

3. Knowledge-based Urban Development, as a New Development Paradigm

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A region's main goal is to provide its residents all the factors needed to develop a high standard of living. The level of life quality is affected by many factors such as the quality of the environment, the security, the quality of available services, thus mapping the performance of a region is complex and multifactorial process. These factors are summarized in the concept of knowledge-based urban development (KBUD), which aims to increase the region's competitive edge, the attraction of highly skilled human resources and investments, and support the people of the region in reaching high standard of living and welfare.

The primary purpose of this study is to review the theoretical background of the knowledge-based economy, and the detailed description of the concept of KBUD in various aspects. The study¹ also summarizes and evaluates the most important international benchmark examples related to the application of this concept. Moreover, the study attempts to map the dimensions of KBUD to achieve a model that illustrates the concept of this concept. This model could provide an opportunity to determine the main trend lines of concentration processes detectable in our country.

Keywords: knowledge, concentration process, knowledge-based urban development

1. Introduction

Definition of the knowledge based economy and the demarcation of the main characteristics of it have been the major research topic for economists since many years, as it is important to understand the new social and economic phenomena of the XXI. century to get the ability of quick and effective responding to changing and transforming economical processes. In our days researchers often use such expressions as, “knowledge”, “information”, “innovation”, “research and development”, “knowledge-based society” to describe the determining phenomena of the present age. These terms are closely linked to the novel economic model of XXI. century, that is called knowledge-based economy. Experts observe these decisive phenomena basically in technical, technological, economic and social aspects or they aim to find relationship between these areas or reveal effects on each other.

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The paper first reviews the main criteria of the knowledge-based economy, a new economic model that was developed as a result of events determining our everyday life. It then describes the knowledge-based urban development concept, which is a new development paradigm is being applied, and seeks to test the performance of complex areas. Then it describes the concept of knowledge-based urban development, which is scored as a new development paradigm that seeks to test the performance of complex areas. In addition to the theoretical approach, the study presents a benchmark example and evaluates the knowledge-based urban development concept to the city of Helsinki, which can serve as a model for the Hungarian regions.

2. Knowledge-based economy

Description of the knowledge-based economy mostly can be found in the disciplines of economic policy or business. The first attempt for giving exact definition can be found in an OECD document published in 1996, titled “*The Knowledge-Based Economy. Science, Technology and Industry*”, that states knowledge-based economies are „those economies which are directly based on the production, distribution and use of knowledge and information” (OECD 1996, p. 7.).

According to this definition those economies can become a knowledge-based economy in which manufacturing processes are based on the production, utilization and distribution of information and knowledge. Based on Oslo OECD Manual it is defined as follows: „*knowledge-based economy is reflected in the trend in OECD economies towards growth in high-technology investments, high-technology industries, more highly-skilled labour and associated productivity gains. Although knowledge has long been an important factor in economic growth, economists are now exploring ways to incorporate more directly knowledge and technology in their theories and models. It reflects the attempt to understand the role of knowledge and technology in driving productivity and economic growth. In this view, investments in research and development, education and training and new managerial work structures are key*” (OECD 2005, p. 28.).

This definition expresses the presence of background processes affecting the economic environment and the importance of interaction between different economic sectors, which are essential to achieve the common goal, the growth.

According to the study of Yigitcanlar and Lönnqvist published in 2013 in the knowledge-based economy the knowledge is the key factor of economic growth and social development, furthermore it plays a crucial role in the improvement of competitiveness of companies and urban regions as well. Additionally it can be stated, that the competitive advantages of urban areas arise not only from cheap labor and natural resources, but the knowledge is beginning to come into foreground as a special resource. The better a region can utilize its knowledge resource to develop new and innovative products, easier it can respond to challenges result from the knowledge-based economy (Yigitcanlar – Lönnqvist 2013).

Although a number of documents (DTI 1998, Kok 2003, OECD 2005, WB 2007) and publications (Leadbeater 1999, Foray 2004, Leydesdorff 2006) deal with the description of background processes of today's economy, uniform definition has not been created yet. One possible reason for this shortage may be that, regions having different conditions and competitiveness, should built their own knowledge-based economy in different ways, making it impossible to formulate a standard definition for all countries and regions.

After summarization of definitions found in the reviewed studies about knowledge-based economy the following conclusions can be made: The term knowledge-based economy arises from the realization of the significant impact of knowledge and technology on economic growth, where the most important key factor of economic growth and productivity is the knowledge. Knowledge intensity and dynamic development of high technology are essential for the knowledge-based economy, as they are determining factors of growth at fields of wealth, performance and employment. Further characteristic is the existence of interaction between the various economic sectors, which promotes the spreading and more integrated application of knowledge. The criterion of calling an economy “knowledge-based economy” is not only the presence of knowledge as a base of the economy, but the knowledge-based society as well, as one cannot function without the other.

The idea of knowledge-based economy can be found in several economics trends (Lengyel 2008). The endogenous growth theory emphasizes the outstanding role of technology, knowledge, human resources and innovation and analyzes the economic growth by explicit modeling of technical development and human resource accumulation (Lucas 1988, Romer 1990). The endogenous growth theory, contrary to the neoclassical growth model, handles knowledge, technical and technological development and innovation not as an exogenous factor, but as an endogenous, internal element (Carpenters – Varga 2000), through which the economic growth is primarily described and explained. The theory emphasizes the crucial role of human capital in growth, which, however, has to reach a critical level in order

to generate growth. In addition, the rate of technological development is determined by the quality of the existing knowledge base and the growth of knowledge producing, creative workforce. According to the model, the spatial diffusion of knowledge and technology leads to increase in productivity. The prominent role of knowledge in economy is underlined by Adam Smith as well in his theory about the benefits of the division of labor and specialized knowledge (Smith 1992). In 1980 Schumpeter published the work "*The Theory of Economic Development*", in which he designated innovation the driving force of the economy (Schumpeter 1980). From all these it can be stated that in today's knowledge-based economy beyond the traditional factors of production, as natural resources, capital and manpower, a new factor of production, the knowledge also shows up. Furthermore, the conclusion can be drawn that the mapping of knowledge-based economy by indicators cannot be accomplished by the involvement of a few randomly selected indicators, but a complex, multivariate analysis should be applied in these studies.

3. Knowledge-based urban development

In recent decades the role of dominant cities increased both in countries having industrialized or newly industrializing economies, the generation and utilization of knowledge became increasingly localized (McCann – Faggio 2009). The predominance of service-oriented activities and increasing rate of highly qualified labor force is characteristic to dominant cities. Basically, the development trends of cities differ from each other, but a trend emerges in which a number of cities orientate towards the knowledge-based rather than the resource-driven fields of industries.

Yigitcanlar and Lönnqvist (2013) agrees Asheim's view that in recent years city regions focus not on the development of business environment but the environment that is necessary for the highly qualified human resources. They attempt to create a living space that is able to attract and retain talented people, creating the analytical, synthetic and symbolic knowledge base of the region in this way. Namely, the knowledge-based development essentially determines the growth path of a city. This raises the question of what type of improvements are needed to make a city closely integrated into a knowledge-based economy? What kind of city development concept should a city apply in order to create and improve a knowledge-based economy? The concept model of knowledge-based urban development may provide answers to these questions.

According to Knight (2008) the knowledge-based urban development is such a social learning process in which the knowledge capital is utilized in the development of a sustainable urban region. Kunzmann (2008) characterizes the knowledge-based urban development concept as a collaborative development framework that provides guidelines to the public, private and academic sectors in the make up of future development strategies that attract and retain talent and investment, as well as to the creation of knowledge-intensive urban and regional policies (Kunzmann 2008).

Foremost Perry (2008) interpreted the knowledge-based urban development from different perspectives, in which the knowledge and the relevant territorial unit are taken into consideration with different weight. When KBUD is defined as a process, the knowledge is set into the center and changes are evaluated as results of external influences. In case of product-driven KBUD, similarly to a process-driven, the knowledge is in the focus and territorial unit does not play a key role, it is a so-called peripheral factor (Perry 2008). However, in the third approach, that is also called acquisition -guided one by Perry, knowledge is just one factor in the development process, which appears embedded to economic, cultural and social processes. According to Perry (2008) combined use of these three dimensions of KBUD may elicit proper, satisfactory results.

According to Fernandez-Maldonado and Romein (2010) for sustainable KBUD the right balance of the following factors should be present: economic quality that depends on the formation of proper business climate that is required to establish welfare. The second is social-societal quality which is based on an open and positive social environment. The third dimension is environmental quality, and the last one is the quality of organization. The organizational quality depends on the coherence of the urban region and the effective interaction between the main stakeholders that manifest in factual initiatives and projects.

Yigitcanlar (2011) looks upon KBUD in the era of the global knowledge-based economy as a novel development paradigm, which is aimed to create economic prosperity, social order, sustainable environment and appropriate municipal governance.

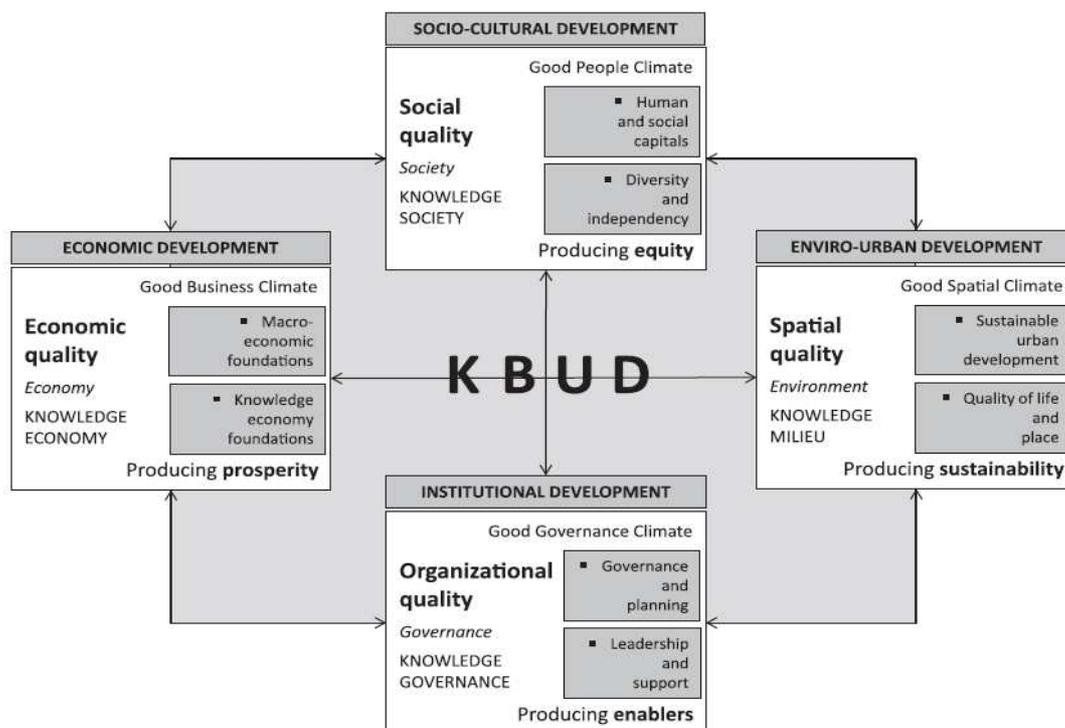
4. Practical application of knowledge-based urban development concept

The study of Fernandez-Maldonado and Romein titled *"The role of organisational capacity and knowledge-based development: the reinvention of Eindhoven"* is an extraordinary example for the practical application of KBUD. From the study of Romein and Fernandez-Maldonado (2010) we can come to know that Eindhoven has been an industrial

city for more than 25 years, thus as an impact of deindustrialisation processes the decline of economy and society was detectable. However, in the past few years Eindhoven has become to be one of the leading technology headquarters of the Netherlands. This result is mainly due to the recognition of the central role of the knowledge and technology, and the implementation of innovations based on these factors. The authors emphasized that the solution of socio-spatial problems and the propensity for closer cooperation between public and private sectors also contributed to the success. In Eindhoven KBUD concept such enhancements and projects have been realized, that made the city attractive for the settlement of highly qualified human resources and technology.

Similarly excellent benchmark example is the study *"Benchmarking knowledge-based urban development performance: Results from the international comparison of Helsinki"* by Yigitcanlar and Lönnqvist. According to Yigitcanlar and Lönnqvist (2013) in the focus of KBUD is the economic, social and territorial (both the built and the natural environment) development, as well as institutional development, that supports the realization of improvement in the prior three areas. These four development perspectives form the framework of the knowledge-based urban development (Figure 1).

Figure 1 Conceptual framework of KBUD



Source: Yigitcanlar and Lönnqvist (2013, p. 3.)

The *economic development* pillar of KBUD is aimed to set the endogenous knowledge capital in the center of economic activities, because according to this concept knowledge is not a supplementary, exogenous factor of development, but a key resource. This perspective efforts to create the optimal business environment and builds a knowledge-based economy that achieves prosperity through strong macroeconomic and knowledge-based economic ground.

The *socio-cultural* pillar aims to improve skills and knowledge of the residents towards the personal and social development of the community. This pillar seeks to develop a knowledge-based society, with main characteristics of strong human and social capital, acceptance of diversity and social equality.

The third pillar of KBUD is the *environmental and urban (enviro-urban)* development. The aim of it is finding the harmony between preservation and improvement of built and natural environment. It also aims to create a strong, knowledge-cluster based development path, that is environmentally friendly, high-quality, unique, and sustainable. The third pillar is the dimension of sustainable urban development and creation of quality of life.

The fourth, final pillar is the *institutional development*. This aims to form a group of local actors who - in cooperation with stakeholders - determine the common vision of future and plan the strategy needed for the implementation of it. Thus, the fourth pillar is about to develop a knowledge-based governance, that can provide the effective institutional background that is essential for design and implementation of the development.

As a result of coordinated development of the four dimensions an appropriate social, environmental, institutional and economic climate will develop, that will create economic prosperity, social equity, and environmental sustainability.

Yigitcanlar and Lönnqvist (2013) applied the KBUD evaluation model for Helsinki. In the past decade Helsinki has been one of the fastest growing regions in Europe, which can be attributed to several factors. Helsinki has high-quality public services, outstanding primary and secondary education, and lets space for innovation and knowledge creation. In addition, high levels of local democracy and governance is characteristic to the city, which is based on a system of progressive taxation and universal social allowances. In addition its society is diverse, that indicates a high level of tolerance. Yigitcanlar and Lönnqvist examined not just the region of Helsinki in their study, but extended it to a comparison with further cities, that matched the following criteria (Yigitcanlar – Lönnqvist 2013):

- Top 20 position in the 2011 Global Competitiveness Report
- Top 20 position in the Global Innovation Index

- Shortlisted for or received a Most Admired Knowledge Cities Award
- Data availability in English and comparability of the political and governance systems

Table 1 KBUD/AM model structure and indicator descriptions

Indicator categories	Indicator sets	Indicators	Descriptions
<i>Economic development</i>	Macro-economic foundations	Gross domestic product	Gross domestic product (GDP) per capita in USD purchasing power parities
		Major international companies	Number of global top 500 companies located
		Foreign direct investment	Ratio of international share in foreign direct investments
		Urban competitiveness	Global urban competitiveness index ranking
	Knowledge economy foundations	Innovation economy	International city ranking in innovation economy
		Research and development	Ratio of research and development expenditure in GDP
		Patent applications	Patent Cooperation Treaty patent applications per million inhabitants
		Knowledge worker pool	Ratio between professionals and managers and all workers
<i>Socio-cultural development</i>	Human and social capitals	Education investment	Ration between public spending on education and GDP
		Professional skill base	Ratio of residents over 18 years with tertiary degree
		University reputation	World university rankings
		Broadband access	Ratio of access to fixed broadband subscribers per capita
	Diversity and independency	Cultural diversity	Ratio of people born abroad
		Social tolerance	International country tolerance ranking
		Socio-economic dependency	Ratio between the elderly population and the working age
		Unemployment level	Ratio of unemployment
<i>Enviro-urban development</i>	Sustainable urban development	Eco-city formation	International city ranking in eco-city
		Sustainable transport use	Ratio of sustainable transport mode use for commuting
		Environmental impact	CO2 emissions in metric tons per capita
		Urban form and density	Population density in persons per sqkm
	Quality of life and place	Quality of life	International city ranking in quality of life
		Cost of living	International city ranking in cost of living
		Housing affordability	Ratio between GPD per capita and median dwelling price
		Personal safety	International city ranking in personal safety
<i>Institutional development</i>	Governance and planning	Government effectiveness	Level of government effectiveness
		Electronic governance	International city ranking in e-government
		Strategic planning	Level of KBUD strategies in strategic regional and local development plans
		City branding	International city ranking in city branding
	Leadership and support Level of institutional and managerial leadership in overseeing KBUD	Effective leadership	Level of institutional and managerial leadership in overseeing KBUD
		Strategic partnership and networking	Level of triple-helix and PPPs and global networking-global city ranking
		Community engagement	Level of institutional mechanisms for community building and public participation
		Social cohesion and equality	Level of income inequality in gini coefficient

Source: Yigitcanlar and Lönnqvist (2013, p. 6.)

Based on these guidelines, the following cities were studied: Boston, San Francisco, Birmingham, Manchester, Melbourne, Sydney, Toronto and Vancouver.

The evaluation was performed by the KBUD Assessment Model (KBUD / AM). The KBUD / AM is an evaluation model based on indicators, that consists of 4 categories of indicators, 8 indicator sets and 32 indicators (Table 1). The four development pillars of KBUD appear as the four main categories of indicators, the 32 indicators were selected according to the relevant literature.

The authors point out that during the collection and selection of indicators they had to face difficulties as few achievable, relevant and reliable indicators are available, thus sometimes they needed "creative solutions".

In the first step of the analysis min-max normalization has been applied, then the resulting values were used as weights for the same model according to the following equations:

$$\begin{aligned}
 I_{MEF} &= \sum_{i=1}^n \frac{MEF_i}{n}; & I_{KEF} &= \sum_{i=1}^n \frac{KEF_i}{n}; & I_{HSC} &= \sum_{i=1}^n \frac{HSC_i}{n}; \\
 I_{DI} &= \sum_{i=1}^n \frac{DI_i}{n}; & I_{SUD} &= \sum_{i=1}^n \frac{SUD_i}{n}; & I_{QLP} &= \sum_{i=1}^n \frac{QLP_i}{n}; \\
 I_{PL} &= \sum_{i=1}^n \frac{GP_i}{n}; & I_{SP} &= \sum_{i=1}^n \frac{LS_i}{n}
 \end{aligned}$$

where I corresponds to the indicator score and MEF, KEF, HSC, DI, SUD, QLP, GP and LS subscripts represent the indicator sets. After that, the indicator domain scores are calculated by the following equation:

$$\begin{aligned}
 I_{EcoDev} &= \sum_{i=1}^n \frac{EcoDev_i}{n}; & I_{SocDev} &= \sum_{i=1}^n \frac{SocDev_i}{n}; \\
 I_{EnvDev} &= \sum_{i=1}^n \frac{EnvDev_i}{n}; & I_{InsDev} &= \sum_{i=1}^n \frac{InsDev_i}{n}
 \end{aligned}$$

where I corresponds to the indicator score and EcoDev, SocDev, EnvDev and InsDev subscripts represent the four development indicator categories (Yigitcanlar – Lönnqvist 2013). As final step, this formula was used:

$$I_{KBUD} = \sum_{i=1}^n \frac{KBUD_i}{n}$$

where I corresponds to the indicator score, KBUD corresponds to the KBUD composite indicator and KBUD_i corresponds to each of the development indicator category scores (Yigitcanlar – Lönnqvist 2013).

Nowdays, a wide range of theoretical and empirical agreement can be observed in that relation human capital, research and development (R&D), technological development and innovation should be regarded as the key impact factors of complex productivity of production and thus the economic growth.

As a result of the studies conducted in all the four dimensions the order of city-regions has been outlined. Based on the examination of the economic development pillar, the authors conclude that Helsinki is at the third place out of the regions, which is due to the research-development and the presence of the knowledge society. However, Yigitcanlar and Lönnqvist points out that local actors should give more attention to the development of business climate, that would attract foreign investors resulting the maintenance and stimulation of local innovation processes. Helsinki is the worst place regarding to the area of socio-cultural development, which can be explained by relatively low university reputation and a lower number of skilled migrants compared to the other investigated urban regions (Yigitcanlar – Lönnqvist 2013).

The functional advantage of KBUD Assessment Model analysis is that the model can map the strengths and weaknesses of a region from different aspects, which can serve as a base for the set up of the practical design process.

The strength of the study is the detailed description of the required steps for the practical application of KBUD Assessment Model and explores the potential difficulties in the analysis as well. The authors point out that the most controversial part of the analysis is always the compilation of the involved set of indicators, as in many cases not all the necessary relevant data are available for testing a model, so compromises should be accepted.

The adaptation of KBUD Assessment Model for Hungarian regions provides the possibility of a novel knowledge-based region mapping method, which may lead to conclusions that reveal further development directions for the observed regions.

5. Conclusion

According to recent studies, human capital, research and development (R&D), technological development and innovation should be regarded as the key impact factors of complex productivity of production and thus the economic growth. In today's economy, the human resource has increasing central role in the development of a country or a region. The primary reason for this highlighted role is the high degree transformation of advanced societies to so-called knowledge-based economies, in which the high education of human

resources is considered as a crucial factor of economic growth. However, apart from the development of knowledge society it is necessary to develop the economic, environmental and governance areas as well. This multi-dimensional development can be presented by the knowledge-based urban development concept, the functional relationships can be evaluated by the KBUD Assessment Model. The study showed example for practical application of the model through the city of Helsinki. The set of indicators used for the analysis provides a suitable base for the investigation of Hungarian regions, especially the suburban centers, that will be the next step of this research.

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