THE ROLE OF TECHNOLOGY IN REALISING SUSTAINABLE REGION

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In the 21st century, due to the emergence of information and communication technologies (ICT), we have to face new challenges in achieving sustainable development. It is widely accepted that the main determinant of economic growth is innovation, which is often associated with the regional concentration of economic activities. It is because the geographical proximity facilitates knowledge and technology transfer and also spillovers that generate technological progress. According to the ICT–based new techno–economic paradigm, less developed regions can catch up with the leaders because knowledge became the main economic resource. Emphasizing the role of technology, this paper evaluates the current situation of Northern Hungary, which is one of the least developed regions in Hungary and provides recommendations on how sustainable economic development could be realised.

Keywords: technology, ICT, regional development, sustainability, human resources

Introduction

Technology plays an important role in explaining cross-country income inequalities[1]. Modelling innovating and non-innovating countries, Krugman (1979) pointed out that the knowledge and material resources required in realising innovation which is available in developed countries, while developing countries can benefit from them due to the diffusion of technologies. The aim of research, development and innovation (RDI) is the creation of new knowledge and putting it into practice. The regional concentration of economic activities facilitates technology and knowledge transfer that generate technological progress which is the driving force of the economic growth.

At the end of 20th century a new techno–economic paradigm shift began due to take place the expansion of information and communication technologies (ICT). The development of information technology, electronics, and mobile

[1] The relevance of technology in economic growth and income inequalities is emphasized in e.g. Solow (1956), Fagerberg (1987), Barro & Sala-i-Martin (1997), Hall-Jones (1999), Easterly-Levine (2001), Mokyr (2003) and Caselli (2004).

communications provide a basis for the information society. The role of knowledge is increasingly important to implement innovation in economy. Employees of the knowledge economy have to face new challenges such as the continuous development of their skills and competences, i.e. participating in lifelong learning.

In Hungary, following the regime change, the economic restructuring processes increased regional differences. The regional policy of the EU aims at reducing territorial and socio-economic disparities among European regions. Except for Central Hungary, the Hungarian regions belong to the less competitive regions of the EU, but their economic performance can be improved by exploiting the benefits of the knowledge economy. ICT has the potential to improve economic efficiency and facilitate the diffusion of technologies. In recent years, the knowledge became the source of sustainable competitive advantage (Karvalics & Kollányi, 2006). High-quality education or skilled human capital is a basic requirement for successful economic performance. In the 21st century the knowledge-based economy makes it possible for the less developed regions to catch up.

This paper focuses sustainable regional development and emphasises the role of technology. Long-term growth is influenced by technological progress which can be sustainable in external and internal economic balance without environmental damages (Erdős, 2004, p. 389). This study evaluates the economic situation of Northern Hungary, which is one of the least developed regions in Hungary.

The Economic Situation of Hungarian Regions in the EU

The establishment of regions was necessary for Hungary's accession to the EU in 2004. In line with the NUTS[2] system, 7 planning regions – Central Hungary, Central Transdanubia, Western Transdanubia, Southern Transdanubia, Northern Hungary, Northern Great Plain, and Southern Great Plain – have been created in Hungary. The regional GDP is used for comparing the economic performance of regions (Pukli, 2000). To evaluate the economic situation of Hungarian regions in the EU, the GDP per capita (PPS) in percentage of the EU–27 average is examined (Figure 1).

[2] The NUTS (Nomenclature of Territorial Units for Statistics) classification is a hierarchical system for dividing up the territory of European Union at different levels. At NUTS 2 level, there are the planning and statistical regions which support the realization of the EU's regional policy which targets catching up of underdeveloped regions.

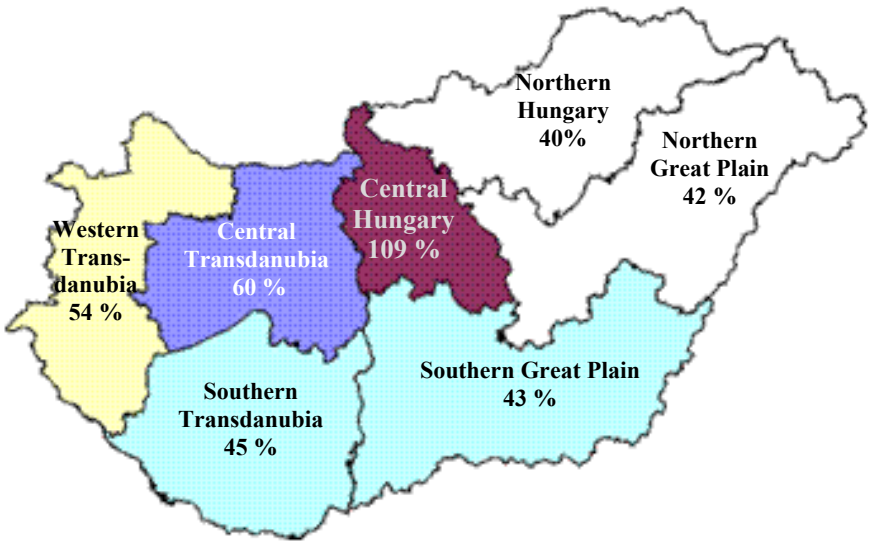

Figure 1. GDP per capita (PPS) in Hungarian regions. Data obtained from Eurostat.
Note. Percentage of the EU–27 average (2009).

The data show all regions are significantly below the EU average, except for Central Hungary. In 2009, the Hungarian GDP per capita was 65% of the EU–27 average, while four regions produced less than half of the EU average, these are in the last third of the EU rankings. The overall economic position of Hungary in the EU is improved by the performance of Budapest and Transdanubia, where the level of employment and labour productivity is much better than the country average. The eastern and southern parts of Hungary are less developed.

According to Lengyel (2003), there are three parts of Hungary, each in a different developing stage. Central Hungary and Budapest are innovation-driven, Western and Central Transdanubia are investment-driven with large companies, and the others that produce for domestic market and have less competitive industries are factor-driven (ibid). In recent years the performance could have been better, but there is no real convergence across regions. The observed improvement in economic indicators is due to the EU's financial support and the accession of new member states, which considerably lower the EU-average. A fundamental question emerges, however, whether the European financial resources are being spent on appropriate, long-term sustainable and remunerative developments or the present practice of investments. Esteeming human resource development, as of secondary in importance, being not really effective and hardly resulting in anything positive on socio-economic development, will be continued (Kovács, 2009b). However, the human resources development is the most important field of all developments, without qualified

employees there is no social and economic development, and especially no knowledge-based society (Kovács, 2009a). To better illustrate regional disparities in Hungary, Figure 2 shows the GDP of the Hungarian regions as a percentage of the national average in the year of accession (2004) and in 2010 (latest data found).

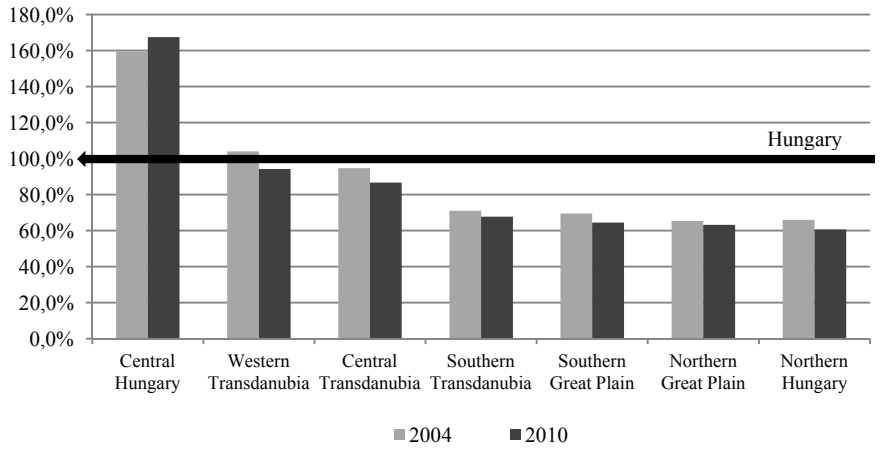

Figure 2. Per capita GDP as a percentage of the national average by NUTS 2 regions in 2004 and 2010 (Hungary=100%). Adapted from the Hungarian Central Statistical Office.

Figure 2 shows that the economic performance of Central Hungary has improved since the EU's accession, but that of other regions became worse. The differences between regions grew larger every year. Northern Hungary is the most lagging region; its performance is 61.18% of the national average, while Central Hungary is more than double the average. Zsúgyel (2006) analysed Northern Hungary's situation in the European economic integration and found that this region is underdeveloped in several fields such as demographic situation, health, agriculture, tourism and labour market which contributes to poor economic performance.

Summarising the economic development level of Hungarian regions, we can say they are lagging behind average of the EU, except for Central Hungary. The differences within the country are growing, thus it is vital to take advantage of the knowledge economy. Whether it will be possible or not, it depends on the demographic process, the solutions of labour market problems and the quality of human resources[3].

[3] In this respect, the *moral deficit* of the Hungarian society is an important question. Hungary today does not appreciate convertible and extendable knowledge gained by tenacious and hard

Sources of Sustainable Regional Development

Technology plays an important role in cross-country income variance because it increases efficiency and influences productivity. The technological potential of a country is related to the availability of physical and human factors. Technology or knowledge is the accumulation of ideas which improve the productivity of an economy (Jones 1995, pp. 764−765). As Dedák (2000) pointed out, in terms of economic growth human capital, including skills, competences, and knowledge is as important as physical capital. Human resources linked to physical factors are necessary but not sufficient to realise technological progress, as according to Fagerberg (1994), social capability and technological congruence are required for a country to adopt new technologies[4]. Fagerberg, Shrolec and Knell (2007, p. 1597) pinpointed three sets of factors that determine the growth rate of a country: (1) the potential for exploiting *knowledge developed elsewhere;* (2) the creation of *new knowledge* within the country; and (3) the *growth in the capacity to exploit* or absorb *knowledge*. Technological progress is the process realised by the combination of physical and human capital in a suitable institutional environment.

At the end of 20th century, the diffusion of ICT induced revolutionary changes in the economy[5]. Examining the industrial revolution, Mokyr (1990) concluded that the unprecedented macro-inventions and incremental micro-inventions have significant impact on income; technological change is the result of human creativity. Improvements require human resources in quality rather than in quantity. Skilled labour is only valuable for the economy if the labour market can utilize these skills. On the other hand, ICT provides opportunities to activate inactive population to work in flexible working hours or other types of atypical employment.

In Europe, technological change influenced countries' income in a different way, which caused significant territorial disparities. During the period of socialism, there is a lack of technological progress (Kornai, 2010). Cross-country differences can be explained by several factors, most importantly geography and culture[6]. Geography includes climate, ecology, and natural resources as well as the geographical conditions of a region. Culture affects

learning by which society basically underestimates its economic relevance, i.e. by this inevitably negative, short-sighted approach also paralysing the possibility of its own ascent (Kovács 2009b)

[4] Social capability depending human factors, is the ability of a country to import a technology or create a new one. Technological congruence related to physical factors, is compatibility requirement i.e. new or accepted technology can fit to the existing system (Fagerberg, 1994)

[5] The ICT paradigm is called third industrial revolution, e. g. Freeman and Louça (2001), Perez (2004)

[6] Acemoglu (2009) classified the fundamental causes of economic growth into four categories such as institutions, geography, culture and luck.

characteristics of human resources, including innovation skills. The environment described by geography and culture creates opportunities for the society that determine technologies available (Acemoglu, Johnson, & Robinson, 2005).

Technological progress is the driving force of economic growth which contributes to better economic performance. The regional concentration of economic activities facilitates technology and knowledge transfer, which requires innovativeness and ability to successfully compete in markets. The role of informal institutions is essential because they create the basis of development. The regional policy of the EU aims to reduce territorial disparities between European regions. According to Tabellini (2010) calculations, culture is strongly correlated with current regional economic development, examining education, urbanization and national effects. In Hungary, regional differences mainly owing to the different economic structure, infrastructure, human capital and innovation. Sustainable development requires that a country applies appropriate technology in energy efficient ways without harming nature and society.

A Case Study of Northern Hungary

Northern Hungary lies in the north-eastern part of Hungary, bordered by the Slovak Republic from the north, Central Hungary from the west and the Northern Great Plain from the south and east. In terms of geographical and natural endowments, tourism has an important role in the economy of the region. The region is rich in natural and historical attractions. World Heritage Sites can also be found within the region, such as Hollókő, the Caves of Aggtelek Karst and the Historical Wine Region of Tokaj. Northern Hungary is the fourth largest region with one of the highest population density in the country. It is a geographically well–situated region which is rich in natural resources. The economic structure is unfavourable, because the industry is dominant but non-competitive. After transition, in the 90's, there was a great decline in heavy industry and primarily in mining and machinery, which caused high unemployment, but the industrial nature of the region has been preserved as yet. In Northern Hungary there are only few large companies with strong market position, mostly in the chemical and the machine industry. The small and medium-sized enterprises suffer from lack of capital and of liquidity problems. There are few investors and insufficient investment capital to develop. The R&D activity and the technological level are low. The state of the infrastructure improved during the last years. The competitiveness of the region is weak as a result of demographic and labour market problems (Figure 3).

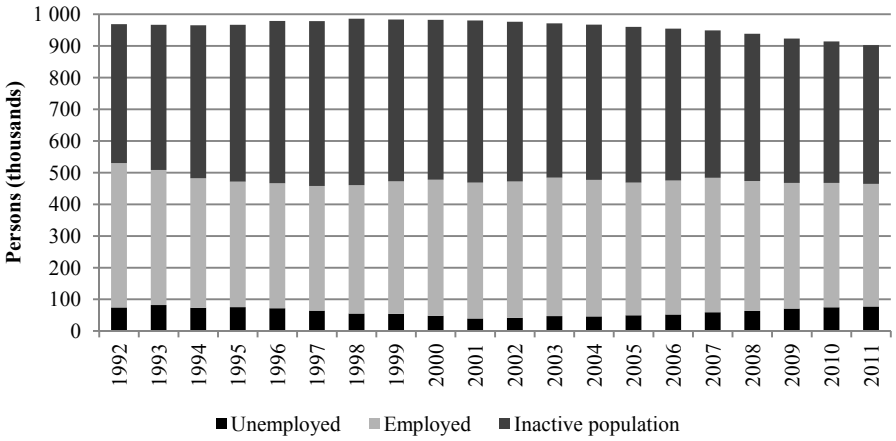

Figure 3. The economic activity of the population (aged 15–74) in Northern Hungary 1992–2011 adapted from Hungarian Central Statistical Office

Figure 3 shows the demographic trends in Northern Hungary in the last two decades. The population was decreasing in the 2000s, which is a general trend in the country for several years. There is a significant increase in the unemployment rate and a decrease in the activity rate. In the region the unemployment rate was the highest one in Hungary (16.7%) and the activity rate was the lowest (51.5%) in 2011[7]. The decreasing activity rate and the increasing unemployment rate result effective demand reduction. The dominance of Budapest in the country's labour market causes intense migration towards the capital.

Northern Hungary suffers from certain problems in the field of the quality of human resources too, but there is potential to improve. The lack of motivation and historically evolved work-culture are the worst problems in the labour market. According to the PISA report (OECD, 2004) test in Hungary the lack of basic knowledge (even problems with reading and writing) is a problem which prevents employment. There are few well-paid jobs so emigration threatens the region because qualified graduates tend to move to Budapest, the Transdanubia region or abroad. The development, based on ICT and higher education, can realise mostly in the region's core cities only (Miskolc, Eger, Gyöngyös, and Hatvan). The role of university research in (regional) economic development is examined with increasing intensity by the literature focusing on the "third" or "entrepreneurial" mission of higher education institutions. Novotny (forthcoming) shows that Hungarian university scientists are not less active in

[7] In Hungary the activity rate is about 10% lower than in European Union and 20% lower than in USA. This is the major weakness of Hungarian labour market.

transferring technology to the business sphere (regarding the ratio of faculty members taking part in technology transfer) than their American colleagues, however, motivations for entrepreneurial behaviour are not entirely identical in the two regions.

As Kocziszky (2007) pointed out, the development program of Northern Hungary for the 2007-2013 period aims to strengthen the competitiveness of the region and to reduce the regional, social, and economic differences in the region at the same time (Norda, 2006). The competitiveness of the region mainly depends on innovation, the transformation of the economic structure, good transport, and the quality of human resources. All these can create an investment-friendly environment, which supports R&D activity and innovation coupled with well-qualified workforce and can eventually realise technological progress.

Conclusion

Technological progress is the driving force of economic growth. It can be realised in innovation coupled with qualified human capital as well as physical capital in a suitable institutional environment. In the 21st century the ICT began a new technological wave, where the importance of knowledge is emphasized. The ICT induced knowledge-based economy makes possibilities to mitigate regional differences. European regional policy aims to reduce territorial disparities and ICT is a potential tool to achieve this.

Northern Hungary is one of the least developed regions in Europe. The economic structure is unfavourable. Industry is dominant, the RDI activity is low, and the infrastructure is below par. The region suffers from several problems mainly concerning human resources which should be improved in quality. The activity rate of the region is the lowest, while the unemployment rate is the highest in the country. The quality of human capital is low. The first step to take in the technological progress is developing human resources. Nowadays the learning-knowledge-innovation triangle gives the fundaments of a successful region. There is a potential in human resources to make Northern Hungary a competitive region. In a sustainable region innovation and technology dominates coupled with qualified human resources protecting natural environment.

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