Integral Knowledge, Innovation and Technology Cluster – New Perspective of Labour Development

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Under the circumstances of rapidly growing globalization and social sustainability development, the importance of human capital in the context of economic growth is constantly growing. Human capital development and adequate employment development require the acquisition of new knowledge and the use of innovation and knowledge in regular activities. The targeted integration of knowledge, innovation and technologies becomes an essential tool in solutions of country's employment problems. The currently available studies lack employment sustainability quantitative measures organized into a sustainability component, as well as their expressions, so the objective of this article is to reveal the importance of knowledge, innovation and technology cluster for employment growth. In order to achieve this objective, the concept of intelligent specialization and a new cluster of knowledge, innovation and technologies have been introduced to promote efficient solutions to employment problems and to lead to positive changes in the labour market, expanding employment growth. The following methods of research were used in this article: analysis of scientific literature, theoretical and practical statements matching method, statistical analysis.

Keywords: cluster, development perspective, employment, innovation, knowledge, technology.

Introduction

The rapidly expanding globalization and the need for social sustainability development in a country enable the growth of competitiveness and the development of employment. The role of human capital for development of the economy is constantly growing if it is based on the importance of new knowledge, innovation and technology integration. Human capital becomes a key factor which, using its knowledge, is capable of implementing innovation and innovative technologies. Sustainable development and targeted integration of knowledge, innovation and technologies (further – KNIT) are the main tools for the world to overcome the existing and potential challenges in the future.

Talking about the intensification of creation of the value added and the possibilities to ensure of employment, primary focus is usually on the development of human capital powers. In Lithuania this problem is directly related to two aspects: first – the decline in potential labour, which is associated with very high migration and aging of population, and second – with the weakening factors for human capital – knowledge, innovation, technologies, and other factors. The degradation of quantitative and qualitative characteristics of human capital prevents the creation of value added. However, researches into sustainable development lack a quantitative measurement of sustainability and also the unified concept and expression of sustainability. Therefore, the general motive of the problem can be formulated as a holistic approach to human capital development and its utilization in the area of production – employment.

It follows that the objectives should include:

- The presentation of smart specialization (Kuleševičiūtė, Rybakovas, 2015),
- The formulation of a new KNIT model, which is oriented to specialization implementation (Rutkauskas, 2012; Rutkauskas, Račinskaja, 2013),
- Decline of the emigration flows (Lietuvos Statistikos Departamentas, 2015),
- The formation of learning system, which is focused on efficient participation in the labour market (Žiogelytė, Kšivickaitė, 2014),
- The positive change of the labour market (Barkauskas, 2009; Rutkauskas, Račinskaja, 2013; Genevičiūtė-Janonienė et al., 2014).

In this case, the positive labour market change is understood as a demand, formulated by the smart specialization for qualified employees, many of whom are unemployed. It follows that solutions for employment development can be successful only through the smart specialization and target development of the cluster of scientific knowledge, innovation and technologies. The preparation of the concept of such cluster and integration of functions of its components – knowledge,

innovation and technologies – creates preconditions for easier understanding of main principles of smart investment, thereby fostering the country's sustainable social development and educating human capital powers, what finally would have a positive impact on employment.

The Concept of Human Capital in the Light of Employment Research

Economic growth is driven by three factors of production – land, labour and capital, and entrepreneurship, which is now increasingly mentioned. In the article the authors will focus on the labour factor, emphasizing the importance of human capital in creating value added to the economy. Work is a totality of human resources, and the importance of human capital has been increasing in the recent decades.

Before World War II employment researches were carried out by Vilnius University, Vytautas Magnus University in Kaunas, but after World War II researches were carried out not only at Vilnius University, but also at Kaunas University of Technology, Vilnius Institute of Civil Engineering, and at departmental authorities of the ministries and planning committees, as well as at the Institute of the Economy of the Lithuanian Academy of regaining Sciences. After regaining independence, attention to the problems of employment declined, many universities closed their labour departments, and the main potential of professionals in employment and labour market were concentrated in Lithuanian Labour Market Research Institute, which was established by the Ministry of Social Security and Labour. However, individual scientists was working in the field of employment at Vilnius University, Vilnius Gediminas Technical University, Kaunas University of Technology and Vytautas Magnus University. Since 2000 (XXI century), the themes of employment have been included into research more actively. Employment studies were particularly facilitated by the inclusion of human capital into the scientific space.

Different concepts of human capital is analysed in works of various scientists (Becker, 1975; Ployhart et al., 2011; Dean et al., 2012; Bezat-Jarzębowska, Rembisz, 2014; De Jong et al., 2014; Potelienė, Tamašauskienė 2014; Peng et al., 2015). Nowadays the concept of human capital has several aspects, which depends on the analysed object, personal characteristics or other factors. Human capital is difficult to imitate, so it is seen as a strategic resource, leading to improved performance and efficiency of the company. Talking about a broader definition of human capital, it may include social capital, defined as a resource that is embedded

in a CEO's network relationships such as political ties. In that way, human capital is necessary to use to understand differences in organizational performance, solving the main tasks (Ployhart et al., 2011). This is well known and an important factor that predicts corporate success and in that way human capital reflects the independent nature of human and social capital and the difficulties of isolating the effect of one from the other (Peng et al., 2015).

The concept of human capital is also known as an explanatory variable for cooperative behaviour, so it is defined as the accumulation of knowledge and skills as a result of education and experience (Becker, 1975; Bezat-Jarzębowska, Rembisz, 2014; De Jong et al., 2014). Here the definition of human capital is the compilation of talents, skills and knowledge of company's workforce. The most common definition of human capital focuses on the knowledge, skills and abilities that are used by the individuals, but lately, rapidly evolving innovations, innovativeness have been also included. In this way, innovativeness is understood as the ability to apply innovations at its usual activity. It follows that an individual who has necessary knowledge, skills, intelligence and is using innovation in his activity can 'contribute' to wealth creation. So, human capital becomes the main source of growth and prosperity. This creates the ability to cope with the tasks assigned and creates preconditions for the need for the development of smart specialization to appear. The unique talents and knowledge of human capital also create the competitive advantage for the company (Dean et al., 2012).

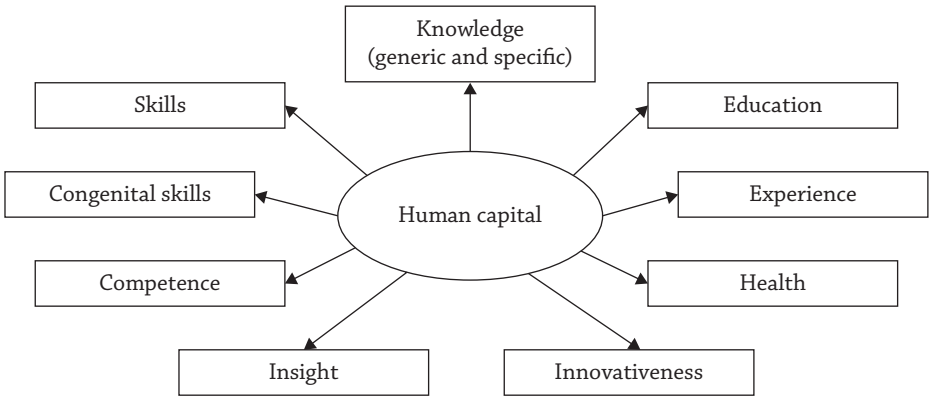
Other scientists (Potelienė, Tamašauskienė, 2014) also understand human capital as personal knowledge, acquired skills, education, experiences, attitudes, behaviour, intelligence, creativity, entrepreneurship, motivation, innovativeness, insights, gained experience, state of health, energy, orientation in the environment with the ability to use knowledge and skills properly and timely, as well as other personal characteristics that may increase individual's productivity and incomes in the form of wages. The structure of human capital is presented in Figure 1 reflecting the main factors for the development of human capital.

Smart specialization is a concept of innovation policy, designed to show the efficiency of public investment in science research (Kuleševičiūtė, Rybakovas, 2015). Its objective is to transform regional innovation in order to achieve economic growth and prosperity, empowering regions to focus on their strengths. The concept of smart specialization also can be used for to ensure employment development.

In the most general sense, employment can be understood as willing to supply the job for all individuals and the relevant 'cooperation' of employees in order to create a general product or service (Ackers, 2014). Employment is often associated with the development of the country's economic activity, because the

country's economic performance has positive effects on the growth of employment. Currently, the economy of Lithuania is growing, and in the near future the country is expected to maintain both economic and employment growth.

Figure 1. The main factors for the development of human capital



Source: compiled by the authors, based on Potelienė, Tamašauskienė (2014).

Analysing the impact of economic factors on segments of the labour market, it is possible to distinguish the main areas of the given issue (Jakštienė, 2012):

- Researches related to the segmentation of the labour market (labour market is divided into separate segments, but a distinctive characteristic is that the formation of different segments of the labour market is interpreted differently),
- Dependences between employment in different labour market segments and researches of economic factors (analysis includes changes in the economic environment depend on employees' competitiveness and factors related to operating activities, investments in human capital, implementation of technical and technological level of innovation in business, political and legal environment, the purchasing power, gross domestic product dynamics and other factors),
- Research into the assessment of impacts of economic factors on employment of labour market segments (scientists are using different econometric analysis methods to determine the impact of different economic factors on employment of different segments of the labour market). Economic factors have a direct impact on the employment rate and thus the labour market.

Labour market is a system of economic relations for labour force selling and buying, in which the categories of labour supply, labour demand and wage are being formed. Some of the key indicators to assess the current economic and social situation of a country are labour market indicators. While analyzing the situation

in the labour market, it is necessary to focus on indicators, which are applicable in official statistics (Gatti et al., 2012; Hyatt, Spletzer, 2013; Tendziagolskytė, Rudzkis, 2014): the level of employment and unemployment, the total number of the employed, the number of employees in the private and public sectors, the number of unemployed, labour force, number of employees.

The participants of different segments of the labour market are differently sensitive to the impact of economic factors, so different assessment methods for the employment of labour market segments, which is conditioned by the changes of economic factors, are used:

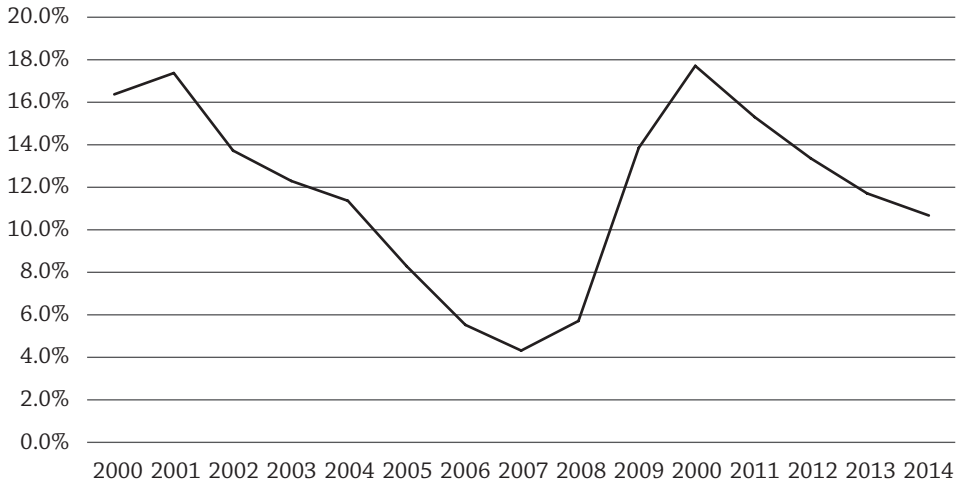
1. traditional methods of research (comparing the data across the approach of time, country, region, territory and its clustering, statistical analysis) (Pocius, 2010; Gruževskis, 2011; Hyatt, Spletzer, 2013; Tendziagolskytė, Rudzkis, 2014),
2. mathematical methods of statistics (correlation, regression analysis) (Andriušaitienė, 2004; Jakštienė, 2012; Kudoh et al., 2015),
3. survey methods (questionnaire) (Žalimienė, 2011; Genevičiūtė-Janonienė et al., 2014).

The above mentioned scientific research leads to the conclusion that the unemployment rate falls within a group of indicators characterizing the results of economic performance, together with average monthly wage and production volume indicators (Andriušaitienė, 2004), so Figure 2 presents the dynamics of unemployment rates in 2000–2014.

The unemployment rate is one of the main indicators, characterizing the socio-economic differentiation. When unemployment rates are growing, the revenues to local budgets are shrinking, respectively decreasing spending for the economy, wages, and capital investment. These negative changes create preconditions for the growth of poverty and an increase in emigration, where most of emigrants are young people able to work (Andriušaitienė, 2004). Figure 2 shows that during the period at issue the unemployment rate was constantly changing. 2007–2010 witnessed a dramatic rise in unemployment, which could be linked with the period of the economic crisis.

According to the results of research of other scientists (Gruževskis, 2011; Žalimienė, 2011), it can be said that the lack of knowledge and experience, inadequate vocational guidance and not knowing where and what to study, and the lack of marketable profession precondition growth of unemployment, as companies tend to accept candidates with experience. The results of questionnaire survey (Žalimienė, 2011) show that more than half of respondents believe they have the appropriate knowledge and skills necessary for their work, and the dominance in the labour market goes to those, who create and control intangible assets: databases, technologies, images and human capital.

Figure 2. The unemployment rate of 15–74 year-old people in Lithuania in percentage, 2000–2014



Source: compiled by the authors, based on the data of the Lithuanian Department of Statistics (2015).

Acquiring new knowledge, using innovations and improved technologies naturally change the economic situation. Major changes driven by rapid global changes require new solutions related to the employment of labour market segments, focusing on the fundamental problems of the country – the lack of employment development (Jakštienė, 2012). A fundamental new solution could involve the use of integrated knowledge, innovation and technology cluster for the creation of intelligent jobs and increasing employment income (Rutkauskas, Račinskaja, 2013), in the environment of the changing nature of work allowing for flexible jobs (part-time work, flexible working hours) (Gruževskis, 2011). In addition, technological changes allow producing the same volume of production at a lower cost. This increases the competitive advantage and creates favourable conditions for the development of employment. Innovation, which has traditionally been analyzed in terms of patents and innovation quantities, enables the occurring of new, improved management methods. Accordingly, changes in working hours, the quality and the need for new scientific knowledge acquisition (Vivarelli, 2012; Rutkauskas, Račinskaja, 2013). In chapter 2 authors will discuss the integrated cluster of knowledge, innovation and technologies (KNIT).

Integral Knowledge, Innovation and Technology Cluster as a System of Employment Development

In the scientific literature, it is hardly possible to detect a more detailed interpretation of the progress of interaction between scientific knowledge, innovation and technologies in view of fostering sustainable development and of the forms of functioning of this interaction between development and integral KNIT cluster with respect to the use of human capital and employment. Realizing that the integral KNIT cluster is based on the human intellect, the transformation of the cluster into the self-organizing system becomes a self-evident process. However, it is an open question of how the KNIT cluster accumulates the potential of development factor, when the cluster itself is mainly composed of elements oriented towards the implementation of different functions. One more open question is whether past studies and implementation of development opportunities have used an adequate structure of the KNIT cluster integrated in specific situations. A confrontation with the past should be given greater attention both in terms of understanding the development sustainability effect and increasing the opportunities of the integrated KNIT cluster in expanding employment volumes. The complexity of the integrated KNIT cluster structure and its changes are associated with the complexity of process or system selected for research. There is no doubt that understanding of the KNIT cluster structure for such sophisticated processes as employment development – is not only a critical but also an extremely high-level scientific challenge. The object of this research is the analysis of the KNIT cluster structure in pursuit of palpable employment development.

The assumptions and value of targeted knowledge, innovation and technology cluster development

The development of subsystems of knowledge, innovation and technologies and, even more so, the perspective of its integral network represent the most complex and thereby the most actual problems for people, and the perception of them may reveal the ways of development that are acceptable and feasible, and how to create conditions for changes in the working environment and wage levels. In addition, this becomes clear when generation of fundamental scientific knowledge and application of innovations and technologies are associated with the creation of intelligent jobs and improvement of wage conditions.

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Nowadays, there is an active integration of knowledge, innovation and technologies, whereas the growth of knowledge need and importance facilitates the emergence of a specialized multidimensional cluster of knowledge, innovation and technologies (Bojnec, Papler, 2011). The cluster is considered as a totality of the interconnected multiple subsystems (knowledge, innovation and technologies) that has a general object of cognition (Rutkauskas, Račinskaja, 2013). The essence of such cluster is to create the general system of existing and gained knowledge, evolving innovations and technologies, which would create a basis to manage properly the object, fostering its state and sustainable development. In terms of the economic system, this would have a positive impact on the economic development and employment. However, it should be noted that the use of KNIT differently influences employment. On the one hand, the implementation of innovation and new technologies often reduces the employment, increases the intensity and efficiency of the use of human capital. On the other hand, it creates conditions for new jobs, their territorial arrangement, improves the working conditions, reduces physical labour, and so on. The use of innovation and technologies often ensure higher wages, thereby increasing the attractiveness of employment in those activities and the motivation of staff.

The base of intelligence of the multidimensional cluster is knowledge as a key resource that promotes the ability to create uniqueness even in an uncertain environment. In the context of globalization, the essence of knowledge management, as an effective performance improvement measure, is based on the fact that in order to maintain the uniqueness, which could not be imitated by other organizations so fast, it is no longer sufficient to manage traditional resources. Knowledge has to focus on the management of essential and exclusive competencies, and organizations must be above the current level of knowledge and be able to create new knowledge at the lowest costs. Therefore, it can be said that in the modern economy the value of knowledge is and will keep growing along with the efficiency of knowledge upgrade. Knowledge and acquired competences have been increasingly determining the value of human capital, access to employment and satisfaction with working conditions.

Scientists are ambiguous in defining knowledge which is approached from different scientific positions (Hawryszkiewycz, 2010; Sullivan et al., 2011; Fletcher et al., 2012; Pacharapha et al., 2012; Glucker, 2013; Rutkauskas et al., 2013). By the levels, knowledge can be classified into: individual, group, organization, sector, state, regional and others. Individual and organizational knowledge can be distinguished according to the holder of the knowledge. Individual knowledge is person's knowledge controlled at the discretion of the individual and not necessarily related to the specific content. Organizational knowledge is related to the specific content.

Knowledge is also regarded as the organizational resource, corresponding to the principles of resource management: produced at the right time and in the appropriate form, available in the right place, fulfilling the quality requirement, created at the lowest costs. However, researchers note that knowledge has some distinctive features compared with other organization's resources: it is intangible, hard to measure and of a volatile nature; is not 'consumed', knowledge quantity increases by applying it; it can not be purchased at any time in the market, results often take some time to be produced; can be used simultaneously in different processes.

This uniqueness of knowledge is determined by knowledge being a substance, where the nurtured process is not yet associated with the energy required for the implementation of the process, and here we have the widest range of possibilities to explore (Sullivan, Marvel, 2011). Knowledge is seen as the ability to perform the specialized tasks and as a means of communicating information, or as experience; it is therefore appropriate to accumulate new knowledge by improving acquired skills and experience (Pacharapha, Ractham, 2012).

In summary of various scientific opinions, knowledge can be described as associated with individuals and their cognitive processes, as dynamically changing depending on changes in the structure of cognition, as a motive for action. Individual use of knowledge is the basis for transforming data into information and creating greater value for problem solutions, formulating, evaluating, adopting, and implementing solutions.

Information is an invisible asset, which is considered an essential resource in the value creation (Sullivan, Marvel, 2011). Improperly managed knowledge loses its value faster than material resources, so the current knowledge must be used in the most efficient way. Decreasing the knowledge demand by increasing the knowledge supply creates opportunities for using more advanced technologies and fostering innovations in business processes. It follows that in the context of the wide-ranging use of IT in corporate processes it has become vital to secure the successful application of technologies with a focus on such key factors as: asset, knowledge, skills and organizational processes. The analysis and interaction of these factors serve as a basis for the integration of knowledge and technologies, which promotes not only the search and application of more improved management methods, but also the changes of organizational business structure or more detailed presentation of industrial characteristics and the development of employment.

The concept of the analyzed assessment aspects suggests that innovations, especially technological innovations, become one of the essential uniqueness factors promoting the emergence of new technological achievements developing skills and knowledge. Technological innovation occurs at the junction of the technologies and innovations, when the application of technologies in the business area becomes more and more important in the economically developing world.

This kind of innovation is seen as an essential uniqueness factor which promotes the emergence of new technological achievements and creates possibilities for a return through the development of skills and knowledge required for employment promotion.

Innovations promote the interactive process of the generation and application of new knowledge. Using innovations, companies better meet the consumer needs, increase their operational efficiency, improve the product quality, reduce the project life cycle and finally improve their position in the market leading to employment growth (Zilber, Araujo, 2012). The results from the analysis of internal and external factors can be used for targeted fostering of innovations and their application in several ways. Consequently, the development of innovations and technologies highlights the need for necessary, missing knowledge. Therefore, knowledge, innovations and technologies are constantly interacting, leading to the formation of a multidimensional cluster which creates preconditions to foster employment with exclusive attention being paid to knowledge development.

Integrated Management of Intelligence and Knowledge, Innovation and Technologies Through Fostering the Development of Employment

A period of time when progress of knowledge, innovation and technologies are identified as key factors in enhancing employment sustainability and coherence already carries a historical significance. In the nowadays economy, the progress of innovation and technologies increases the flexibility of employment, provides more opportunities for employees to reconcile their work and family responsibilities on a more flexible basis; material disintegration of production (teleworking) creates conditions for employees to maximally adapt the working environment (time, intensity and so on) to their needs and possibilities. Identification of the functional possibilities of the KNIT cluster appears to be particularly active in solving the social, economic and general problems of sustainable employment development[1]. Yet, the cognition of anatomy and self-organizing patterns of the

[1] Sustainable employment development is defined as maintain of current level of consumption just to provide employment, hence only less work can lead us to a more environmentally conscious way of living (Schor, 2005). Sustainable employment is concerned with adequate job opportunities, job securities and purchasing power. It is the possibility to safe employment for those individuals who desire to work. It means that an individual remains in work in one job or by moving to other job and here are provided opportunities to advance and earn more in that work (Ashford et al., 2012; McQuaid, Fuertes, 2014). The interaction of sustainability and employment firstly reflects the technologically optimistic scenario of ecological modernization (when innovations enables the current economy to reduce its adverse effects on the environment also producing new "green jobs" in the growing "green economy")

integral KNIT cluster requires special efforts. However, assuming the real circumstances that the KNIT cluster probably becomes the only available resource for solving employment-related problems, revealing the value structure of the integral KNIT cluster becomes the problem required an urgent solution.

The use of the KNIT cluster in tackling employment problems

This research focuses on more employment solutions involving scientific knowledge, the progress of innovations and technologies as the key resources forming or directly influencing changes in employment. In this sense, an essential employment development condition is human capital development through the use of the targeted integration of knowledge, innovation and technologies.

Figure 3 presents a list of 12 components of country's development aggregated into four subsystems and abbreviated as follows: political – integrational - management and marketing (PIV); social (demographic) – economic – environmental (SEE); educational/professional - creative/cultural - religious (EKR); and financial – investment – innovation/technological (FII).

Figure 3. Subsystems of the country's universally sustainable development

INTELLIGENT INVESTMENT STRATEGIES										
POLITICAL SUSTAINABILITY	INTEGRATIONAL SUSTAINABILITY	MARKETING SUSTAINABILITY	SOCIAL-DEMOGRAPHIC SUSTAINABILITY	ECONOMIC SUSTAINABILITY	ECOLOGICAL SUSTAINABILITY	EDUCATIONAL-PROFESSIONAL SUSTAINABILITY	CREATIVE AND CULTURAL SUSTAINABILITY	RELIGIOUS SUSTAINABILITY	INNOVATIVE-TECHNOLOGICAL SUSTAINABILITY	FINANCIAL SUSTAINABILITY
PIM			SEE			ECR			FIT	

Source: Rutkauskas (2012); Rutkauskas, Račinskaja (2013).

and secondly, one is the "radical change paradigm" that abandons the ideals of an economic and social system based on growth, consumer society and full employment and advocates fundamental changes in the way we define work and welfare (Köves et al., 2013).

We will further present the definitions of the main components (Rutkauskas, 2012) of the country's universally sustainable development:

- *social – demographic sustainability* – the growth of power of human capital and the ability to reconcile harmoniously the different interests of various social groups, ensuring appropriate human existence conditions on every hierarchical level, and what is most important – the ability to understand the evolution of society, based on scientifically recognized regularities,
- *economic sustainability* – the result of the ability to use rationally both internal and externally attracted resources, while ensuring sustainable growth of the created economic results and employment development,
- *educational-professional-creative and religious sustainability* – the ability to combine learning, vocational education and training, and creativity in developing business intelligence, creative industries, dominance of creativity, and the knowledge economy, which ensures the balance of supply and demand in the labour market. Religious sustainability – the recognition of the humanity's moral values, prevention of hostility to religious themes, and attracting each person's specific attention to the problems of weaker and unhappier members of society, especially in the field of employment,
- *innovative – technological sustainability* – the ability to ensure the use of the most advanced technologies based on the most efficient innovations, in production and service delivery, as well as in ensuring sustainable employment development.

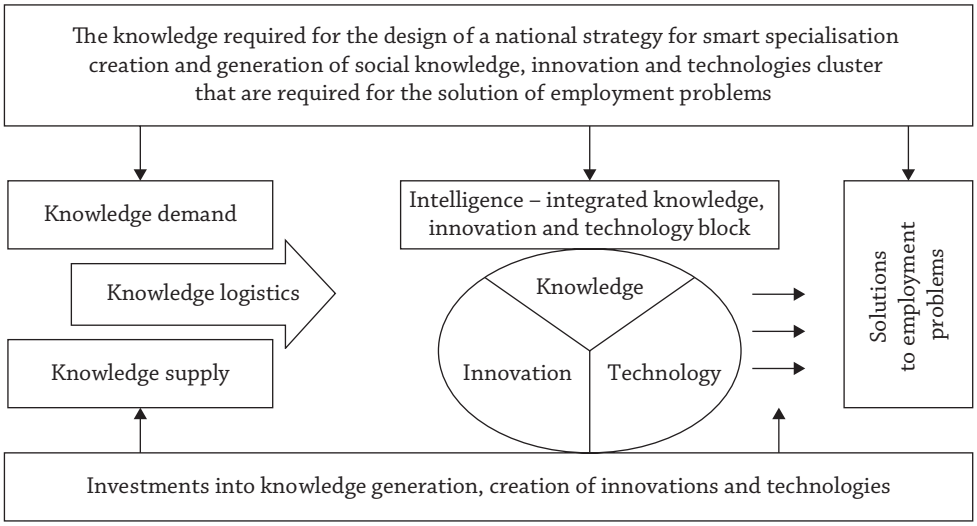
Figure 4 presents a systematised scheme of solutions to employment problems using the integration of knowledge, innovation and technology.

Acquisition of new knowledge required for the creation of smart specialization and fostering targeted integration of knowledge, innovation and technologies lead to changes in the working conditions. Firstly, knowledge provides the organization with real, but hardly identifiable benefits (Barkauskas, 2009), manifesting through the nurture of the tacit knowledge acquisition. The employment of skilled and experienced people is increased. The relationship of employment and smart specialization manifests it self in economic progress and improved competitiveness, as well as structural transformations of region's economic activities. Basing practical activities on innovation and technologies provides a competitive advantage and contributes to the specific potential of economic growth (Kuleševičiūtė, Rybakovas, 2015). The key factor required for the targeted integration of knowledge, innovation and technologies is investment that acquires both a material (monetary) and immaterial (knowledge) form.

The issues of human resource management has become one of the most important research objects. The rapidly changing country's economic situation, which is

due to advances in technological process and globalization, even more highlights the need for skilled and motivated employees in order to create a competitive advantage in the business environment (Žiogelytė, Kšivickaitė, 2014). Improper motivation of employee leads to the turnover of staff, reduced productivity and volumes of operations, additional costs, and company's loss of knowledge and experience.

Figure 4. The knowledge, required for the design of a national strategy for smart specialisation creation and generation of science knowledge, innovation and technologies cluster that are required for the solution of employment problems, system



Source: Rutkauskas, Račinskaja (2013).

In summary, the targeted integration of knowledge, innovation and technologies allows the development of employment that occurs during high value creation, increasing the employment and work motivation. This in turn ensures the sustainable development of the generated economic results and employment growth.

The illustration of experimental situation with optimized allocation of resources

Presuming that the sustainability of country's development can be analysed through a model of complex system, we have to admit in advance that the entirety of elements actually existing in reality is, as a rule, characterized by the following features:

- a very complex structure,
- high sensitivity to minor changes in dependencies between individual components,
- it is difficult to identify and verify it, even if its design or function, or both of them, are known,
- it is characterized by the abundance of interactions between different components,
- possibility of new features, or even states, to occur over time.

All these characteristics are common to the country's sustainable development phenomenon. However, if it is also required to have an open self-regulating system, whose functional purpose requires resources that, if becoming the input elements, can lead not only to changes in internal dependencies, but also have effects on individual subsystems and on the system itself, we have to agree that a system containing a totality of the above-mentioned features also requires the creation of adequate opportunities for the system cognition and management.

Figure 5. Optimal allocation of resources among four subsystems

1 subsystem	2 subsystem	3 subsystem	4 subsystem
0.26	0.32	0.2	0.22
Parameters: e=1.151202; p=0.77; r=0.029649			

Source: Rutkauskas, Račinskaja (2013).

Let us chose an analogue alternative for problem formulation and solution (Rutkauskas, Račinskaja, 2013) where the main roles in the subsystems of the country's development system are given to: 1. Employment sustainability, 2. Economic sustainability, 3. Educational, cultural, religious sustainability, 4. Innovative – technological sustainability.

Similarly, choosing the expert evaluation and the integral system's sustainability indicator to measure the selected sub-geometric mean, we can see that the most useful in this situation would be such a marginal investment unit (see Figure 5) in which the largest portion of the marginal unit is represented by subsystem 2 – economic sustainability.

Conclusions

- Over the years the importance and volume of employment research have been changing. Before World War II, employment researches have been carried out only in two major universities, but after World War II, when the concept of human capital has been increasingly included in the area of education, solutions to employment problems intensified. These changes have led to the creation of smart specialization, where innovation has enabled the rapid development of employment.
- Basing on the data from the survey (Žalimienė, 2011) used in the process of literature analysis, it can be concluded that people are not adequate in assessing their opportunities and skills. Therefore, the development of human capital is only possible through acquisition of required knowledge and application of innovations and technologies.
- The multidimensional cluster promotes the uniqueness and the ability to survive in the uncertain environment. The need to fill knowledge gaps enables the targeted integration of knowledge, innovation and technologies that fosters employment, because there is a need to recruit people with the necessary knowledge.
- The targeted integration of knowledge, innovation and technologies is focused on the fostering of social, economic, educational and innovative sustainability, so the mentioned knowledge system shows the importance of knowledge for the proper fostering of the structure of the KNIT cluster in view of solving employment problems. The conducted calculations suggest that adequate solution of employment problems requires the biggest investment flows to be must be directed towards the development of economic sustainability.

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Streszczenie

Integralny klaster wiedzy, innowacji i technologii – nowa perspektywa rozwoju pracy

W warunkach szybko rosnącej globalizacji i zrównoważonego rozwoju społecznego znaczenie kapitału ludzkiego w kontekście wzrostu gospodarczego stale rośnie. Kształcenie kapitału ludzkiego i odpowiedniego rozwoju zatrudnienia wymaga zdobycia nowej wiedzy oraz wykorzystania wiedzy czy innowacji w codziennych działaniach. Celowe: integracja wiedzy, innowacji i technologii stają się niezbędnym narzędziem w rozwiązywaniu problemów zatrudnienia w kraju. W obecnie trwających badaniach brakuje ilościowej analizy trwałości zatrudnienia. Celem artykułu jest ujawnienie znaczenie klastra wiedzy, innowacji i technologii dla wzrostu zatrudnienia. Aby osiągnąć ten cel, wprowadzono koncepcję „rozumnej" specjalizacji i nowego klastra wiedzy, innowacji i technologii, promowanie efektywnych rozwiązań problemów zatrudnienia i określonych pozytywnych zmian na rynku pracy, zwiększenie wzrostu zatrudnienia. W artykule zastosowano następujące metody badań: analiza literatury naukowej, porównanie teoretycznych i praktycznych wątków, metody analizy statystycznej.

Słowa kluczowe: klaster, perspektywy rozwoju, zatrudnienie, innowacje, wiedza, technologie.

Резюме

Кластер знаний, инноваций и технологий – новая перспектива развития труда

В условиях быстро растущей глобализации и устойчивого социального развития, важность человеческого капитала в контексте экономического роста, постоянно растет. Образование человеческого капитала и адекватного развития занятости требует новых знаний и привлечения инноваций и знаний в повседневной деятельности. Интеграция знаний, инноваций и технологий становится незаменимым инструментом в решении проблем занятости в стране. В продолжающихся исследованиях не хватает количественного анализа стабильности занятости и его совместимости с компонентами устойчивого развития, поэтому целью данной статьи является выявление важности кластера знаний, инноваций и технологий для роста занятости. Для

достижения этой цели, авторы ввели концепцию «рациональной» специализации и нового кластера знаний, инноваций и технологий, выявили принципы принятия эффективных решений проблем занятости - позитивные изменения на рынке труда и увеличение роста занятости. В этой статье использованы следующие методы испытаний: анализ научной литературы, сравнение теоретических и практических тем, методы статистического анализа.

Ключевые слова: кластер, перспективы развития занятости, инноваций, знаний, технологий.

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