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INNOVATIVE MANAGEMENT OF A UNIVERSITY

Abstract:

The transformation of universities from the classic model to the entrepreneurial university and later to the innovative university is the stimulator for the creation of a knowledge society providing the foundation for an economy based on knowledge. This process is the effect of internal disputes running between traditionalists and pragmatists at universities. Among the traditionalists there is a conviction that knowledge is of a theoretical dimension that comes down to the value of discovery, retention and conveyance of knowledge in its own right.

The aim of the herein paper is to conduct an analysis of the process of innovative management of a university, while also to define the innovative features of a university and the principles of management of a university of the third generation.

The effect of the pilot research conducted is the proposal of the model of the university of the third generation, whose development is generated by constant innovation, cooperation with the economy, while also social partners and civic society.

Keywords:

Management of university, Innovative university, Knowledge university, Network cooperation

JEL Classification: M10, M19, I25

Introduction

The contemporary model of society encourages universities to change the hitherto model of the concepts of education, nurturing, transfer and marketization of knowledge. The development of science, techniques, while also the development of information technology has accelerated the transformation of social structures, while an information society is rapidly being formed. The progress in scientific research, while also the immediate transfer of innovation to the economy is changing the management of a university. The employees, students, PhD students and graduates of the university are authors and participants of the new product, process, organizational, marketing and ecological solutions which are transferred to the economy. The management of a university manifests itself in the commercialization of knowledge, in which the enumerated "actors" and the university participate in business activities, while also creating the innovative success of the enterprise. The education process is changing, in which the preparation of students for conducting business activities or professional work is of significant importance. There is the necessity of a constant enhancement of the quality of education geared towards practical teaching, whereby during the course of studies a student participates in seminars, tutorials and work placements on an intensive basis.

In order to execute the new innovative aims, the university is obliged to intensify the appertaining features and compliant knowledge of the university (Wysocka, Leja, 2018, pp. 4-9). The most significant features include the servant leadership, both strong and ancillary with regard to the academic society of the guiding centre (Clark, 1998, p. 5), the flexibility of the university in the field of didactic and research activities (Krupski, 2005, p. 22), blurred structures (Morgan, 2005, p. 89), team learning (Morgan, 2005, p. 102), knowledge sharing (Wawrzyniak, 2004, p. 278), supporting creativity (Evans, 2005, pp. 61-62), fluidity of roles and range of duties (Drucker, 2002, p. 120), a culture compliant with knowledge (Jablecka, 2004, p. 16), openness to variety (Andrews, Tyson, 2005, p. 26)

The transformation of the functions and features of the university in terms of relations with the economy and self-government/government administration (triple helix) emerges when each of the entities indicated may take on the role of the other to an increasingly greater degree. The theory of the Triple Helix claims that the infrastructure of knowledge may be explained with the aid of the indicated variable relations. The arrangements and networks between these three entities constantly ensure contributions and sustainable development of science based on the innovative processes. It plays a leading role in this new configuration of the academic environment, while also supporting entrepreneurship, creating institutional support entities (career office, academic incubators and pre-incubators of entrepreneurship, centres of technology transfer, scientific-technological parks, clusters), innovative enterprises (spin off), while also being the source of development of innovative technologies and the provider of educated employees (Etzkowitz, 2001. p. 1).

An innovative university, which is termed the university of the future facilitates good talent management and better management of talented students by indicating the paths for their professional careers, with particular mention of the honing of the ability to perceive the opportunities and combine theoretical knowledge with practical knowledge.

The key to the dynamic development of the universities of the future is becoming an effective system of education (Pawłowski, 2004, pp.92-96). The university of the future constitutes the most significant link in a network of innovations and open innovations (Bucic, Ngo, 2012), while also building links for global innovations (Lee, Cho, Cheong, Kim, 2013, pp. 30-41, Lichtenthaler, 2012, pp. 851-861, Park, Kim, Kang, 2015, pp. 196-208). Due to its place in the triangle of innovations, it plays the main role in the diffusion of technological innovations for industry and services. With this aim in mind, it should conduct technological foresight (Okoń-Horodyńska, 2007, p. 15), in order to predict the potential paths of developing the economy, identify the new research areas, have its own development strategy, whose preparation constitutes one of the principal tasks of the university authorities (Leja, 2006, p. 12).

Hence, it is necessary to ask the question as to how the process of innovative management of the university is running in current practices. The aim of the research conducted was the identification of the process of the innovative management of the university in chosen indigenous and worldwide universities. The definition of their specifications, while also thematic scopes, shall facilitate the preparation of good practices of the innovative management of a university in further research in the future and may provide the opportunities to promulgate and standardize the innovative management of a university.

In executing the afore-mentioned aim, the following research questions have been put forward:

- What are the effects of the process of the innovative management of a university?
- In what way is it better to avail of the greatest value of a university, namely its employees, students, graduates and the knowledge possessed by them than up to now?
- What features should an innovative university have?

1. Literary review

In the Polish academic environment, there is constantly a discussion about the future model of a university, described as an innovative university of the third generation. There are increasingly more widespread convictions that the Humboldtian model, which is solely based on the didactic functions and scientific-research activities, came to an end at the end of the 20th century.

In subject-related literature, we may encounter a division of universities into four concepts as follows:

- Napoleonic concept — the state maintains full control over activities,
- the Kant notion of a university — the state intervenes only in some aspects of the activities of a university,
- the Humboldtian concept — the state plays a secondary role and does not interfere in the internal matters of a university,
- the Newman notion — the model of university in England — the state is not the owner of the universities, but merely supports them in their activities; (Tight, 1988).

In analysing the functional side of the activities of universities, three models are commonly accepted (see: Makiela, 2017):

- Model of university of the Middle Ages (scholastic),
- Model of Humboldtian university,
- Model of University of the Third Generation of 21st century.

With reference to the proposed new model, the notion of the “University of the Third Generation” has emerged (Wissema, 2005, pp. 21–39), which as opposed to universities of the Middle Ages, is solely based on educational functions and expansion by reforms of the Humboldt brothers at the beginning of the 19th century in terms of scientific-research activities. At present, we live in a historical moment in which the “University of the Second Generation”, of the Humboldtian model does not fulfil the requirements of the contemporary society and economy. Thus, a transition period has arrived, in which there is a move towards the model of the “University of the Third Generation”. Some universities, mainly in Anglo-Saxon countries, fulfil the assumptions of the “University of the Third Generation”, yet this is still not a prevalent model [Wissema, 2009, p. 9].

What is the difference between the “University of the Third Generation” and the hitherto university model?

In the new model of the “University of the Third Generation” there is a prevalence of the inter-disciplinarity and trans-disciplinarity (the departure from the rigid division of science, which is to favour creativity), increased contacts with society, including with the business world, private firms, corporations, while also other research and educational centres (Kwiek, 2010, Leja, 2013, Gorzelak 2009, Cyfert, 2014, p. 43).

The added value of the University of the Third Generation is the consistent creation of network structures, the departure from the traditional organizational solutions, while also availing of the new methods of management and commercialization of research results (Makiela, 2017, p. 24). The network structure of a university is featured by intensive and long-lasting ties with society, business organizations, enterprises, corporations, research, educational and self-governing centres. The network structures open up the space for the commercialization of knowledge, which favours the financial autonomy of the activities of the university and consequently independence. Furthermore, scientific research is capital-intensive over a long period of time, while also a high degree of risk, which the state is unable to guarantee. The strategies of an entrepreneurial university are determined by cooperation with enterprises and corporations that finance research and avail of their results.

An important role in terms of building the financial independence of an entrepreneurial university is played by academic entrepreneurship, in which employees, students and graduates are the creators of new solutions that bring financial effects for academic enterprises and universities. The university is becoming a centre for the flow of know-how, while also a place to arouse academic entrepreneurship and technology transfer.

The subject of an entrepreneurial university, academic entrepreneurship and technology transfer is an important issue for institutional policies, as well as building the ties of the university with the economic and business environments (Kwiotkowska, 2011, pp.158–171). Entrepreneurship at a university is conditioned by the level of its autonomy, which in turn mostly depends on the legislative and financial circumstances of the university itself (Andrzejczak, 2015, pp. 123–125, Popławski, Markowski, Florkiewicz, 2013, p. 60). Its manifestation is the professional activity of its graduates, cooperation with the business environment, offer of statutory education (i.e. post-graduate studies, courses and training), the acquisition of the sources of financing (grants), the commercialization of the research results (centres of technology transfer), intervarsity cooperation, the commercialization of knowledge, protection of intellectual property, the creation of entities to support academic

entrepreneurship (incubators of entrepreneurship, technological parks), the creation of spin-off firms.

Contemporary phenomena of social and economic aspects, as well as technological innovations, entrepreneurship, the role of a territorial self-government all have an impact on researching the science of management (Czakoń, 2013). In this process, an increasingly important role is being focused on at universities, which plays a dominant role in terms of shaping network ties, while also cooperating and competing in terms of acquiring innovative resources. The effects of these ties are striking for all the stakeholders, in that they change the principles of their functioning, while new functions are formed and the characteristics attributed to them are also changed. Simultaneously, fulfilling the expectations of all the groups of clients of academic services would seem to be impossible, even if the requirements of the methodological rigour were to be reduced (Obój, 2009, pp. 3–5). One of such dilemmas is the simultaneity of the occurrence of cooperation and competition between the same organizations, which is termed cooptation (Ritala, 2012, pp. 307-324). The level of significance of cooptation of network cooperation is to be found in the deliberations of W. Czakoń (Czakoń, 2013, p. 13), who indicates that “cooptation as a dynamic weave of cooperation and competition is appreciative, while also a promising research subject. It brings both intellectual challenges associated with the paradoxical nature of the phenomenon, while also manifesting significance for business practices” and should be availed of in research on the management of an innovative university.

2. Research methodology

The first stage of research referred to the analysis of the fundamental literature relating to the specified research aims. The sources of publications containing full text sources were selected and availed of as follows: ProQuest, Emerald, SCOPUS. As a result, access was acquired to the current and significant magazines and publications of an international nature. Subsequently, a selection was carried out on the basis of the following key words: university management, innovative university and knowledge management. A further stage was to expand the analysis of an auxiliary notion, namely, network cooperation. The source material collected was narrowed down by means of excluding such works as communiqués, conference presentations, as well as book reviews. Finally, analysis of the contents was conducted on the basis of abstracts narrowing down the references to the field of science of management. In the subsequent stage, the literary material was expanded with Polish scientific publications of both monographs, as well as reviewed papers in the leading Polish magazines in the Library of the Jagiellonian University.

The acquired references were subject to systematization of literature and in terms of the complete analysis of the contents the quality of the acquired publications was established (while rejecting the unnecessary ones from the viewpoint of the research aims), systematized and ordered on the basis of the adopted assumptions of key words, which facilitated the broad analysis of the problematic issues of the management of an innovative university, which was confirmed by the growth of international literature, particularly in the field of empirical research on the sphere of creating innovation.

The adopted methodology facilitated the accumulation of source materials that were significant for the further analysis.

In the subsequent stage of literary research, empirical analysis was conducted. Case studies of programs of the management of innovative universities were collected, thematic areas were chosen, particularly management of innovations, while also management of academic entrepreneurship. The starting point for the search for case studies was acknowledged to be the ranking of Perspektyw¹, which is a ranking of the following: higher education colleges, courses of studies and engineering studies in Poland according to the following criteria: the internationalization of studies, conditions of education, scientific efficiency, scientific potential, innovativeness, prestige, while also graduates on the labour market. The ranking of the best colleges from around the world² is based on the list by the firm Quacquarelli Symonds. The ranking of Quacquarelli Symonds is arranged on the basis of a points system. A college may gain a combined total of 100 points, which are awarded for, among other things, the reputation of the college worldwide, the opinions of employers, the opinions of scientists, etc.

By applying the aforesaid methodology, well thought-out and complete data was collected as it is derived from a multitude of sources and provides the possibility of triangulation involving the comparison of information from various sources.

The selection of the cases was undertaken on the basis of a subjective assessment of the management of an innovative university in the sphere of similarity and competitiveness. The induction data analysis provided the opportunity to illustrate the accuracy by moving from the general characteristics to the increasingly detailed analysis, as well as facilitating the multiple returns to the accumulated material with the aim of expanding the research process.

With regard to the limited number of pages, only one case study is presented in the herein paper – the Jagiellonian University. The effects of the research on the management of the University of the Third Generation shall be published in the following works.

3. Model of Third Generation University

On the basis of the literary study, the model of the University of the Third Generation was proposed. The University of the Third Generation is a college whose essence is that of fundamental research, original experimental work that is undertaken with the aim of acquiring new knowledge about phenomena and facts without the concentration on direct practical applications. The added value of the model of the University of the Third Generation is the creation of the network structure, departure from the traditional organizational solutions, the application of the new methods of management, while also the commercialization of the research results. Building the network structures favours the process of the commercialization of knowledge, which in turn favours making the financing of the activities of the university more flexible.

Deliberations on the model of the University of the Third Generation, also termed entrepreneurial/innovative/learning university, lead to the consideration as to in what way to avail of the greatest value of a university that is constituted by its employees, students, graduates and the knowledge possessed by them in a better manner than up to now.

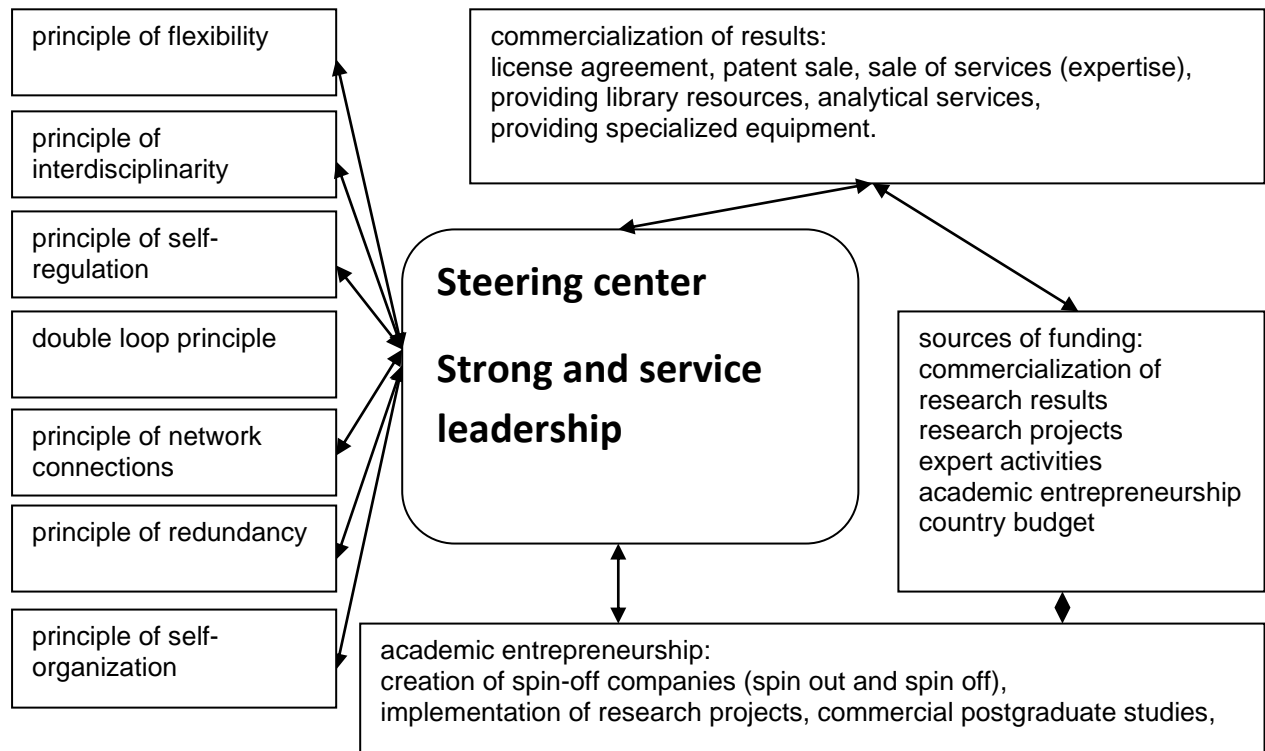
The University of the Third Generation is a model for a university based on the following values:

¹ For more information see: <http://ranking.perspektywy.pl/RSW2019/>

² For more information see: <https://businessinsider.com.pl/rozwoj-osobisty/ranking-najlepszych-uczelni-na-swiecie-quacquarelli-symonds/ljj2mwl>

- flowing from the creation of knowledge and its constant enhancement,
- accruing from fundamental research, research and development work, the commercialization of the research results (inventions, patents, licences, trademarks, etc.),
- from statutory education and promotion of scientific staff,
- from the orientation of the university towards global needs,
- from the network and flexible management of the university (Figure 1).

Figure 1. Concept of Third Generation University



Source: self-analysis.

In the process of managing the University of the Third Generation, a decisively significant role in the process of management is played by the “Centre (the Rector)”, whose task is to strengthen the organizational units (faculties, institutes, departments). In this process, being guided by the principles that are binding in the best universities (Table 1) is a skill, namely, the principle of flexibility, self-organization, self-regulation, double loop, network ties, creativity, team work, inter-disciplinarity, excessiveness (redundancy) (Leja 2011).

Table 1. Principles of managing Third Generation University

Principle of flexibility	With the aid of statutory and institutional instruments that do not encompass all teams/employees, this enables the implementation of the solutions of deepening the process of integration of the college by the “Centre”. Flexibility may be ensured by the implementation of the procedures relating to the mechanisms of the course of action in the case
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	of various scenarios. It should feature leaders who know that the actual conditions are significantly different from those that were planned, while should also make relatively rapid and expected changes. The need for a flexible approach to the management of a college does not exempt the “Centre” from the process of establishing goals and appropriate actions in order to achieve them (Jasiulewicz-Kaczmarek, Drożyner, 2011, p.p. 49–58).
Principle of self-organization	Managers should be flexible and facilitate the self-organization of teams and not deal with organizing them. In the college team, the roles may change regardless of the circumstances. In departing from the hierarchical format, the basis of the actions of the team are enquiry, rather than a pre-conceived project (Bradburn, 1991, p.p. 37–41).
Principle of self-regulation	The principle of self-regulation facilitates the use of tacit and explicit knowledge for the achievement of the assumed goals of an organization, research teams, while also employees of the college. Within the framework of internal regulators on the basis of the configuration of information (not only regulatory) which is acquired from the environment, an internal system of self-regulation should be established in the organization, which is perceived as a structurally distinct team of regulations, e.g. the procedures of the courses of action, that facilitate the processing of every piece of information in terms of managerial decisions (Szałucki, 2012, p. 19).
Principle of double loop	Learning on the basis of the double loop (learning how to learn) involves undertaking additional activities that centre around questioning the significance of the fundamental norms, policies and operational procedures with relation to the changes in the environment. This in turn, requires the following: – supporting and appreciating openness, activity, cooperation, reflection and independence in terms of thinking and ease in the flow of information and knowledge; which enables coming to terms with mistakes and uncertainty as an inevitable feature of life in an intricate and turbulent environment, – the process of planning based on not only specified goals, but also on planning what you want to avoid, namely, defining limitations and questioning them, which is favourable towards increasing the space that is possible to undertake action, – adopting a system of responsibility that shall favour the adoption of active attitudes by the employees and their managers, which in turn, shall favour the analysing and solving of intricate problems by the team while respecting various points of view and not delving in deceit, unclear presentation of problems or minimizing their importance if they can not cope with them, concealing various unpleasant issues, simplification of interpretation, etc., – overcoming the gap between theory and reality, namely, what people say (espoused theory) and what they do (theory in use), in order to facilitate the questioning of espoused theories, as well as values and norms that are embedded in the theories in use (Wołoszyn, 2009, p. 103.)
Principle of network ties	The cooperation of an organization within the framework of partnership networks enables its participants to effectively avail of better educated, specialized, talented and qualified people, to reach higher level and unique skills that enable the acceleration of the building of an exceptional and key potential that is decisive in terms of the success of the execution of

	undertakings that lead to the achievement of the assumed goal for which the network was created, while also: – in order to reach a wide range of specialized organizations and their key processes and best practices, – effectively use the rapidly developing and expanding sources and possibilities of mobilizing the resources that are located outside the organization, – cooperate with those that ensure a really significant unique value, – gain access to new knowledge by means of developing the processes of learning from other partners, while also acquiring better skills of common resolutions to difficult social and business problems, by means of among others, a better perception of the challenges and opportunities facing the organizations, – the effective combination of efforts in terms of building the network potential thanks to focusing the creative people of the appropriate qualifications and skills of creative activity in the sphere of setting out goals, tasks and ways of their resolution, – acquiring access to new sources of information, expanded database and information systems that ensure the flow of information both within the organizational network, as well as outside the network, while also cooperation of all the partners in the utilization of the network information system (objective use, integrated dynamic model, identified as the most important functions and processes existing in the network (Nogalski, Dwojacki, 1998, Chmielarz, 2000, p. 25).
Principle of interdisciplinarity	This is based on “breaking down the borderlines between disciplines and not accumulating knowledge. This is expressed by conducting research on the chosen fragments of the surrounding reality and their perception in terms of the perspective of various disciplines” (Markowski, 2012, s. 15).
Principle of excessiveness (and redundancy)	This illustrates that the excess of unnecessary or harmful interference/regulation of the work of teams (e.g. scientific teams, individual employees) leads to the purposeless use of resources without the possibilities of gaining the rational effects, e.g. allocating teams/employees new tasks, new research undertakings in which a change of roles and competences is required (Leja, 2011, p. 16).

Source: self-analysis.

4. Case study of innovative management of university

In the subsequent stage of research, the first validation of the accepted model took place, as well as an attempt to answer the question as to whether the Jagiellonian University is a University of the Third Generation. Selecting these entities shall also facilitate the verification of the model in terms of other universities in the future.

The Jagiellonian University (UJ), established in 1364 by King Kazimierz III Wielkiego (Kazimierz the Great), is the oldest university in Poland. Today it consists of 15 faculties devoted to over 80 various fields of science. Academic entrepreneurship is an important entity in the process of the internationalization of both didactic and scientific activities, while also the commercialization of knowledge at UJ.

At UJ, a system of supporting academic entrepreneurship was established, whose central base is at the Centre of Innovation and Technology Transfer (CITTRU) and whose task is to support activities aimed at the cooperation between science and business. UJ also inspires

joint intervarsity undertakings as exemplified by the cooperation with the Jagiellonian Centre of Innovation Sp. z.o.o., Małopolski Centre of Biotechnology (MCB). The Jagiellonian Centre of Innovation Sp. z.o.o. is the managing operator of the cluster of the Park Life Science in Cracow, which streamlines the cooperation between enterprises operating in the sector of Life Science with the use of the resources of UJ (Figure 2).

Figure 2. Innovative entities of University of Third Generation within the framework of the Jagiellonian University in Cracow.



Source: Self-analysis.

The Małopolskie of Centre of Biotechnology (MCB) is a joint project of the Jagiellonian University and the Agricultural Academy in Cracow. Researchers of both universities deal with scientific research associated with biotechnology, food safety, genomics, nutrigenomics and bioinformatics.

Centre of Innovation and Technology Transfer (CITTRU) in Cracow

The Centre has been functioning for 10 years as a unit of the Jagiellonian University. Its task is to support activities aimed at cooperation between science and business, by means of,

among others, the creation of the technological offer of UJ, building a network of contacts between science and business, while also helping to create joint research and implementation projects. The offer of the Centre is geared towards the scientific employees of UJ and to enterprises. Activities undertaken by the Centre with relation to scientists are adjusted to the requirements submitted by them (evaluation of the possibilities of the implementation of research, preparation of the technological offer for firms, the acquisition of a business partner, participation in trade fairs, assistance in acquiring funding, preparation of agreements, while also the coordination of commissioned research). However, in the case of an enquiry from a firm that wants to cooperate with the university researchers, the Centre renders services that involve the search for the appropriate partner, negotiating agreements, etc. The Centre submits a training-advisory offer to such firms (presentation, auto-presentation, creation of business plans, funding, etc.). Within the framework of the functioning of AIP with the aid of the Centre over 50 firms have been established [*Centrum Innowacji...*, 2015, p. 14].

The Centre of Technology Transfer, or CITTRU (CTT CITTRU) is a unit of UJ, which is in charge of intricate cooperation between science and the business environment.

Its tasks include the following:

- identification of the innovative solutions emerging in the UJ,
- comprehensive legal protection of the research results, analysis of the market potential of the research results,
- selection of the optimal way of commercializing the scientific achievements by means of granting licences,
- sale or creation of the spin-off companies in cooperation with the creators and interested entrepreneurs,
- preparation of a technological offer of UJ which encompasses innovative solutions for industry, while also offers of research services of UJ that are conducted for external institutions on order,
- promoting the technological offer for trade fairs, business conferences, while also direct meetings with potential clients of technology,
- identification of the potential business partners that are interested in cooperation in terms of the commercialization, or purchase of technology prepared by the scientists of UJ and the creation of a network of contacts with industry,
- negotiating, preparation and supervision of the execution of contracts associated with commercialization,
- coordination of the execution of research services at UJ, including the creation of the offer of research services and their promotion among potential clients, while also negotiating the appropriate contracts,
- cooperation with external entities, including foreign partners in the sphere of innovativeness, as well as creating and executing pro-innovative activities.

CITTRU – Academic Incubator of Entrepreneurship of UJ

Within the framework of CITTRU the Academic Incubator of Entrepreneurship (AIP UJ, which previously functioned as a unit of UJ within the framework of the Jagiellonian Centre of Innovations, together with all its infrastructural facilities) also functioned as a project dedicated to innovative academic firms. The Academic Incubator of Entrepreneurship of the Jagiellonian University (AIP UJ) was founded with entrepreneurial people in mind, while also people who wanted to try their hand at business by running their own start-up. The offer of AIP UJ is directed at the most creative and entrepreneurial group of students and graduates of UJ.

AIP UJ is open to everyone who wants to set up his/her own start-up and has an idea for that. It advises entrepreneurs what moves to make on the market, how to manage a firm, or in what way to lay out a business model in order for it to bring both personal satisfaction and financial satisfaction. Apart from the meritorical support, young entrepreneurs may avail of co-working, namely the space for common work and meetings. As business also entails relations, AIP UJ emphasizes networking based on the mutual familiarization, making contacts and entering cooperation with others who are willing to share their knowledge. In the Incubator it is also possible to count on bookkeeping/tax support, as well as legislative and administrative aid in the process of pre-incubation.

Jagiellonian Centre of Innovation (JCI)

The Jagiellonian Centre of Innovation conducts activities of an investment and development nature. They are first and foremost directed at people who are interested in transforming a scientific project into commercial activity, as well as at companies in search of financial resources to finance new areas of activities. The firm also deals with the promotion of Cracow as a place that advocates the development of innovation by offering high class laboratories in the built-up Life Science Park, which is to serve commercial research in the fields of biotechnology, biomedicine, chemistry, biochemics, pharmacology, biophysics and physics.

Cluster - Life Science Park

The subject matter of cluster activities is that of undertakings encompassing research on innovative medicine, generic medicine and other medical products, preparation of the diagnostic procedures and solutions. The level of financing a project is dependent on the requirement submitted by the individual project-provider or company. Due to the differentiated level of the financial needs, the company not only finances projects at the “seed” phase, but also in the subsequent stages of their development. With this aim in mind, work is conducted on the allocation of a fund with the possibilities of exceeding the financial level that is characteristic for *venture capital* funds.

The laboratory section is adjusted to any given adaptation which facilitates the implementation of advanced research in the field of biotechnology, biomedicine, biology, chemistry, pharmacology, physics, nanotechnology and environmental protection.

The Life Science Park also has an offer for small enterprises from the sector of start-ups, namely those that are at the initial stage of development (*start-up*, *spin-off*), while also for scientists conducting their own research projects.

The investment of Life Science Park is located in the vicinity of the III Campus of the Jagiellonian University in the area of the Special Economic Zone of Cracow.

Cluster Life Science of Cracow

The Initiative of the Life Science Cluster of Cracow constitutes 75 entities. The largest group constitutes enterprises of the sector of SMEs (50%), whereas the second largest – large enterprises, including hospitals (20%), while the next group consists of scientific units (universities and research and development institutes) (15%).

The Life Science Cluster of Cracow was established in 2006 as a network of cooperation between institutions and firms and the macro-region of southern Poland, which combines the common goals and vision of the development of the ecosystem of innovations in the area of biotechnology and *life science*:

- the creation of a network of cooperation in the area of life science, which facilitates the effective connection and use of the existing potential of people there, as well as

- enterprises, universities, scientific and research units, institutions of the business environment, while also local and regional authorities;
- supporting entrepreneurship and innovativeness in the area of *life science* and the creation of conditions for the effective commercialization of the results of research and development work;
- combining and developing the resources, while also competences from the area of *life science* with the aim of the effective use of both the existing possibilities, as well as the opportunities associated with the development of an innovative economy based on knowledge.

Since 21 October 2016, the Life Science Cluster of Cracow has had the status of Key Domestic Cluster, whereby it simultaneously joined a group of 16 elite strategic clusters that are of great significance for the development of the Polish economy and are competitive, as well as innovative in terms of international aspects. With the aim of the better use of the potential initiative of the Life Science Cluster, the undertaking of challenges facing the Bio-Region of Małopolska, as well as the effective use of the opportunities of development in the area of *life science* and biotechnology, the Foundation of the Life Science Cluster in Cracow was founded.

The mission of the cluster is as follows:

- the creation of the network of cooperation in the area of **life science**, which would facilitate the combination and use of the potential of individual people, institutions, enterprises, universities, scientific and research units, the business environment, as well as the local authorities in the region of Małopolska;
- supporting entrepreneurship and innovativeness in the area of *life science*, while also creating the conditions for the effective commercialization of the results of research work of universities and research and development units;
- combining and developing the resources, while also competences from the area of *life science* with the aim of the effective use of the existing possibilities and opportunities associated with the development of an innovative economy based on knowledge.

Academic *maker-space* – Garage of Complexity.

A garage of miscellaneous items, a garage of curiosity, a garage of personalities, bio-garage, a garage of wonders are all only just a few of the synonyms that have appeared up to now with reference to the Garage of Complexity of UJ among the people who have heard of this exceptional undertaking somewhere.

The Garage of Complexity of UJ is the first academic *maker-space* in Poland, which is equipped with professional research infrastructure, while also an interdisciplinary scientific laboratory, space for creative DIY and experimentation, while also the creation of new ideas and notions. The projects which are initiated here transgress the initiatives executed within the framework of a formal course of study. They are conducted by people who, apart from their everyday obligations, want to fulfil their passions in a group of people that is accompanied by the desire to become familiar with, discover and implement their ideas.

Garage enthusiasts are groups of students, PhD students and scientific employees of the Jagiellonian University, in which each of them has the role of an initiator, searcher, executor, mentor, manager and leader to fulfil.

Complexity is one of the notions that reflects the essence of the Garage. This refers to the complexity and interdisciplinarity of the research projects that are conducted, while also referring to the variety of people working in research teams, while also quite often to the complexity and intricacy of the activities undertaken. Work takes place in the Garage which

arouses the interest of firms associated with it and which play the role of partners involved in the execution of the chosen projects.

These activities are exemplified by the following: designing and 3D printing, individual models of the livers of patients with a visible system of blood vessels, as well as the located tumour, which is very helpful for the surgeons preparing for the operation, or the construction of 3D printers dedicated to printing the base for the three dimension cell breeding, as well as the synthesis of a cell that is compatible with the material used in the printing.

The Garage of Complexity of UJ is part of the Research Centre of Complex Systems named after Marek Kac, which is located in the Faculty of Physics, Astronomy and Applied Informatics and closely cooperates with the Centre of Technology Transfer CITTRU, the Academic Incubator of Entrepreneurship, as well as other faculties of the Jagiellonian University.

Conclusions

The identification and analysis of the effects of the management of an innovative university (the University of the Third Generation) certainly requires undertaking further significantly broader interdisciplinary research.

In the herein paper, the significant structures of management and the fundamental principles which condition the management of an innovative university were indicated by listing them with the chosen innovative entities belonging to the innovative university, which function within the framework of the Jagiellonian University in Cracow.

It is necessary to state that the competitiveness of the university of the future shall be decided to a significant extent by the academic society and the factors of competitiveness that are cohesive with it.

The gauge of competitiveness shall definitely be the vibe of entrepreneurship and innovativeness, albeit, it would seem that an equal footing in terms of the competitive position of a university of the new generation shall be decided by the truth, attitudes and the ability to shape them, while also participation and leadership.

Recommendations

The University of the Third Generation of the 21st century requires a new model of management, whose aim is the efficiency of cooperation with the domestic and international environments, while scientific research fulfils the conditions of commercialization. The search for the factors of competitiveness of an innovative university should be directed at the employees of science, students and graduates. An important task for the controlling centre is that of their motivation to undertake competitive challenges. The gauge of the competitiveness of the university of the future shall be entrepreneurship and innovativeness.

The suggested changes to the management of a university should lead to the strengthening of the entrepreneurial and innovative attitudes of the employees, students and graduates, while making entrepreneurial attitudes an academic custom. It is essential to strengthen the innovative potential of the tools of academic entrepreneurship, which are termed the innovative infrastructure of academic entrepreneurship for the execution of these intentions, which include programs and projects of support, institutional forms of supporting academic entrepreneurship, e.g. spin off and spin out enterprises, academic incubators of entrepreneurship, career offices, centres of technology transfer, scientific and technological parks, etc.).

The university of the future should compete having the values that define the level of innovativeness, i.e. the number of patents registered, the number of patents of an

international scope, the total number of quotations associated with patents, the indicators of the analysis of the impact of the patent for the future development of research, the combined number of scientific papers relating to inventions, the number of the papers prepared by scientists from a particular university in cooperation with the market.

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