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Implementation of New Technologies in Information Society

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The article deals with theoretical and practical underpinning pertinent to the implementation of new technologies in information society. The abundance of information flows as well as the rapid development of information and communication technologies accelerate emergence of new technologies and speed up their practical implementation. Interdependence of seven innovative areas – strategy, business, product or service, process, technology, organization, marketing – has been uncovered in this article. The systematic approach – from an innovative idea to its complete commercialization – enables to have a better understanding of the entire technology innovation and implementation process. The four technology implementation phases – research, development, demonstration, and commercialization – have been reflected in the article to designate the implementation path.

The article also unfolds the idea of single European technological zone where countries are supposed to maintain the exchange of scientific ideas, good practices and experience by exploiting their heterogeneous uniqueness. The gap between scientific and research activities and their practical implementation in Lithuania has been suggested to be filled up by mutual efforts of both business and non-business entities.

Keywords: *new technologies, information society, innovation*

Introduction

The emergence of the information society, building on the pervasive influence of modern information and communication technologies, is bringing about a fundamental reshaping of the global economy. In an increasingly global economy, where knowledge about how to excel competitively and knowledge about who excels are both more readily available, innovation is quickly becoming the key factor in global competitiveness and it fuels sustainable economic development and growth. Recent technological developments have led to shifts in the composition of factors of production, with a considerable decline in the importance of raw materials, energy and labour inputs and an increase in knowledge intensity.

The issues of new technologies and their implementation have been under investigation for years. Since the pioneering work of Abramovitz (1956) and Solow (1957), many researchers have found that technological progress is essential in the growth process. Recent studies suggest that a large part of income variation is explained by the differences in technology employed in each country (Acemoglu, Zilibotti, 2001; Caselli, 1999). The idea that skill is required for the adoption of a new technology is also expressed by other economists. In an influential paper, Nelson and Phelps (1966) construct models where education enhances adoption. They obtain insightful results such as: the return to education is higher if the technological progress is faster, and the level of technology adopted is higher when the level of education is higher. Nelson and Phelps do not consider the process of technology implementation explicitly. In their model, the law of motion for adoption is given exogenously leaving out an endogenous process of technology implementation or diffusion. Contrarily, Galor and Tsiddon (1997) explicitly analyze the improvement of a technology as an exogenous process. Many recent empirical studies examine the relationship between the adoption of new technologies and the skill level. Bartel and Lichtenberg (1987) argue that there is a positive correlation between skill and new technology adoption. They consider the hypothesis that a firm that adopts new technologies demands more skilled workers. A recent study by Doms, Dunne, and Troske (1997) suggests that a firm with more skilled workers is more likely to adopt a new technology. More recently, Caselli and Coleman (2001) analyze the diffusion of computers among countries. They show that the human capital level in each country is a significant determinant of computer imports. There are several important recent papers that attempt to explain implementation of new technologies as an endogenous process. Jovanovic and MacDonald (1994) analyze innovation and diffusion of knowledge. Firms try to acquire better knowledge (technologies) by R&D and learning. Implementation of new technologies is slow because of informational barriers: it takes time and effort for firms to learn new technologies. Other scholars argue in favour of the conservative path since not only the vintage of technology but also the amount of old capital available for that specific vintage (Chari, Hopenhayn, 1991), external learning by doing (Jovanovic, Lach, 1989), the benefit from adopting a new technology as well as its costs (Caselli, 1999) determine the development process.

Obviously, existing scientific literature elaborates on new technologies as ready-made products but it lacks significant attempts to analyze the entire process – from generation of ideas to their complete commercialization. **The novelty** of this article particularly lies in the systematic approach guiding throughout the entire process that tends to be ignored in the recent literature. Consequentially, a phrase 'implementation of new technologies' seems to have a better reflection instead of 'technology diffusion' since the former undoubtedly pinpoints the relevance of ideas as well as paper drafts and prospects that go the long

way through until wide practical application has been achieved. Moreover, analysis of Lithuanian environment with respect to the issues enhances the relevance of theoretical deliberations and opens up new spaces for further scientific investigation.

The object of this article – new technologies and their implementation in information society.

The objective is to investigate and highlight challenges that information society places on implementation of new technologies.

Tasks set out to achieve the objective:

- to reveal ever-growing effect of information on the world society as well as highlight opportunities due to its abundant presence;
- to define the role of innovation and its areas as well as the challenge it places on commercial and non-commercial entities;
- to disclose how information and communication technologies facilitate intercommunication and fuel development of other advanced technologies;
- To determine the impact of new technologies on adaptability to abundant information flows.
- To assess and substantiate the relevance of new technologies in Lithuania entering the European technological zone.

Research methods applied – the logical analysis and synthesis of scientific literature, the systematic analysis of statistics, the statistical grouping method, and the comparison and generalization method.

The emergence of information society

The rapid development of advanced information and communication technologies is having far-reaching effects on all aspects of modern life. They play a crucial role in facilitating networking, exchange of experience and good practices. Information and communication technologies have brought about deep changes in the way of working and living, as their widespread diffusion is accompanied by organizational, commercial, social and legal innovations.

The first most significant attempt to point out the relevance of information flows and the formation of knowledge-based society could be observed in Alvin Toffler's book "The Third Wave", published in 1980. The author used a historical perspective to argue that the transition from an industrial society (the Second Wave) to an information society (the Third Wave) can be best understood by looking back in time to the transition from the agricultural society (the First Wave) to the industrial society. Figure 1 illustrates shifts from one society to the other what leads to advancement and improvement in the quality of life. Today's most technologically advanced economies are truly knowledge-based (World Bank, 1999).

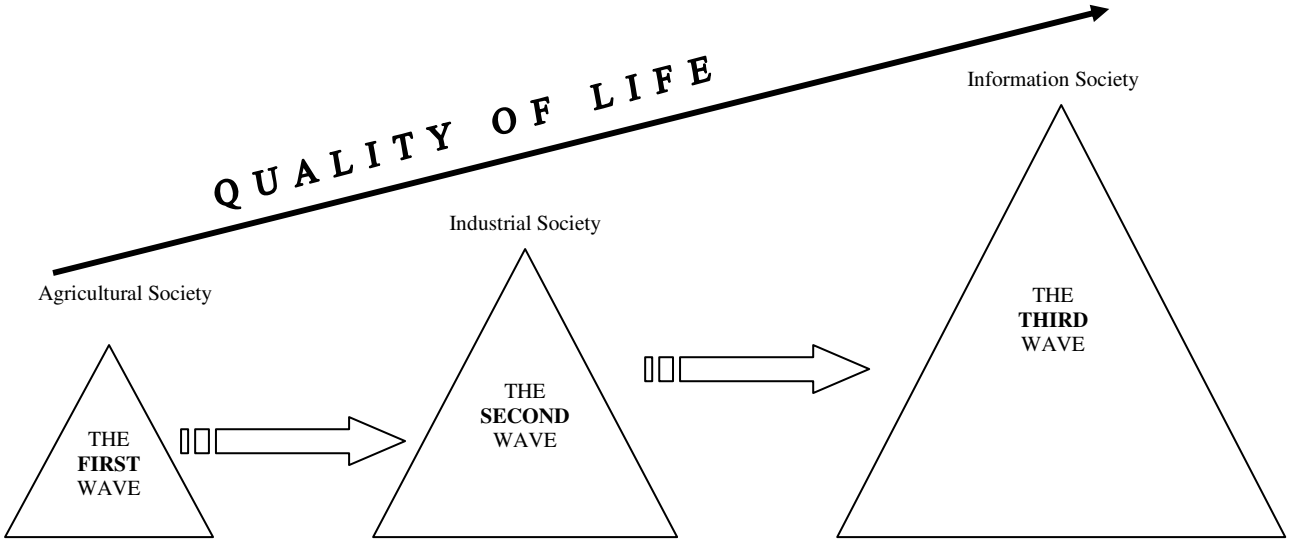

Figure 1. Transition Society Waves

Since then, many writers and scholars have joined in the study of the transition from the manufacturing-orientation of industrial society to the information- and knowledge-orientation of the Third Wave as well as a variety of new terms has been coined by scholars striving to precisely reflect and specify contemporary trends and phenomena in swiftly changing business environment. The increasing relevance of knowledge and information as the key drivers of economic prosperity has instigated researchers to introduce such terms as "knowledge industries" (Machlup, 1962), "knowledge work" or "knowledge worker" (Drucker, 1969; Drucker, 1995; Drucker, 1999). Other contemporary researchers such as M. Csikszentmihalyi (1996), J. Rifkin (1995) and R. Heilbroner (1985), to mention a few, use the terms "post-market era", "post-capitalist society" or "new world order" to describe the way they see society functioning today; they all speak to major changes in the global village based upon the very same rationale A. Toffler (1980) uses.

Unlike capital and labour, information and knowledge have many of the characteristics of what economists call public goods. Once discovered and made public, knowledge can be shared at zero marginal cost and its value is not depleted in consumption – it is non-rival. Indeed, the economic

and social value of information and knowledge actually increases as it is shared with and used by others. Just as the importance of land in production changed dramatically when the economy moved from agriculture to industry, so too does the movement to a knowledge economy necessitating a rethinking of economic fundamentals (Stiglitz, 1999).

The foregoing deliberations capacitate to single out what lies behind the term "information society". In short, the "information or knowledge(-based) society" describes a society as well as an economy that captures the increasing contemporary influence of new information and communication technologies seeking to make the best possible use of them (Plasichuk, 2000). It is essential to embody an organizational process that seeks synergetic combination of data and information processing capacity of information technologies, and the creative and innovative capacity of human beings.

Technologies available for information society support the competitiveness of companies through international collaboration, in creating links and networks of innovation. The primary goals undoubtedly remain to bring high quality research and development efforts to the market and to use multiplying effects of cooperation. Moreover, information society developments have a particular significance for other new technologies since knowledge-based innovation is becoming the key source of sustainable competitive advantage.

The innovation challenge

Innovation fundamentally means coming up with new ideas about how to do things better or faster. It is about making a product or offering a service that no one has thought of before. And it is about putting new ideas to work in enterprise and having a skilled work force that can use those new ideas. Policies relating to science and technology, industry and education will need a new emphasis on the role and importance of innovation systems, the requirement for infrastructures, and incentives which encourage investments in research and training to support those systems (Houghton, Sheehan, 2000). Innovation is virtually the life blood of any business. The famous W. Shakespeare's saying "to be or not to be" could be re-phrased into "to innovate or to die" striving to reflect contemporary business tendencies – this may seem rather dramatic but there is a strong element of truth. Businesses and especially manufacturing businesses which do not constantly develop new innovative methods, best practices, procedures and systems will not, in the global economy, survive since innovation is important to manufacturers as a catalyst for productivity growth.

The most important property is now intellectual property, not physical property. And it is the hearts and minds of people, rather than traditional labour, which are essential to growth and prosperity. Intellectual property rights underpin innovation by providing a tool for businesses to make a return on their investment. For many innovators, access to finances is impossible without intellectual property protection. Furthermore, the patent regime helps to spread technological knowledge because applicants have to disclose information about their invention.

New developments can be protected through formal intellectual property rights, such as copyright, trademarks, designs and patents, for which the Patent Office has responsibility. Informal methods, such as know-how, speed to market, confidentiality agreements, and secrecy, also play a role. Which options, or combinations, are chosen will depend on a number of factors, not least the level of awareness of those options.

Figure 2 illustrates how intellectual property rights can interact with the generation, development and protection of ideas, including using information available through intellectual property rights.

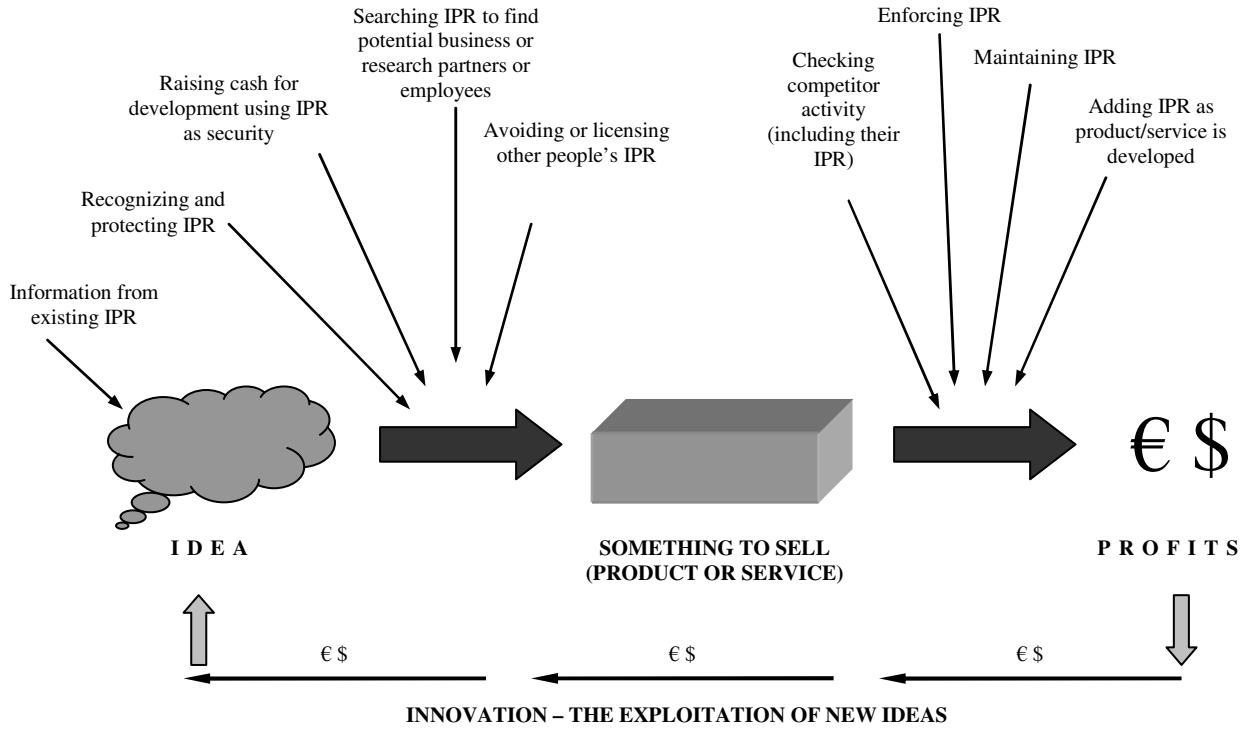

Figure 2. The Role of Intellectual Property Rights (IPR) in Commercializing Ideas (UK Department of Trade and Industry, 2003)

In this changing environment, holding the status quo is not an option – either an economy moves forwards and embraces the conditions necessary to underpin higher value economic activity, better jobs, and new social prosperity or it prepares to fall into relative decline. In the global information or knowledge society, sources of sustainable competitive advantage increasingly depend on knowledge-based innovation. Continuous market-driven innovation is the key to competitiveness, and to economic growth. This requires not only a strong science and technology base, but equally importantly are the capacities to link fundamental and applied research, to convert the results of that research to new products, services or processes, and to bring these innovations quickly to the market.

Meanwhile, general familiarity with digital technologies throughout society, and ready availability of the new skills needed by high-tech and knowledge-based enterprises, is becoming critical to supporting innovation and underpinning sustainable economic development. And the knowledge society in turn can deliver better jobs and higher standards of living to support enhanced social prosperity. It is imperative to foster a learning environment that supports and facilitates the process of adapting to ongoing changes (Tamasevicius, Jasinskas, 2004). The clear implication is that there is no alternative to prosperity than to making learning and knowledge-creation of prime importance, with a new focus on scientific and technological innovation through research and development. Now, thanks to satellites and fibre-optic cables, ideas leap among people almost like lightning. In this age, through a terminal, a satellite, and a decent battery or a plug in the wall, ideas can jump from an island to anywhere – and likewise attract. The only limit now is the worth of the idea, the intelligence that uses it, and the innovation it creates (Harris, 2002).

Until recently innovation has been primarily seen as the means to turn research results into commercially successful products or services. Today, while research keeps playing its critical role as a major contributor to innovation, many new forms of innovation have emerged. They include system's approach to integration of new technologies and processes from other fields, new business models and ways of doing business, and new ways of reaching and servicing customers. In point of fact, not all research leads to innovation and not all innovation is research-based. Beyond any doubt, research is still a major contributor to innovation, generating a flow of technical ideas and continually renewing the pool of technical skills (European Commission, 2003). Important though research is as the source of invention, innovation encompasses more than the successful application of research results. Innovation can also stem from adopting new technologies or processes from other fields, or from new ways of doing business, or from new ways of marketing products and services. The evolution of the innovation concept – from the linear model having R&D as the starting point to the systemic model (see Figure 3) in which innovation arises from complex interactions between individuals, organizations and their operating environments – demonstrates that innovation policies and practices must extend their focus beyond the link with research (European Commission, 2003).

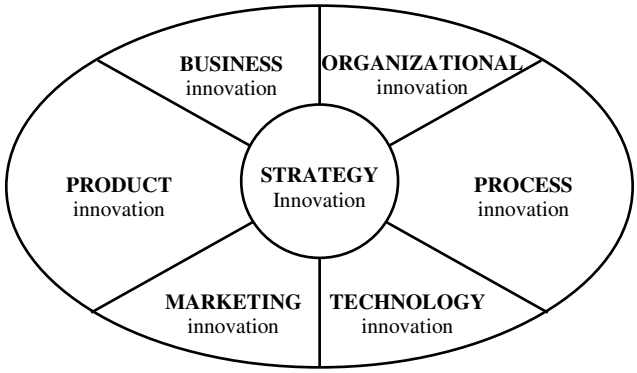

Figure 3. Systematic Approach to Innovation: Seven Interwoven Areas of Innovation

Figure 3 demonstrably represents the interdependence of the innovation areas:

- **Strategy** innovation is about challenging existing industry methods of creating customer value in order to meet newly emerging customer needs, add additional value, and create new markets and new customer groups for the sponsoring company (Tucker, 2002). It is to help a company to develop new value added services, enter new markets, create new market segments/categories, new distribution methods, and new forms of customer service and customer partnership.
- **Business** innovation involves a wide spectrum of original concepts, including development of new business models, organizational innovation, business application of technology and communications, new management techniques, environmental efficiency, new forms of stakeholder participation, transport and finance.
- **Product/service** innovation is the result of bringing to life a new way to solve the customer's problem – through a new product or service development – that benefits both the customer and the sponsoring company (Tucker, 2002).
- **Process** innovations increase bottom-line profitability, reduce costs, improve efficiency, raise productivity, and increase employee job satisfaction. For manufacturing companies, process innovation include such things as integrating new production methods and technologies that lead to improved efficiency, quality, or time-to-market, and services that are sold with those products. For service companies, process innovations enable them to introduce 'front office' customer service improvements and add new services.
- **Technological** innovation covers innovation derived from research and technology developments that are independent of product and service initiative. The best companies maintain roadmaps that define the next technologies they will pursue and the requisite timing of each. These technology roadmaps are matched to their product roadmaps to ensure that the two are synchronized (Meyer, 1998).
- **Organizational** innovation reflects the recognition that new ways of organizing work in areas such as work-force management, knowledge management, value chain management, customer partnership, dis-

tribution, finance, manufacturing, etc. can improve competitiveness. Organizational innovation also includes business model innovation.
- **Marketing** innovation mainly covers new ways of organizing work through innovative presentational activities.

The innovation areas circle around the strategy innovation in as much as the enterprise sustains its core competences through strategic goals. Since pertinent strategy mintage undoubtedly determines boundaries of future prosperity, similarly strategic consolidation of the innovation system areas will determine boundaries of the enterprise's longevity.

Technology Innovation and Implementation

It takes time for a new technology to acquire economic significance. First, it has to be brought into the economy. Then, it is gradually adopted by many people. The last decade has witnessed a large development in the economics of innovation. However, not much attention has been paid to the economics of implementation. Implementation or diffusion is as important as innovation: no new technologies have an economic impact until they become widespread in the economy. Implementation is not a trivial process — in general, it takes a long period of time. Moreover, innovation and implementation are closely interrelated.

A common feature of newly invented machines is that initially they are difficult to handle. This feature leads to a well-known empirical fact: high levels of skill are required in the early stages of technology implementation. For example, Bartel and Lichtenberg (1987) hold that the early ranks of computer programmers included a high proportion of Ph.D. mathematicians; today, high school graduates are being hired. During the early stage of transistors chemical engineers were required to constantly supervise the vats where crystals were grown. As processes were perfected, they were replaced by workers with less education. Thus, high level of skills is firstly required to adopt a new technology; later on, the nature of a new technology changes as it becomes more and more accessible to less skilled machine users.

It is essential to highlight that new information and communication technologies foster technological improvements or pure novelties in other sectors as physical boundaries are diminishing due to the death of distance. However, these effects should not be overestimated thanks to experience of previous communication revolutions. The transport revolutions of the nineteenth century did not lead to the dispersion of economic activity, but instead to its concentration – in relatively few countries, and within those countries in large and often highly specialised cities. Lower transport costs reduced the value of proximity to consumers, who could be supplied from cities in which production exploited the advantages of increasing returns to scale and agglomeration externalities. So too with advanced information and communication technologies, it might be expected to see changes in economic geography of the world economy, but not necessarily changes towards the 'integrated equilibrium' view of the death of distance.

Venables (2001) argues that geography matters greatly for many economic interactions; these interactions – be they trade, investment, or knowledge transfers – are overwhelmingly local, falling off sharply with distance. He also states the costs that cause interactions to fall off across space also have major implications for the world income distribution. Using measures of distance based on the intensity of economic interaction between countries Venables (2001) shows that distance can account for a large part of international inequalities. Poor countries are poor, in part, because distance inhibits their access to the markets and suppliers of established economic centres.

Therefore, some activities will become more deeply entrenched in high income countries – and typically in cities in these countries. These activities will generally be complex – knowledge intensive, rapidly changing, and requiring face-to-face communication. But they will also include supply of non-tradeables, and of produced goods where shipping is costly or time consuming. Other activities which are more readily transportable and less dependent on face-to-face communications may relocate to lower wage countries, and this will be an important force for development. However, since these activities may cluster together, development is likely to take the form of rapid development by a small number of countries (or regions) rather than a more uniform process of convergence. Although information and communication technologies facilitate the relocation of these activities, the proportion of world GDP that can operate as though geography has no meaning is likely to be small.

Though information and communication technologies do not mean the death of distance, the contribution of these technologies to economic development will nevertheless be important. It will come primarily from allowing individuals greater access to knowledge, education and basic services, not through rewriting the rules of economic geography.

Another relevant issue talking about implementation of new technologies is that people fear the unknown, especially when they believe that it could adversely affect their health or established social systems. Undoubtedly, new technologies will continue to substantially influence the global society. However, the directions in which these technological developments may take the society are neither obvious nor risk-free. The global society needs to determine which forms of innovation and what uses of technology are acceptable, how to balance benefits against risks. Risks are not always obvious at the time of introducing a new technology (freons $\Rightarrow$ ozone hole; coal fired power stations $\Rightarrow$ climate change; cars $\Rightarrow$ urban air pollution). In this case, information and communication technologies can serve as a handy tool to promptly spread out any message about adverse side-effects experienced implementing new technologies even in the most faraway countries of the world.

Both risks and opportunities emerge from new technologies fueled by the initial idea. However, as important as the initial idea is, it is not sufficient and it is truly an innovation until it has undergone further development and final implementation. As technological knowledge flows towards commercialization the idea gains substance and simultaneously intellectual property is created. The technology implementation process generally goes through four phases depicted in Figure 4:

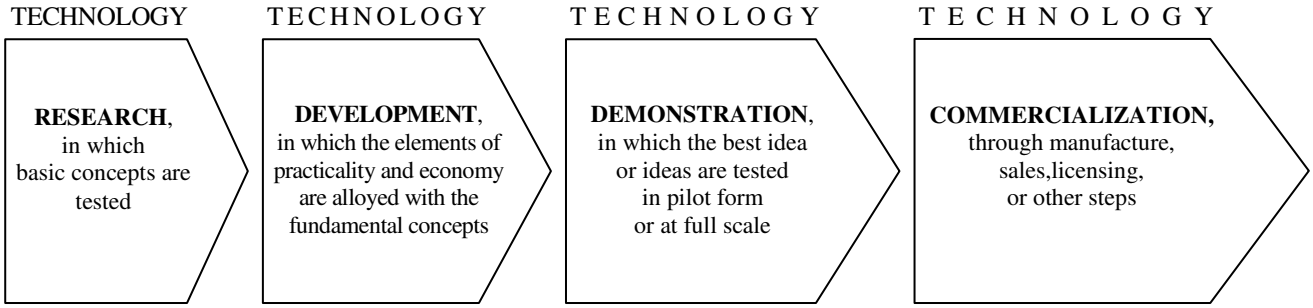

Figure 4. Four Technology Implementation Phases

Technology provides a means of developing new products, processes and services, or new ways of doing things. It is vital to address weaknesses in the innovation systems (technology research) that hold back the development and exploitation of new technologies (technology commercialization). Nevertheless, there are huge opportunities to benefit from the new technologies that are emerging almost daily. At the same time though, companies fear they may not be able to keep abreast of all the new developments, and may miss something vital that their competitors can use to get ahead of them.

In order to meet some of the costs and risks associated with research and technology development it is relevant to facilitate collaboration between different businesses and the future focus should be on broader strategic areas of technology that are likely to impact across sectors and key market priorities and thereby engage with a broader range of industrial participants. Thanks to advanced information transmission systems, knowledge transfer networks will encourage the diffusion of new and existing technology base.

The end of the 20th century witnessed a wave of scientific discovery and technology innovation in a range of areas that have only just begun to change the way people work and interact with their physical, natural and social environments. For example, mapping the genome of humans and disease-causing agents, such as the malaria parasites, using massive computing power, has opened the way to wider, rapid screening and targeted, more cost effective treatment. Biotechnology is transforming life sciences and has huge potential for accelerating human development. In the area of medicines and agriculture, biotechnology is helping to design new drugs and treatments for some of the major health challenges, such as AIDS. In the agricultural field, plant breeding is providing promises to generate higher yields and resistance to drought, pests and disease. Miniaturisation and the growing ability to operate at the nano scale have opened up the prospect of even greater performance and functionality across a wide range of products and services, including electronics and healthcare.

In order to maximize possible future achievements, the best solution would be to bring businesses, governments, and research and knowledge transfer communities together to identify the most important emerging, potentially striking technologies on the basis of their potential economic, social and environmental benefits. It is more than a necessity to develop collaborative, application-based solutions to technology development, drawing on the resources and instruments available to all parties.

In doing so, local governments should provide support for technology innovation where private firms may underinvest in knowledge acquisition and development through R&D because of market or system failures. Such investment can be justified on the basis of:

- **Spillover benefits** – technology development in one firm may produce benefits elsewhere in the economy that are not captured by the firm making the investment. Even collaborations with other firms may not be sufficient to capture all the benefits because some will arise in unanticipated areas. These benefits can also be social or environmental.
- **High degrees of risk** – the development of the technology may be uncertain, as may be the commercial potential. These uncertainties are likely to be greatest at the early stages in taking an idea from basic research through to a commercial application, while the size of investment can be significantly greater through the subsequent development and prototyping phases. There may be information asymmetries between the firm wishing to innovate and potential backers. Access to finance may be particularly difficult for small and medium-sized enterprises that are less likely to have access to internal finance or equity funding.
- **Barriers to effective co-ordination** between different businesses – technology applications are also increasingly likely to cross sectors and these linkages (especially between manufacturing and service industries) may not be well appreciated or developed. Governments can facilitate knowledge transfer between businesses by enabling or creating networking opportunities. Direct and indirect government involvement can build trust between participants, e.g. by allaying concerns about protection of intellectual property. Governments can also facilitate business collaboration for major technology validation programmes cutting across a range of companies and potentially sectors.

In conclusion, it would not be too daring to say that leading-edge industrial innovation depends on exploiting new scientific developments, but, unless it can be measured, a process or product cannot be reproduced or commercially exploited.

Lithuania joining the European technological zone

Europe is also facing a productivity and innovation challenge in terms of competitiveness in the global knowledge economy. For many years, Europe has trumpeted its diversity as an asset but in reality it has seemed, linguistically at least, to have been a handicap. Moreover, Europe

is having some difficulty constituting itself as a political entity, since it cannot manage to build and develop an integrated technological space. The European political will is permanently outflanked by a scientific and technical dynamic beyond its control (Barry, 2001).

The question of the constitution of this space is, therefore, crucial. The reply Barry (2001) provides boils down to a single expression: the 'technological zone'. This is directly linked to the 'technological landscape' proposed by Appadurai, and shares with it the central notion of circulation (Appadurai, 1996). A technological zone is defined by the fact that the technologies in one place (in that zone) are (relatively) similar to those available in other places in the same zone: their transportability and conditions of operation are ensured in every respect. This presupposes the existence of an infrastructure without which the circulation and implementation of technologies would be impossible. A technological zone requires significant logistical investments; moreover, its boundaries and internal organization are fluid.

The idea of one technological zone in Europe could materialize if countries of the region understand and accept that heterogeneity underpins innovation – they will have a real chance to capitalise on European diversity provided every country maintains the opportunities for the exchange of ideas, good practice and experience. In particular, it is required to turn the increased diversity brought about by enlargement into innovation and use technologies to gain a balance in daily lives.

There is an important message for regional development in the new Member States, including Lithuania: their regional strategies and priorities should be distinct from those of other European regions and countries. In deploying their structural funds, their objective should be to leapfrog rather than play 'catch-up'. These regions could bring to the Union new competences and wider diversity. Whilst good practice from EU-15 regions may be useful, it needs to be assessed and adapted to the local context to support distinctive and diverse regional strategies.

Integration of policies at all levels (European, national, regional and local) is of paramount importance. Policies and programmes do not stand alone. Regions in particular need to have an integrated approach in their strategies and their policies need to go hand in hand. In this case, governmental actions should encourage businesses to develop and implement new products and services. Therefore, governmental institutions constantly need to review the adoption of new technologies in the region, the financing needs of new innovative start-up companies as well as to assess consequences of information and communications technologies for regional innovative technological developments.

Initiatives in recent years, to speed up the implementation of research findings from universities into the economy, support knowledge transfer through the publication of research results and the supply of highly skilled people capable of transferring and adapting codified and tacit knowledge. Therefore, the research centres have focussed considerable extra energy and resources on working with industry over the last few years. The primary purpose is to coordinate and streamline many individual activities such as knowledge generation in collaboration with industry, continuous professional development, knowledge transfer through networking, development of entrepreneurial skills, promotion of start-up companies, etc.

Research and development policies play an essential role in developing Lithuania's innovation strategy. Modern innovative concepts enabled research to be market-related, thus providing the opportunities for a country's R&D potential to be commercialized. However, it is vital to intensify international cooperation in applied research if Lithuanian companies are to benefit fully. Radical changes are required in the financing policy of Lithuanian universities and research institutes working on new technologies. It is essential to provide the substantial funding needed for research teams to be able to deliver high technologies, which could be patented in the EU, the US and other national systems. An innovation-friendly environment needs to be re-created, which means reform in schools and universities. It is necessary to promote innovation, direct state science policy towards applied research that meets global market needs, provide tax incentives to encourage innovation by companies, and create favourable conditions to attract venture capital.

Figure 5 indicates tertiary graduates in science and technology per 1000 of population in the EU (25 countries) as well as in three leading European countries in respect of this outlook. Lithuania belongs to the leading group together with Ireland and the United Kingdom. However, Figure 6 presents a controversial viewpoint where Lithuania falls behind all European Union countries by a number of patent applications, except for such countries as Romania and Turkey (Liechtenstein, Switzerland, Sweden – the leading group; Lithuania, Turkey, Romania – the lagging group).

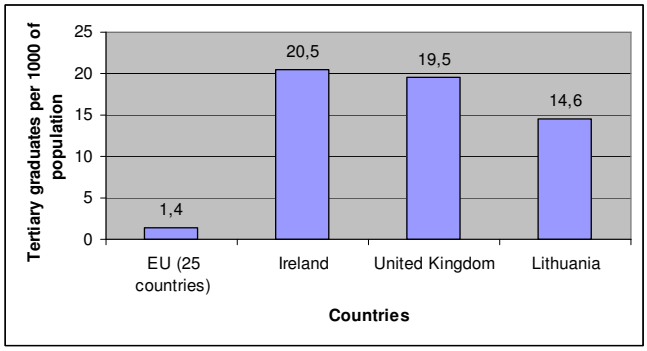

Figure 5. Tertiary Graduates in Science and Technology per 1000 of Population Aged 20-29 Years During the Year of 2003 (Eurostat, 2004)

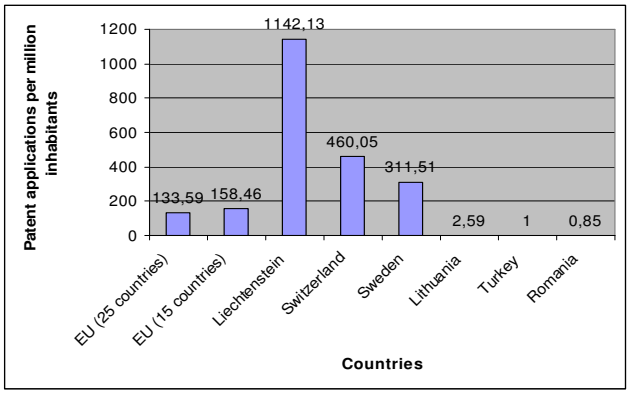

Figure 6. Eurostat Estimate: Number of Patent Applications to the European Patent Office per Million Inhabitants in 2003 (Eurostat, 2004)

The key idea of the paradox may lie in that fact that there is a clear gap between scientific and research activities and their practical application. The other reason could be that qualitative criteria (number of graduates) have been outweighed by quantitative criteria (knowledge base and its relevance).

Attempts to mature information society in Lithuania will undoubtedly contribute to strengthening the country's position in technology innovation and development processes. However, the Technology Society Development Committee (http://www.ivpk.lt/main_en.php) supports only issues of general character. In addition, the Committee seems to have no clear future vision (no in-depth Strategy or Action Plan) and lacks initiative for organizing cooperation between different players on, at least, national level. It could serve as a start-up platform between scientific centres and business entities facilitating company-university cooperation through dynamic exchange of information flows as well as knowledge spreading.

Meanwhile, Lithuanian Academy of Sciences (http://neris.mii.lt/LMA/english/mokslo_.html) could more significantly contribute to determining scientific research priorities and bringing endeavours together with a special emphasis on new technologies, including more efficient use of information and communication technologies through the promotion of increased cooperation, greater complementarities and improved coordination between relevant actors, at all levels (Strategy Action Plan 2004-2006 prepared by Lithuanian Academy of Sciences seems to be more of theoretical nature – no concrete steps have been disclosed pursuing this Plan). State budget allocations and reward entitlements seem to be more of sponsoring rather than investing character, thus the widening gap between theoretical underpinning and practical application has to be reduced where the Technology Society Development Committee could play an important role in diminishing the absence of adequate networking. Thus, promotion of tight cooperation between Lithuanian Academy of Sciences and the Technology Society Development Committee may grow into a flexible and reliable structure both theoretically and practically supporting development and implementation of new technologies.

Implementation of new technologies in information society requires bringing together all research actors – universities, research institutes, small and large companies, governmental organizations, etc. – across Lithuania and Europe to shape short-term and long-term strategies focused on open collaboration between policy-makers and private sector firms. Bridging the gap between theory and practice as well as efficient cooperation between funding and research bodies are of paramount importance. The sooner new technological ideas will be marketed through information centres the sooner they will be adopted by end-users. New export-oriented businesses and new jobs based on new technologies could be created in Lithuania providing the Government creates a favourable environment, providing research centres closely cooperates with information and business centres, providing information and communication technologies more and more facilitates innovative technological improvements as well as their implementation.

Conclusions

The emergence of advanced information and communication technologies facilitates widespread implementation of other technologies and the increasing relevance of knowledge and information becomes a key driver of economic prosperity and wealth. In modern information society it is sought to derive the full benefit from available information flows combining data and information processing capacities with creativity of human beings. The primary goal of information society remains to bring high quality research and developments efforts to the market by means of applying multiple effects of cooperation.

It is required to be involved in a continuous process of innovation activities since they stand for a catalyst of productivity growth. All areas of innovation – strategy innovation, business innovation, product/service innovation, process innovation, technological innovation, organizational innovation, marketing innovation – are of paramount importance for business entities. Meanwhile, intellectual property rights strengthen innovation by providing a tool for business to earn profits, on the one hand, and to spread technological knowledge, on the other hand. The more fundamental research is linked with applied research the more results are converted to new products, services or processes.

No new technologies have an economic impact until they become widespread in the economy and, as a rule, the process of technology implementation takes a long period of time. In this case, new information and communication technologies foster technological developments and reduce the time of their implementation. Even though information and communication technologies cause changes in economic geography of the world economy these changes, however, will not necessarily mean the death of distance. As technological knowledge flows towards implementation it goes through research, development, demonstration, and commercialization paces.

The idea of single European technological zone could materialize if countries of this region accept heterogeneous innovation policies and maintain the exchange of ideas, good practice and experience. Research and development plays a crucial role in developing Lithuania's innovation strategy it is therefore required to make changes in the financing policy of Lithuanian universities and research institutes working on new technologies seeking to bridge the gap between theoretical findings and practical applications. Maintaining close cooperation between the Technology Society Development Committee and Lithuanian Academy of Sciences could serve as an efficient structure that would assist end-users in their adopting new technological ideas.

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Naujų technologijų diegimas informacinėje visuomenėje

Santrauka

Šiuolaikinėmis komunikacijos priemonėmis perduodami milžiniški informacijos srautai kasdien daro įtaką naujų technologijų atsiradimui. Naujos technologijos ilgus metus buvo ir yra mokslinių tyrimų objektas, nes technologinė pažanga yra laikoma viena svariausių varomųjų jėgų, nulemiančių ekonominį šalies augimą. Didelė dalis mokslininkų nukreipė savo pastangas, siekdami nustatyti ryšį tarp naujų technologijų diegimo bei reikiamų žinių, būtinų šioms technologijoms diegti, lygio (Bartel, Lichtenberg, 1987; Doms, Dunne, Troske, 1997; Caselli, Coleman, 2001); siekdami sulyginti naudą su iškylančiais kaštais (Caselli, 1999); norėdami atskleisti informacinius barjerus (Jovanovic, MacDonald, 1994) bei išryškinti mokymo proceso reikšmę (Jovanovic, Lach, 1989) naujų technologijų diegimo bei valdymo procesuose. Deja, mokslinėje literatūroje jaučiama stoka reikšmingų darbų, kur būtų sistemiškai analizuojamas naujų technologijų diegimas, pradedant idėjų generavimu ir baigiant galutine šių idėjų komercionalizacija, kartu apibrėžiant informacinių ir komunikacijos technologijų vaidmenį nagrinėjamame procese.

Šio straipsnio **objektas** – naujos technologijos bei jų diegimas informacinėje visuomenėje.

Tikslas – išanalizuoti ir nustatyti, kaip informacinė visuomenė veikia naujų technologijų diegimą.

Uždaviniai, kuriais įgyvendinimas tikslas, yra šie: atskleisti nuolat didėjantį informacijos poveikį pasaulinei visuomenei bei įvardyti informacijos gausoje atsirandančias galimybes; apibrėžti inovacijų vaidmenį, nustatyti inovacijos sritis, taip pat išryškinti jų poveikį tiek komerciniams, tiek nekomerciniams subjektams; parodyti, kaip informacinės ir komunikacijos technologijos palengvina tarpusavio bendravimą bei veikia kitų naujų technologijų vystymąsi; nusakyti naujų technologijų poveikį, adaptuojantis prie informacinių srautų gausos; įvertinti ir pagrįsti naujų technologijų diegimo svarbą Lietuvoje, jai integruojantis į bendrą Europos technologijų zoną.

Tyrimo metodai – mokslinės literatūros loginė analizė ir sintezė, statistinių duomenų sisteminė analizė, statistinio grupavimo metodas bei palyginimo ir apibendrinimo metodai.

Žinių generavimas ir panaudojimas šiuolaikinėje visuomenėje tampa vyraujančiu veiksniu kuriant turtą. Todėl, auganti žinių ir informacijos svarba paskatino mokslininkus įvesti naują terminą „informacinė visuomenė“, kurioje žmonės naudojasi informacinių ir komunikacijos technologijų tiekiama visokeriopa nauda. Informacinei

visuomenei prieinamos technologijos užtikrina kompanijų konkurencingumą per tarptautinį bendradarbiavimą, formuojant ryšių bei inovacijų tinklus.

Šiuolaikinėjo globalinėje ekonomikoje verslas, ypač gamybinis, neišsilaikys, jeigu nebus nuolatos ieškoma inovacinių metodų, geriausios praktikos, tinkamiausių procedūrų bei sistemų, kur papildomai intelektualinės nuosavybės teisės remia inovacijas, suteikdamos verslui įrankį, leidžiantį susigrąžinti įdėtas investicijas. Bendras visuomenės supratimas apie skaitmenines technologijas bei egzistuojanti galimybė pasinaudoti naujais įgūdžiais, kurie būtini modernių technologijų ir žinių įmonėms, tampa neišvengiamu veiksniu, lemiančiu inovacijų atsiradimą bei tolygų ekonominį vystymąsi. Naujų inovacijos formų gausa – tai sisteminis požiūris, integruojantis naujas technologijas bei procesus iš kitų sričių, naujus verslo modelius bei verslo vykdymo alternatyvas, taip pat naujus būdus pritraukiant ir aptarnaujant varotojus. Strateginė inovacija, verslo inovacija, produkto (paslaugos) inovacija, proceso inovacija, technologinė inovacija, organizacinė inovacija, marketingo inovacija yra aiškiai tarpusavyje susijusios, o strateginis inovacijos sričių konsolidavimas nulemia kompanijos ilgaamžiškumą bei gerovę.

Technologijų inovacijos ir diegimas paprastai ilgai trunka, kol procesas išbaigiamas ir tampa vis labiau prieinamas mažiau žinių reikalaujančiam darbo personalui. Paskutiniais metais technologijų inovacijų ir diegimo laikotarpis ženkliai sutrumpėjo dėl naujų informacinių ir komunikacijos technologijų atsiradimo, nes pastarosios skatina technologinių patobulinimų vystymąsi ar užtikrina spartų naujovių diegimą. Nors informacinių ir komunikacijos technologijų panaudojimas nereiškia, jog atstumo sąvoka laikui bėgant gali išnykti, tačiau šių technologijų indėlis ekonominiam vystymuisi turi lemiamos reikšmės.

Technologijų diegimo procesas paprastai pereina mokslinio tyrimo, vystymo, demonstravimo ir komercionalizacijos stadijas. Svarbu pašalinti technologijos kūrimo trūkumus mokslinių tyrimų stadijoje, nes, antraip, gali būti stabdomas naujų technologijų vystymas bei diegimas komercionalizacijos etape. Modernios informacijos perdavimo priemonės įgalina bendradarbiauti skirtingų verslo rūšių atstovus bei vieną nuo kitos nutolusias institucijas, taip pat leidžia sujungti naujas ir esamas technologijas į visumą pasauliniu mastu.

Šalies vyriausybės turėtų suteikti paramą technologinių inovacijų vystymui ten, kur privačios kompanijos gali nepakankamai investuoti, ypač jei naujai sukurtos technologijos teikiama nauda persiduoda kitoms sritims; jei egzistuoja didelis neapibrėžtumas pradiniame vystymo etape, palyginti su tolimesniais etapais, jei technologijų vystymas susiduria su tam tikromis kliūtimis, kurios neleidžia efektyviai koordinuoti skirtingas verslo sritis.

Europa taip pat susidūrė su produktyvumo ir inovacijų konkurencingumo užtikrinimo problemomis, žvelgiant iš pasaulinės informacinės ekonomikos taško. Integruotos technologinės zonos idėja (technologijos vienoje vietoje yra palyginti panašios į kitoje tos pačios zonos vietoje egzistuojančias technologijas) Europoje sukelia mokslines diskusijas, kuriose raginama panaudoti Europos regiono skirtingumą su ta sąlyga, kad kiekviena technologinės zonos šalis aktyviai rems galimybes pasikeisti naujomis idėjomis, gera praktika ir patyrimu. Šiuo požiūriu, Lietuva gali įnešti savo turimus gebėjimus ir praplėsti esamą įvairovę tarp Europos Sąjungos šalių, laikydamasi šuolio, o ne vijimosi strategijos. Būtini radikalūs pokyčiai Lietuvos universitetų ir mokslinių centrų, dirbančių prie naujų technologijų, finansavime, nes yra aiškus atotrūkis tarp teorinių duomenų pateikimo ir jų praktinio įgyvendinimo. Lietuvoje esama potencialo vystyti naujas technologijas, kartu prisidedant prie jų plataus diegimo visoje Europos technologinėje zonoje su ta sąlyga, kad Lietuvos vyriausybė sukurs palankų klimatą veiklos vystymui; kad moksliniai centrai glaudžiai bendradarbiaus su verslo subjektais ir informacijos skleidimo centrais.

Iš atlikto tyrimo galima daryti išvadą, jog šiuolaikinės informacinės ir komunikacijos technologijos labai veikia naujų technologijų diegimą pasauliniu mastu, o pagrindinis informacinės visuomenės tikslas išlieka įgyvendinti aukštos kokybės mokslinius tyrimus praktikoje, naudojantis įvairiausiomis bendradarbiavimo formomis tarptautiniame lygmenyje; taigi bendra Europos technologinė zona gali tapti patrauklia baze Lietuvos universitetams ir moksliniams centrams, dirbantiems su naujomis technologijomis, tuo atveju, jei vyriausybinės institucijos, verslo subjektai ar pavieniai individai pasirinks efektyvią ir visiems priimtiną tarpusavio bendradarbiavimo strategiją.

Raktažodžiai: *naujos technologijos, informacinė visuomenė, inovacija.*

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