

COMPETENCIES AND INNOVATIONS LABS: HUMANITIES IN ENGINEERS' HIGH-EDUCATION

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ABSTRACT

The contemporary system of science, research and high education need a new approach concerning engineers' education because of the accelerated technological development. One of the main task remains the reinvention of education which shall make a new strategy for development (Arciszewski 2009). At the beginning of the 21st century the new age of creativity and innovation is broken out (Prahalad, Krishnan 2010). And the new creative and innovative attitude concerns also the new destination of knowledge and education and the new definition of the essential outcomes of science, research and education in the future.

One of the most important subject in this context is the necessity to elaborate a new orientation concerning the question of competencies' formation adequately to the new forms and structures of the informational and knowledge-based society. In particular this applies to the key or core competencies as an expression of the ability to self-realization and self-improvement, to the social integration and employment, but also to the attitude as an active citizen. In according to the recommendation of the European Parliament (2006) concerning the key and core competencies the process of lifelong learning bases on the development of the informational, technological and engineer's, but also on the formation of the communicative, social and civil competencies as the components of the ability to implement the idea of lifelong learning.

The other principal question concerns the importance of innovations. The knowledge-based society and economy suppose a permanent process of development and implementation of innovations, which are at the same time the decisive and determinant element of social, economic, technological and cultural development. This interdependence concerns the principal – connected and dependent to each other – areas of the modern society and culture: economy, medias and science from the one, and education, social supporting and social communication from the other hand. The degree or level of innovations but also the innovations deficit in these areas has directly a bearing on the condition and function of the whole system.

These assumptions demarcate the stages in the following analysis but also the works in the two different basic-research projects elaborated at the Humanities' Department the Wrocław University of Technology in form of two humanistic laboratories on the point of junction between humanities, social science, culture studies, pedagogics and engineering science: "Competencies' Lab" and "Innovations' Lab". The both – competencies and innovations – complement and condition each other with regard to the improvement of the creative potentiality in research and teaching/learning process, and with the high education herself as an interdisciplinary subject of research and studies (Kwiek 2010)

KEYWORDS: *key and core competencies; humanities and engineers high education; transdisciplinary / comparative education and research.*

1.0 INTRODUCTION: THE AGE OF CREATIVITY AND INNOVATION

The contemporary system, policy and culture of science, research and high education need a new approach concerning engineers' education because of the accelerated technological development. One of the main tasks remains the reinvention of science, research and education which shall make a new strategy of the development. The reason for this reinvention are first of all the so called Asiatic challenges (Arciszewski) which result from the dynamic economic, scientific and technologic development of the countries like China, India, Korea or Taiwan. At the beginning of the 21st century the new age of creativity and innovation is broken out.

The background of the emerging challenges is the development and mass-dissemination of the new information and communication technologies and at the same time the increasing conflict between different and often contradictory civilizations and religions on the global level. For this reason the main elements of the new research and education strategy are 1) the cooperation between different research centres, and 2) the elaboration of interdisciplinary research and educational projects on the supranational level.

The universal history is expressed by the development of civilizations which reach from the nomadic and agriculture, then the industrial, and finally to the knowledge-based, informational form of the society. Nowadays it is the time of crossing to the culture based on creativity and innovation. And the new creative and innovative attitude concerns also the new destination of knowledge and education with the efforts to designate the new results of research and science. The elaborated

definition of the essential outcomes indicates the outline of science, research and education in the future. For this new orientation the change of the paradigms is necessary. Especially concerning the engineering science and education the change of paradigms pass from the classical paradigm based on practice and the relation between the master and apprentice through the modern scientific paradigm to the paradigms of innovation and creativity of science, research and education.

The innovative and creativ paradigms reaches to the renaissance with the artes liberales and the so called Medici-Effect as a form of the 'creative environment'. There appears at first the conception of a creative class and its importance for the science development but also for the growth of a region and country. This new paradigm is characterised by an integration of the practical, analytical and creative intelligence with the task to generate new ideas and conceptions. In this way the integrated knowledge and science makes out the new 'model' of engineers' competencies and his general formation. Above all the conception of the creative environment is characteristic for the modern and postmodern science. The creative and innovative environment includes the abduction and induction at once. The abduction expresses the whole brain thinking with rational, innovative and creative, then practical and analytical elements. The abduction makes it possible the elaboration of the new hypothesis (Arciszewski, 2009). Therefore the expression of a successful education is the number of patents, also as the expression of the innovations' and creativity's level and potentiality (OECD, 2011).

2.0 COMPETENCIES IN THE INFORMATIONAL SOCIETY

The necessity of the elaboration a new orientation concerning the question of competencies' formation results from the process of becoming the modern society with the appearance of new forms and structures of the knowledge-based society. From the theoretical point of view the main framework of this new form of society are broadly understanding humanities with the theories of culture, and the accelerated development and mass-dissemination of the new ICT. This concerns especially the specificity of the high engineering education and the designation the role of humanities in the modern engineer's formation.

According to Castells (2007a), the essence of informational society as a new form of culture and social life is the potentiality and competence to operate with information and knowledge, to create new strategies,

and finally to generate new solutions. The skills to this are the new technologies and the global networks of communication. Castells points out, that at the beginning of the 21st „the uses of wireless communication have been transformed by its users as communication networks have diffused globally. From a professional communication device catering for an upscale market, mobile devices have become mass-consumer products, woven into the communicative practices of hundreds of millions of people everywhere in the world” (Castells, 2007b).

In the informational society in particular appears the importance of the key and core competencies as an expression of the self-realization and self-improvement, of the social integration and employment, but also of an attitude as an active citizen. In according to the recommendation of the European Parliament from 18.12.2006 concerning the key and core competencies the process of lifelong learning bases on the development of the informational, technological and engineers’, but also on the formation of the communicative, social and civil competencies as the components of the ability to implement the idea of lifelong learning. At the same time in the present system of high education in Poland we can ascertain a deficit of such proposed solution in comparison to the others research centres in Europe, for instance the House of Competencies at the Karlsruhe Institute of Technology or the interdisciplinary project “Promovieren plus” at the Dresden University of Technology.

2.1 The Conception of the Core Competencies: Economy and Education

Nowadays it seems indispensable to consider in the new situation of the science, research and education system the conception of core competencies presented by C.K. Prahalad and Gary Hamel in the 1990s. The question is, how far the economic model of the core competencies can be implemented also in the system of high education in the reality of a supranational cooperation. The analogy – between the managing and operating with strategies and competencies in the companies on the market form the one, and university and research centers in the education and research system from the other side – is obvious. The both are an organizational systems with the same methods and skills, but with different motifs and aims. However it is interesting to analyze the differences and similarities concerning the core competencies as the condition of the innovative potentiality or, with other words, the competencies as the principal source of innovation.

The core competencies of a corporation can be characterized in analogy to the three as the root system which is the decisive factor of function, development, and change the system as an entity. The system bases

on a portfolio of core competencies which “nourishing and stabilizing everything” (Prahalad), so it makes possible the function of an entity, such as organization, company, but also the research project or the whole system of high education. This portfolio is also a kind of knowledge (individual and collective) which ensures the coordination and implementation of different methods, skills, and technologies in the process of production, teaching and learning, and finally inside the system of science and research. Comparing with the economics in the system of science and high education as the most important and principal core competence appears the methodology understanding as the ability to use the different methods and skills adequately to the research objectivity.

Concerning the competencies and innovations as the elements of the formation of students and absolvents of the high education nowadays, Subra Suresh (Dean of MIT School of Engineering) underlines: “The modern engineer must be at least two things: a creator of new ideas and new technologies, and a re-inventor of those that are less new”. In the field of high education and the mentioned portfolio of core competencies we have a kind of reversible triangulate interdependence between leadership, policy, and technology where the technologies make out the basis of the development and are figurative materialization and objectivities of the core competencies (MIT Technology and Policy Program). The development, but also the evaluation of the core competencies result from the mind-set which includes cooperation across organizational boundaries from the one, and is characterized by the long term thinking from the other hand. The cultivation of this set of core competencies means to take a prospective attitude towards time and future, the ability to affirm the coming changes and challenges, and to moderate these with the aim to identify also the next generation competencies.

The comparative analysis presented by C.K. Prahalad and G. Hamel in the time of transformations the global system of trade and economy focus of the management culture and strategies in the 1980s and the 1990s. First of all they confirm, that the “most powerful way to prevail in global competition is still invisible to many companies. During the 1980s, top executives were judged on their ability to restructure, declutter, and delayer their corporations. In the 1990s, they’ll be judged on their ability to identify, cultivate, and exploit the core competencies that make growth possible – indeed, they’ll have to rethink the concept of the corporation itself” (Prahalad and Hamel, 1990). Nowadays the management culture is characterized by the interdependence between competencies and innovations (Prahalad and Krishnan, 2008).

The turning-point concerning the development of companies in the time of transformations towards a global market was the affirmation of the importance of core competencies, because they “conceived of itself in terms of core competencies”. In this time emerged new strategic factors as decisive elements on the market: 1) the ability and possibility to inventing new markets, 2) “quickly entering emerging markets”, and finally and above all 3) the negation of the classical economic principle, i.e. “dramatically shifting patterns of customer choice in established markets”. For the management it was and still remains the main challenge “to create an organization capable of infusing products with irresistible functionality or, better yet, creating products that customers need but have not yet even imagined” (Prahalad and Hamel, 1990: 3).

The affirmation of the importance of the core competencies, then the elaboration of the strategic architecture, and finally the formulation a portfolio of core competencies are the main steps and at the same indispensable condition for development and implementation of innovations such as new management methods or new products resulting from the new information and communication technologies. “The real sources of advantage are to be found in management’s ability to consolidate corporate-wide technologies and production skills into competencies that empower individual businesses to adapt quickly to changing opportunities” (Prahalad and Hamel 1990: 4). Hereby the dilemma remains the choice between the continuing or disruptive innovations (Christensen, 1997).

In this manner the authors explain the conception of core competencies in the system of diversified corporation in analogy to the tree: “The trunk and major limbs are core products, the smaller branches are business units; the leaves, flowers, and fruit are end products. The root system that provides nourishment, sustenance, and stability is the core competence. You can miss the strength of competitors by looking only at their end products, in the same way you miss the strength of a tree if you look only at its leaves” (Prahalad and Hamel 1990: 4). – Basing on this analogy we have a multidimensional interpretation and meaning of the core competence. Above all the core competence symbolizes the collective learning process in the organizational system “especially how to coordinate diverse production skills and integrate multiple streams of technologies” (Prahalad and Hamel 1990: 4). The core competencies are related above all to the services and not to the production and manufacturing.

With the learning process is connected the specificity of the organizational and managerial cultures in countries comparison

(Prahalad and Hamel 1990: 4) In this context the core competencies can be interpreted as expression and skills of communication implemented between the different levels and functions of the organizational system: "Core competence is communication involvement, and a deep commitment to working across organizational boundaries", and the skills "that together constitute core competence must coalesce around individuals whose efforts are not so narrowly focused that they cannot recognize the opportunities for blending their functional expertise with those of others in new and interesting ways". And finally the core competencies don't diminish with the use, but "competencies still need to be nurtured and protected; knowledge fades if it is not used. Competencies are the glue that binds existing businesses. They are also the engine for new business development" (Prahalad and Hamel 1990: 5). – According to this description of core competencies as learning and knowledge, the communication and the use result from the definition of the corporation which "like a tree, grows from its roots. Core products are nourished by competencies and engender business units, whose fruit are end products" (Prahalad and Hamel 1990: 5). In this manner the core competencies are at the same condition and complement of the innovation.

The development and formation of the core competencies depends and results finally from the strategic architecture which is "a road map of the future that identifies which core competencies to build and their constituent technologies" (Prahalad, Hamel 1990: 9). Therefore the functions of the strategic architecture are: the creation a new managerial culture, the introduction of teamwork, the capacity to change, the willingness to share resources, the protection proprietary skills, and the thinking in long term. In this way the core competencies are "the wellspring of new business development. (...) Only if the company is conceived of as a hierarchy of core competencies, core products, and market-focused business units will it be fit to fight" (Prahalad, Hamel 1990: 14). – The important recognition of the core competencies express the new dynamic strategy by business development from the one, and this strategy – based on core competencies – is an alternative to the narrow, traditional, and mechanistic strategy in business which dominated till now from the other side. The components of the new method of strategizing are: 1) the new managerial culture, 2) the building of a strategic architecture, 3) the permanent program of foresight, but not a vision, 4) the idea of core competencies with the new definition of organization or company as a portfolio of core competencies.

2.2 Competencies as Condition of the Technological and Intellectual Leadership

Could be identified the technology leadership with the intellectual one? Prahalad underlines that the “technology leadership is but an enabler”, the decisive part is the intellectual potential expressed by core competencies, strategic architecture, and resulting from these the potential of innovations. This characterizes the Western companies in comparison with Japan, China or India. The technological and intellectual leadership was dominated by the Western companies till the 1980s. But in the last two decades the West lost this dominant position. In the global market and economy the pattern of industrial leadership is partially changed. Prahalad poses the fundamental questions: 1) “How did the intellectual and market leadership in so many industries shift in such a short period of time?”; 2) “how did the intellectual leadership slip away?”; 3) “But why and how did the U.S. lose leadership in so many industries during the 1975-1985 period?” (Pralhad, 1993).

In the following considerations Prahalad explains the two strategic gaps in business on the global market according to the reality of the 1990s: “If growth and new business development are the real issues, value creation will be the scorecard for managers during this decade. This scorecard consists of two parts: 1) managing the performance gap; i.e., improving performance across a wide variety of dimensions such as quality, cost, cycle time, productivity, and profitability; 2) simultaneously, managers should focus on the opportunity gap, profitably deploying resources to create new markets, new businesses and a sense of broad strategic direction” (Pralhad 1993: 41). The performance and opportunity gaps are the twin aspects of value creation. In consequence the main question for managers is, “how to redeploy the investment pool, created by focusing on the performance gap, in the pursuit of new opportunities for growth. To create value, concerns for operational improvement (performance gap) and strategic direction (opportunity gap), must coexist” (Pralhad 1993: 42).

Pralhad concentrates his analysis on the opportunity gap as condition of a new framework for value creation which consists of a logic with four interlinked parts: 1) Aspiration level of the organization with the strategic intent, so that the aspiration “must focus the energies of the organization toward innovation (changing the rules of the game) in the way the firm competes”. 2) Capacity to leverage corporate resources based on the strategic architecture which includes core competencies and core products: “Reusability of invisible assets, as well as core products, in new and imaginative configurations to create new market

opportunities is at the heart of the process of leverage". 3) Competing for the future with creating a new competitive space, and the possibilities of a new business development. That means to develop a framework "for identifying new opportunities, focusing on functionalities rather than on current products and services, and dramatically altering the price-performance relationships in an industry". 4) Recognition the organization and/or company as a whole, as an entity with strengthening organizational capabilities: "energizing the whole organization – all people, at all levels, in all functions, and in all geographies. It involves developing a shared mindset and shared goals, and developing strategies for acquiring competency" (Prahalad 1993: 42).

Concerning the strategic architecture Prahalad underlines, that it is "a distillation of a wide variety of information. It is a way of capturing major discontinuities and trends in the industry", with the aim to capture the milestones changes, and to develop a framework for innovation managing: "The underlying assumption is that innovation is a line job and not a staff job. (...) We need to develop a framework in which innovation can be planned and managed. Strategic architecture provides one such framework for proactively managing the innovation process" (Prahalad, 1993: 43). Strategic architecture gives the possibilities of realization the fusion or convergence in the field of new ICT, e.g. between computing and communication. – But the most important element of a strategic architecture is the identification of the core competencies. Prahalad emphasizes that the concept of core competencies "tends to be confused with core technologies and / or capabilities. Core technologies are a component part of core competencies. Core competency results when firms learn to harmonize multiple technologies (...) that it is not just technical capabilities that matter. What matters is the creative bundling of multiple technologies and customer knowledge and intuition, and managing them as a harmonious whole" ((Prahalad, 1993: 45).

Prahalad formulates the concept of competence as a product of technology, governance process, and collective learning. In this context the core competencies involve innovations: "When we model the corporation as a portfolio of core competencies, we tend to focus on new application opportunities. This perspective enhances the focus of management on new business development" (Prahalad 1993: 46). The three levels of competition on the global market are: 1) competition for the end product markets and services with price-performance competition; 2) competition for dominance in core products with the development of new functionalities; and 3) competition for core competence, i.e. the capacity to create new business.

The change of the orientation focused on core competencies and the emerging new age of innovation means a new strategy and attitude: “We want to move from satisfying needs to anticipating needs; from being close to customers to leading customers; from thinking in terms of products to focusing on functionality and rapid market incursions; from focusing on core business to diversifying around core competencies. This is a very different mindset. (...) We need to start with a strategic intent, create a strategic architecture, understand core competencies and products, such that there is a logic for business units, both current and new, and that leverage is based on continuous reconfiguration of these competencies. – To realize both the stretch and the leverage that this set of ideas promotes, we need to develop a set of values and beliefs that are consistent with this orientation to profitable growth” (Prahalad, 1993: 47).

Strategic intent as expression of the aspiration level inside the organization or company “is a way of creating an obsession with winning that encompasses the total organization (all levels and all functions). It is a shared competitive agenda, sustained over a long period of time, for global leadership. Extraordinary accomplishment is often based on a clearly articulated strategic intent”. And that means “the power of a clear strategic intent” (Prahalad, 1993: 43), which – if formulated – became the decisive factor for all activities inside the whole organization.

2.3 The Core Competencies in Education and the Indicators of ICT

The role of competencies as condition of the technological and intellectual leadership results from the acquired competencies during the educational period, so that the system of education determines the potentiality of management and leadership in the macro-scale. This concerns at first the level of the primary and secondary education with regard to the indicators of ICT, which express the educational development and progress, and reaches to high education and the acquired competencies by students (European Commission, 2009). The method to analyze the ICT-indicators is the comparative monitoring of education on the international level, understanding also as a part of strategic international cooperation and policymaking in the field of education at all: “While national monitoring provides evidence regarding educational progress in one country, often countries feel the need for international comparisons for better interpretation of the national educational developments”. Hence the increased interest for participation in international comparative educational monitoring,

these “assessments are intended to assist policy makers to better understand to what extent their educational system are measuring up with developments taking place in other countries” (European Commission, 2009).

The new information and communication technologies are the skills to modernize the process of learning and teaching. The process of policy-making in the field of education takes place at different levels reaching from local (school and universities) to international cooperation. In this context is argued in the EACEA-Report that “the core areas for monitoring educational progress concern the skills and attitudes of students as well as the opportunities to learn these skills at school and outside school (...) that multi-level monitoring may be an important option for the future”. And why the necessity of monitoring the ICT-indicators? Because the communication technologies are “not just an instructional tool, but THE backbone of the information society, which touches upon almost every aspect of private and professional life. Just like reading and writing are traditional competencies transmitted through education, the effective use of ICT for learning, communication and cooperation is one of the basic competencies which schools need to care for. Monitors are needed in order to determine to what extent education systems realize these competencies and in which areas improvements are needed” (2009:1).

The use, dissemination and implementation of ICT in teaching and learning process, for instance in form of e-learning or blended-learning, underlines the importance and necessity of reforms in the educational system. In this context the authors of EACEA-Report notice: “A currently common notion is that educational reforms can only take place if assessment practices are changed (...) that, the core of monitoring ICT in education should be the competencies of students to use ICT for learning in a variety of domains. Conditional factors are of interest for exploring to what extent they have a potential positive impact on these competencies” (2009:2). – The monitoring of ICT-indicators is focused on the following categories: 1) infrastructure with the attainability to hard- and software and access to the Internet; 2) curriculum with pedagogical approach, par example autonomous learning, content with methods development, and assessment with a portfolio or digital license; 3) outcomes and attitudes express by competencies or digital literacy; 4) leadership and managing potentiality; 5) connectedness with the intensity of international cooperation and strategic public-private partnership; and finally 6) teachers’ competencies.

The opportunities for the students to learn with ICT and to acquire the ICT-competencies are recognized as the core areas and the most influential comparative indicators by monitoring of ICT dissemination, use and implementation in form of the education-policy. The EACEA-Report stresses that on “the long term a modern system for educational monitoring is needed (...). Designing and implementing such a system is a complex process, in which the engagement of multi-disciplinary development teams is needed. This is a big challenge, but not impossible. Just as mankind is able to build sophisticated telescopes to observe far distant planets, it is certainly possible to create a system of permanent observation of educational progress” (2009:5).

3.0 COMPETENCIES AND INNOVATIONS AS RESEARCH SUBJECT

The description of the following research projects presents the attempt to transfer and integrate Prahalad’s conception of core competencies into the system of high education, especially in the reality of engineer’s study and research programs. The projects are focused even on competencies and innovations as the transdisciplinary completion of the absolvents’ profile.

3.1 Transdisciplinary “Competencies’ Lab”

The main axis of the project consists of the elaboration a transcultural and transdisciplinary orientation as the theoretical basis in the process of competencies’ forming, then with the endeavour to found and to strengthen the basic-research in the fields of philosophy, humanities and social science, also with the cooperation with the other research centers in Poland and Europe within the transdisciplinary “Competencies’ Laboratory”. The interdisciplinary and transcultural orientation designs the comparative studies as the principal method of research. At the same time the assumptions and works of the project including in the activities of the Laboratory result from the specificity of the Humanities’ Department the Wroclaw University of Technology as an interfaculty research and didactic unit. At the same the project has to improve the efficiency of the education through the complement of the graduated profile with the postulated also from the employers humanistic factor. In this context the project and the laboratory integrate three main research areas: 1) Culture, science and technologies studies, 2) Education, pedagogics and social supporting in the informational society, 3) Social communication with the medial, organizational and institutional competencies.

Culture, science and technologies studies

The objective of the project is the theoretical elaboration of the transcultural and transdisciplinary orientation on the background of the philosophy of culture, comparative science of civilizations and religions, theory of science and finally of the analysis the phenomenon of social changes. Within the project is planned the completion and publishing of the works which make out an integral parts of the research projects, like "Humanities and Technologies. New paradigms of culture and science", "Technological transformations of society", "Civilizations and religions towards the technology development" and "Transcultural and transdisciplinary competencies" as a collective work. In the Competencies Laboratory the following research and empiric works are dedicated the research politics and reforms of the high education system in Poland and EU with regard to the process of competencies' forming and acquirement: 1) Comparative studies concerning the Bologna-Process with pedagogic and didactic aspects; 2) Process of informatization in the high education and the dissemination of the e-learning methods; 3) Analysis and examination of the virtual community by the students. The last element is piloting elaboration of the experimental Intelligent Tutoring Systems as a project's orientated form of tutoring with use of the ICT.

Education, pedagogics and social supporting in the informational society

The main task in this module of the project is the description of the process of forming the core competencies connected with three models of educational working with the adults (the technological, humanistic and critical) and then the estimation of the influence the transdisciplinary education for the development of the core competencies through the formal (institutional) education but also the informal education. The development of the informational society designs new spaces of the human activity. One of the most important is the creation of the virtual community with the groups concentrated around the idea of the mutual aid and networks of social supporting. The empiric research hereby consists of social supporting networks, its educational and consulting functions with two different examples: 1) the supporting groups of woman with chest-cancer, 2) and groups supporting their self-development. The core issue in this context is the elaboration of the method supporting the competencies' development indispensable in the informational society but also by participation in the virtual community and by creating the social supporting networks.

Social communication with the medial, organizational and institutional competencies

Considerations concerning the innovations in management and organizations are important in the process of forming the professional and executive competencies. The other issue is the role of competencies in social communication, the ability to communicate in transcultural relations and environment, to recognize the differences and similarities (Hofstede and Hofstede, 2007). The main topic is the analysis of the transcultural exchange of information and the creation of virtual community. This is also the background of forming and acquirement of the transcultural competencies in the perspective of the global labour-market. The empiric research concentrates here on the foreign students at the Wroclaw University of Technology and the Polish students participating in the exchange programs of the EU.

Transdisciplinary "Innovations' Lab"

The knowledge-based society and economy suppose a permanent process of development and implementation of innovations, which are at the same time the decisive and determinant element of social, economic, technological and cultural development. This interdependence concerns the three principal – connected and dependent to each other – areas of the modern society and culture: economy, medias and science. The degree or level of innovations but also the innovations deficit in these areas has directly a bearing on the condition and function of the whole system. These assumptions demarcate the stages and works in the project. The starting-point is the critical analysis of the meaning and importance of innovations concerning the socio-economic system in the three mains areas, and with its exemplification in particular issues: 1) Agriculture: Barriers and chances of a sustainable development; 2) New Media in the Economy; 3) Networks and interdependence between science, technologies and economy.

Agriculture: Barriers and chances of a sustainable development

Concerning the economic transformation in Poland after 1989 the analysis concentrates on the institutional changes and implementation of modern technological innovations in the sector of agriculture. The main issue is hereby the investigation of barriers in the process of innovations introduction in the country areas and at the same the fact of progressive overcoming by the institutions concentrated around the sector of agriculture. Basic research and the use of the poll-method should make it possible to evaluate the degree of innovation in the

Polish agriculture and how far the farms has changed in the process of structural transformations. Moreover the investigations of the process of technologization in the exemplary farms in Lower Silesia should give a complete picture of the changes in the agriculture last decades. The examination of transformations in the country areas bases on the analysis of the number of implemented innovations, their types, the level of the capital expenditure into innovations compared with the total costs of a farm and the achieved benefits. There would be also examined the role of research programs at the Wroclaw University of Technology and how far its contribute to the transfer of new innovative solution into the agriculture sector of whole national economy. The output of this part of the project are two monographs: "The influence of innovative technological solutions on the development country areas" and "Development through innovation – a global economy".

New Media in the Economy

The aim of the subproject is investigation and characterization of the cultural, social and businessinnovation of the creative industries in Poland. The growing importance of the creative industries as well as SMEs for the Polish economy is the justification of the subproject. The three parts of the research are going to be conducted: introductory theoretical research, especially critical examination of the new media enterprises, especially the innovation of the new media with preparing the book "Creative Industries and New Media", which will summarize this part of the research; and empirical research on innovation of micro and small new media enterprise in Poland. Few integrated methods are going to be used at the third stage of the subproject: quantitative interviews, observation of the daily works of the enterprises, document analysis and individual semi-structured in-depth interviews. The theory of innovation of micro and small new media enterprise will be the result of the subproject presented in the book: "Innovation of the New Media Enterprises in Poland".

Networking interdependance between science, technologies and economy

The third element of the research project and the Innovations' Lab is the fundamental question concentrated around the relations and phenomenon of the feedback between the development of science and society, between science, technology and economy as the essential source generating solutions and innovations. One of the main subject in this context is the analysis of status, role and importance of the university and high education in the social and economic system.

The extrapolation of this subject concerns especially the innovative potentiality the Wroclaw University of Technology in three main domains: 1) the analysis of the student-orientated educational programs; 2) the scientific and research programs for the academic staff; 3) the innovative potentiality expressed by the research and development programs which includes the reforms of high education system on national and European measure. From the theoretical point of view the elaboration two monographs are envisaged: "Civilizations, organizations and medias. The coordinates of the informational society and economy" and "Innovation and Economy. The cultural and technological determinants of economic transformations".

4.0 THE EFFECTS AND PRODUCTS OF THE PROJECTS

The supposed orientation consists of two main areas. The Competencies' Lab with the transdisciplinary orientation of competencies' forming and acquirement encloses three subject: 1) Culture, science and technologies studies, 2) Education, pedagogics and social supporting in the informational society, 3) Social communication with the medial, organizational and institutional competencies. The Innovations' Lab concerns permanent process of innovations development and implementation especially in the areas of 1) Agriculture with barriers and chances of a sustainable development, 2) New media in the economy, 3) Networking interdependence between science, technologies and economy.

One of the most important subject in this context is the necessity to elaborate a new orientation concerning the question of the competencies' formation adequately to the new forms and structures of the informational and knowledge-based society. In the informational society appears in particular the importance of the key and core competencies as an expression of the ability to the self-realization and self-improvement, of the social integration and employment, but also of an attitude as an active citizen. In according to the recommendation of the European Parliament (2006) concerning the key and core competencies the process of lifelong learning bases on the development of the informational, technological and engineer's, but also on the formation of the communicative, social and civil competencies as the components of the ability to implement the idea of lifelong learning.

The other principal question concerns the importance of innovations. The knowledge-based society and economy suppose a permanent process of development and implementation of innovations, which are at the

same time the decisive and determinant element of social, economic, technological and cultural development. This interdependence concerns the three principal – connected and dependent to each other – areas of the modern society and culture: economy, medias and science. The degree or level of innovations but also the innovations deficit in these areas has directly a bearing on the condition and function of the whole system.

These assumptions demarcate the stages in the following analysis but also the works in the two different basic-research projects elaborated at the Humanities' Department the Wroclaw University of Technology in form of two humanistic laboratories on the point of junction between humanities, social science, culture studies, pedagogics and engineering science: "Competencies' Lab" and "Innovations' Lab". The both – competencies and innovations – complement and condition each other with regard to the improvement of the creative potentiality in research and teaching/learning process, and with the high education herself as an interdisciplinary subject of research and studies (Kwiek, 2010).

In the case of the "Competences' Lab" the measurable effects and persistent products of the project are: 1) Establishing of the research team "Humanities and Technologies: Culture – Education – Competencies"; 2) Initiation of the edition "Technopolis. Competencies and Innovations"; 3) Constitution of the Competencies' Laboratory as the instrument for the development of an interdisciplinary teaching and research environment; 4) Elaboration and publishing a series of theoretical monographs; 5) Elaboration of two experimental models of competencies. In the same way the "Innovations' Lab" contains the effects and persistent products of the project: 1) Establishing of the research team "Technology. Innovation – Economy – Media"; 2) Initiation of the library edition "Technopolis. Competencies and Innovations"; 3) Constitution of the "Innovations' Lab" at the Humanities' Department as the instrument but also the basis for the research development in the three areas of the project; 4) Elaboration and publishing a serie of theoretical monographs; 5) Elaboration of three statistic classes as the output of the empirical research concerning the interdependence between economy, media and high education.

The project itself makes out the space for elaboration the particular projects by team members which results with the considered number of publications. Whereas the works contained in project, the specified research areas and empirical research underline the informational society, media, technology and economy as an interdisciplinary subject of theories and research. And that means an innovative contribution

to the transdisciplinary orientation on the point of junction between humanities and engineering science as well the extension of the interdisciplinary orientation in the humanities self.

The assumptions and works of the project result from the specificity of the Humanities' Department at the Wroclaw University of Technology as an interfaculty research and didactic unit. At the same time the project has to improve the efficiency of the education through the complement of the graduated profile with the postulated also from the employers humanistic factor by the modern engineers.

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- Prahalad/Hamel underline: "The problem in many Western companies is not that their senior executives are any less capable than those in Japan nor that Japanese companies possess greater technical capabilities. Instead it is their adherence to a concept of the corporation that unnecessarily limits the ability of individual businesses to fully exploit the deep reservoir of technological capability that many American and European companies possess" (1990: 4).

- Prahalad, C.K. (1993). The role of core competencies in the corporation, [in:] "Research Technology Management", Nov / Dec 1993, p. 40.
- Prahalad 1993: 45): The following explanation includes the concept of competence: "The key to understanding competence is that although it incorporates a technology component, it also involves the governance process inside the organization (the quality of relationships across functions, across business units), and collective learning (across levels and functions) inside the company. (...) The message is clear: Investments in technology, if they are not, in tandem, accompanied by investments in governance and creation of a learning environment at all levels in the organization will remain under-leveraged. So, the logical point of leverage for Western firms resides in investments to improve the quality of organization".
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