Appliance of virtuality Consumer needs' research	<u>Technological (also environmental) activity</u> Appliance of scientific and technological research and their results Appliance of new technologies Usage of information technologies Saving resources Implementation of cyclical production Implementation of cleaner production

Complexity of entrepreneurship phenomenon implicates further research. One of the important questions is how evaluate expression of entrepreneurship. The question is fragmentally analysed in theoretical works and implicates more detailed studies in this sphere.

Combination of theoretical entrepreneurship characteristics can disclose perception of entrepreneurship expression in an appropriate researched area or object. The whole complex of characteristics should reflect fuller perception of entrepreneurship expression and penetration in practice, developing innovative, competitive, knowledge, and technology based entrepreneurial business.

### Research methodology

Research is based on two researching objects – EU FP-6 innovative projects for SMEs (2002-2006) and enterprises of KTU Regional Science Park. The research aim is to reveal the expression of characteristics of entrepreneurship in projects and enterprises of the park as in different areas of expression of characteristics.

The analysis of the EU projects is based on content analysis identifying the expressing characteristics of entrepreneurship in the researched area. There were analysed three groups of projects: Collective Research, Co-operative Research and Economic and Technological Development projects, devoted to the EU SMEs' development. There were analysed 213 projects at all. The results of content analysis allowed to fulfill the cluster analysis of entrepreneurship characteristics expressed in the projects.

The other part of the research is the research based on interviewing managers of enterprises of regional science park of KTU. Enterprises of the park are considered highly entrepreneurial, competitive, and innovative. For that reason they are meaningful and appropriate for research of expression of entrepreneurial characteristics. The aim of interview is to identify entrepreneurial characteristics expressing in the activity of enterprises of KTU Regional Science Park.

The regional science park of KTU joins 44 enterprises and 25 enterprises – as associate members. Interview was fulfilled in 12 enterprises, found as the most progressive and competitive in the park.

The research instrument was an interview questionnaire. The questionnaire was constructed from 5 parts, based on theoretical reasoning on expression of entrepreneurship. The first part of questionnaire is devoted to relativity of entrepreneurial characteristics. The second part is appointed to research the meaning of entrepreneurship characteristics for overall business success. Characteristics of entrepreneurship, meaningful for Lithuanian business, are presented and evaluated by managers of the park in the third part. The fourth part of interview questionnaire was constructed for displaying entrepreneurship characteristics in researched enterprises. The fifth part of questionnaire is constructed for evolution of entrepreneurial characteristics.

Question types are various for seeking to guarantee reliability and exactness of information, as well as informativity.

Interview results' analysis is from several stages:

- Analytical tables are made, based on theoretical considerations and entrepreneurship characteristics. These reflect frequency and expression of characteristics in different enterprises.
- Analysis of characteristics of entrepreneurship is revealed on characteristics' level of frequency.
- Factors and sources changing entrepreneurship concept are analyzed by cluster analysis.
- The overall results evaluation is made.

### Results of cluster analysis

Researching the innovative projects for SMEs there was found two actual clusters of entrepreneurship characteristics, expressed in them. The first cluster is the cluster of entrepreneurial characteristics reflecting orientation to production in activity of enterprises taking participation and being financed by structural funds (see Table 2).

**Table 2.**

<b>Cluster of entrepreneurial characteristics reflecting orientation to production</b>	
<i>Economic activity</i>	<i>Social cohesion activity</i>
Profitability Economic vitality Meaning of production/ services process Coordination of production factors	
<i>Managerial activity</i>	<i>Technological activity</i>
Human resources quality and management Consumer need research	Appliance of scientific and technological research and their results Appliance of new technologies Saving resources

As it may be seen from Table 2, such a clusterisation of entrepreneurial characteristics reveals a special attention to manufacturing enterprises, especially to those, which apply research in their activity. Enterprises using the newest research results, new technologies, saving resources are desirable in projects activity. Oriented to manufacturing enterprises seek to be profitable. They

research consumer need, applying appropriate policy of human resource management. The aspects of social cohesion are not a priority in researched projects.

The second cluster of entrepreneurial characteristics may be seen in Table 2. Clustered characteristics are reflecting innovative orientation.

**Table 3.**

<b>Cluster of entrepreneurial characteristics reflecting innovative orientation</b>	
<i>Economic activity</i>	<i>Social cohesion activity</i>
Activity effectiveness Competitiveness	
<i>Managerial activity</i>	<i>Technological activity</i>
Innovation creation and usage Knowledge creation and usage Implementation of sustainable development conception	Appliance of new technologies Saving resources

Innovation is a priority implementing the EU supported projects for SMEs. Striving to be competitive and to work effectively small entrepreneurial enterprises must use innovation; create knowledge, apply new technologies. The made cluster analysis reveals such priorities of enterprises

The made cluster analysis of expression of entrepreneurial characteristics in KTU Regional Science Park is presented in Table 4; 5 and 6.

As it could be seen from Table 4, the cluster involves

characteristics expressing in economic and managerial activities. Enterprises of KTU Regional Science Park actualize those two activity spheres. The park connects SMEs, which are interested in applying all managerial possibilities for effective results and successful position in the market. Implementation of cleaner production or pollution prevention is also a priority. Environmental characteristics express in the enterprises of the park as the enterprises value environmental aspects as important in their activity.

**Table 4.**

<b>Cluster of modern managerial characteristics</b>	
<i>Economic activity</i>	<i>Social cohesion activity</i>
Economic risk Meaning of financial investments Meaning of production/ services process Coordination of production factors Risk capital investments Added value creation Value of trademark	
<i>Managerial activity</i>	<i>Technological activity</i>
Change management Meaning of decision making Existence of entrepreneurial motivation Implementation of sustainable development concept Leadership Appliance of virtuality Networking Appliance of intrapreneurship Consumer need research	Implementation of cleaner production

The cluster of entrepreneurial characteristics is reflecting orientation to society development and responsiveness to society (see Table 5).

Creation of new job places and responsiveness to society fits together in this cluster. Also economic vitality

is related with human resources quality and management, organizational development, existence of teamwork.

Entrepreneurial characteristics striving to be competitive and socially responsible are clusterising in the cluster, presented in Table 6.

**Table 5.**

<b>Cluster of entrepreneurial characteristics reflecting orientation to society development and responsiveness to society</b>	
<i>Economic activity</i>	<i>Social cohesion activity</i>
Economic vitality Creation of new job places	Responsiveness to society Friendliness to problematic social groups
<i>Managerial activity</i>	<i>Technological activity</i>
Human resources quality and management Organisational development Existence of teamwork	Saving resources Implementation of cyclical production

**Table 6.**

<b>Cluster of entrepreneurial characteristics striving to be competitive and socially responsible</b>	
<i>Economical activity</i>	<i>Social cohesion activity</i>
Activity effectiveness Profitability Competitiveness Activity dynamics	Responsiveness to the owner Responsiveness to investors Responsiveness to employees
<i>Managerial activity</i>	<i>Technological activity</i>
Innovation creation and usage Knowledge creation and usage Human resources quality and management	Appliance of scientific and technological research and their results Appliance of new technologies Usage of information technologies

As it could be seen from Table 6, in this cluster innovation of science and technology and social functions have a connection striving for innovative, knowledge-based business results. Creation and usage of innovation and knowledge allow striving for effectiveness, dynamism and competitiveness.

### Conclusions

- Cluster analysis of expression of characteristics of entrepreneurship revealed different in some way grouping of characteristics of entrepreneurship, presented in theoretical assumptions for research.
- Innovation and orientation to production are the emphasis on entrepreneurial enterprises activity, striving for financial support from various sources in the EU level.
- The modern entrepreneurial management is important for enterprises of KTU Regional Science Park. The researched enterprises give priority to production, implementing socially responsible and competitive activity.
- The connections among different characteristics may be object for further researching expression of entrepreneurship.

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